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Prehistoric Obsidian Use on the Volcanic Tableland and its Implications for Settlement Patterns and Technological Change in the Western Great Basin

By

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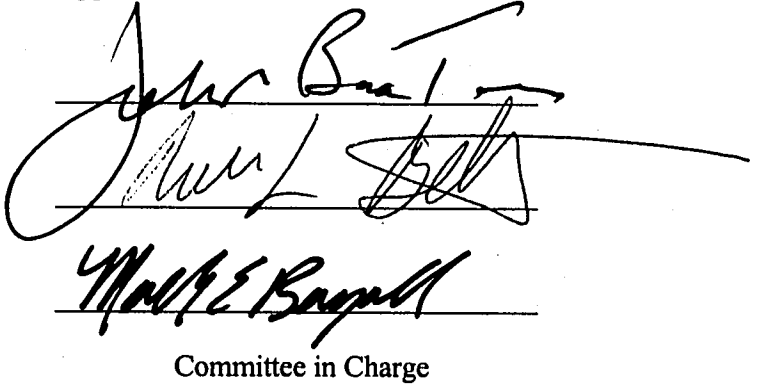

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Dedicated to my parents, Elissa and Ronald,
and to my family, for years of encouragement
and tolerance.

May we all travel paths less complicated
but equally worthwhile.

ABSTRACT

This dissertation examines spatio-temporal patterns of obsidian use on the Volcanic Tableland and their implications for long-term change in lithic technology and regional settlement ranges in the western Great Basin. The core of the study is a massive set of obsidian source and hydration data, fostered by the use of existing artifact collections and new materials recovered through survey and excavation.

Shifts in flaked stone technology occur with the introduction of the bow-and-arrow. At the Newberry/Haiwee transition (1400 B.P.), the switch from Elko dart points to Rosegate arrow points was accompanied by changes in the roles and forms of bifaces, cores, and flake tools. Also, projectile points are shown to be useful time markers in the Great Basin, using hydration data and point types as proxy measures.

Throughout its prehistory, the Tableland was occupied by groups entering mainly from the north and northeast. Early and middle Holocene occupations (ca. 8500-4000 B.P.) centered on Fish Slough. Visitors came from extreme distances north and south, stopping only briefly. Between 4000-1400 B.P., occupations shifted to the plateau, people hailing from shorter distances to the north/northeast. Habitations were extended or repeated enough to produce middens and focused on dryland plants and animals. More recent occupations (ca. 1400-200 B.P.) targeted plateau sites, and reused sites at Fish Slough, emphasizing the bulk procurement and processing of dryland seeds. Ricegrass was gathered while green and "flash-burned" to remove chaff, the seeds ground on bedrock with two-handed manos. Visitors had restricted northern territories, making settlement moves between western Nevada, the Mono Basin, and Long Valley. The presence of Owens Valley groups was limited, the terminal prehistoric pattern (200 B.P. - Contact) showing near exclusive use

by northern populations. Major sites were again reoccupied and used to process seed plants in bulk. Late Holocene settlement systems including the Tableland saw the kind of spatial circumscription commonly ascribed to the Owens Valley settlement regime. This suggests other populations in eastern California/western Nevada experienced conditions of growth and competition, the effects of which led to subsistence intensification across the Inyo-Mono region.

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Given the length of time it took to complete this dissertation, there is an incredibly long list of people who made valuable contributions, either directly or indirectly. Try as I might, I will surely fail to thank a few individuals who helped me somewhere at some critical point. Rest assured the assistance of these unlisted people is greatly appreciated.

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TABLE OF CONTENTS

Chapter One: INTRODUCTION 1

GENESIS OF THE DISSERTATION 3

RESEARCH GOALS 4

Primary Research Aims 5

Secondary Research Aims 6

CONTRIBUTIONS TO SETTLEMENT ARCHAEOLOGY 8

ORGANIZATION OF THE DOCUMENT 10

Chapter Two: NATURAL AND CULTURAL CONTEXT 11

REGIONAL ENVIRONMENTAL SETTING 12

Geology and Geomorphology 12

The Volcanic Tableland 14

Fish Slough 16

Antiquity of the Fish Slough Drainage 19

Climate and Hydrology 21

Contemporary Flora and Fauna 23

Paleoenvironments 28

REGIONAL CULTURAL SETTING 31

Late Pleistocene Prehistory 32

Early Holocene Prehistory 34

Middle Holocene Prehistory 36

Late Holocene Prehistory 38

Ethnographic Period 39

PREVIOUS ARCHAEOLOGICAL RESEARCH IN THE INYO-MONO REGION 43

Prior Efforts on the Volcanic Tableland 48

GEOGRAPHIC AND ARCHAEOLOGICAL CONTEXT OF OBSIDIAN PROCUREMENT 50

Bodie Hills 52

Casa Diablo 53

Coso Volcanic Field 53

Fish Springs 54

Mono Craters 55

Mono Glass Mountain 56

Mt. Hicks 57

Pine Grove Hills 58

Queen Impostor and Saline Valley 58

Truman-Queen 59

Other Obsidians 60

Archaeological Distributions of Major Obsidians 61

Chapter Three: THEORETICAL BACKGROUND 67

OBSIDIAN SOURCING WITH ENERGY DISPERSIVE X-RAY FLUORESCENCE SPECTROSCOPY (XRF or EDXRF) 68

Research in X-ray Spectrometry with California Obsidians 70

OBSIDIAN HYDRATION STUDY IN EASTERN CALIFORNIA 74

Empirical ("Natural") and Induced Hydration Rates 84

Hydration Band Measurement 87

EMPIRICAL HYDRATION RATES FOR EASTERN CALIFORNIA OBSIDIANS 88

Continuing Problems in Obsidian Hydration 93

Future Directions for Obsidian Hydration Rate Research 97

THE ORGANIZATION OF FLAKED STONE TECHNOLOGY 99

Patterns of Lithic Acquisition and Use 105

MOBILITY, SETTLEMENT PATTERNS, AND LITHIC SOURCE DATA 107

SOME WORDS ABOUT SITE- AND ARTIFACT-BASED INTERPRETATIONS 109

Chapter Four: ANALYTICAL AND SAMPLING METHODS 111

VISUAL SOURCING OF EASTERN CALIFORNIA OBSIDIANS 111

Methods of Visual Sourcing 118

Truman-Queen 119

Casa Diablo 120

Fish Springs 121

Test For Accuracy in Visual Source Assignment 122

METHODS AND ANALYTICAL CONDITIONS FOR XRF ANALYSIS 126

Internal Standards 126

Discriminant Analysis and Source Assignment 130

Test of XRF Methods 133

METHODS FOR OBSIDIAN HYDRATION ANALYSIS 138

Slide Preparation 138

Rim Measurement 139

Tests of Obsidian Hydration Methods 139

SAMPLING STRATEGIES FOR OBSIDIAN STUDIES 143

Visual Source Sampling 143
XRF Sampling 145
Obsidian Hydration Sampling 146
METHODS FOR FLAKED STONE ANALYSIS 149
Projectile Points 152
Point Blanks 152
Bifaces 152
Simple Flake Tools 153
Formed Flake Tools 153
Drills 155
Cores and Core Tools 155
Debitage 156
Chapter Five: THE SURFACE SURVEYS 159
ENFIELD SURVEYS: 1960-1993 159
SYSTEMATIC SURVEYS: 1993 AND 1997 163
Slough Survey 163
Slough Survey Results 167
Plateau Survey 168
Plateau Survey Results 173
SURVEY SITE DESCRIPTIONS 175
Slough Survey 176
Plateau Survey 188
OVERALL SURVEY RESULTS AND COMPARISONS 200
Site Densities on the Volcanic Tableland 200

Comparisons with Meighan and Enfield Surveys 204

Site Typology for the Volcanic Tableland 205

Site Types and Distributions on the Volcanic Tableland 211

Site Types Summary 223

Chapter Six: SITE-SPECIFIC INVESTIGATIONS

1993 TESTING PROGRAM - FISH SLOUGH 226

Site MNO-1992 227

533 237

Summary of 93 Excavations 240

1995-1996 TESTING PROGRAM - FISH SLOUGH 241

Site FS4C-1 243

Site FS10A-2 249

Site FS10B-2 249

Site FS12C-2 254

Site FS14C-1 254

Site FS14C-2 255

Site FS14D-1 256

Site FS18C-2 259

Site FS18D-1 260

Site FS20C-1 261

Site FS22B-1 261

Site FS26B-1 262

Summary of 95-96 Excavations 263

1997 SURVEY AND TESTING PROGRAM 265

FLAKED STONE ASSEMBLAGES AND TECHNOLOGY AT FISH SLOUGH 266

Projectile Points 270

Point Blanks 271

Bifaces 271

Formed Flake Tools 272

Simple Flake Tools 274

Drills 274

Cores and Core Tools 275

Debitage 275

COMPARISONS AND DISCUSSION 277

Chapter Seven: PROJECT OBSIDIAN COLLECTIONS 283

THE ENFIELD COLLECTIONS: 1960-1993 284

THE 1987-1989 CO-OP PROJECT 301

RECENT COLLECTIONS FROM SURVEYS AND TEST EXCAVATIONS 302

OBSIDIAN ARTIFACTS FOR POTENTIAL ANALYSIS 305

Summary and Implications 311

Chapter Eight: OBSIDIAN USE ON THE VOLCANIC TABLELAND 312

VISUAL SOURCING 312

X-RAY FLUORESCENCE SOURCING 317

Source Distributions Between Artifact Classes and Site Types 326

Source Distributions Across the Volcanic Tableland 337

Differences Between Slough and Plateau Domains 348

Temporal Patterns in Source Data 350

Summary 357

OBSIDIAN HYDRATION 358

Indices of Technological Change on the Volcanic Tableland 359

Summary 371

Chapter Nine: EVALUATION OF RESEARCH RESULTS 373

OBSIDIAN HYDRATION RATES ON THE VOLCANIC TABLELAND 373

Truman-Queen Hydration 375

Evaluating the Basgall/Giambastiani Truman-Queen Hydration Rate 384

Casa Diablo Hydration 388

Mt. Hicks and Fish Springs 390

PROJECTILE POINTS AS TIME MARKERS ON THE VOLCANIC TABLELAND AND IN EASTERN CALIFORNIA 393

CHANGES IN FLAKED STONE TECHNOLOGY ASSOCIATED WITH THE INTRODUCTION OF THE BOW-AND-ARROW 398

Changes in the Use of Bifaces, Cores, and Flake Tools 401

Changes in Production Levels at Obsidian Quarries 404

Initial Use of Previously Unexploited Obsidians 406

IMPLICATIONS FOR LATE ADAPTIVE CHANGE ON THE VOLCANIC TABLELAND 407

Late Holocene Subsistence Intensification 414

Chapter Ten: PREHISTORIC SETTLEMENT PATTERNS IN EASTERN CALIFORNIA 418

REGIONAL CONTEXT OF OBSIDIAN USE 419

Spatial and Temporal Distribution of Truman-Queen Obsidian 426

Distributions of Other Eastern California Obsidians in Owens Valley 431

REGIONAL SETTLEMENT PATTERNS: A VIEW FROM THE TABLELAND 434

Early and Middle Holocene Settlement Patterns (8500-3500 B.P.) 437

Early Late Holocene Settlement Patterns (3500-1400 B.P.) 441

Later Holocene Settlement Patterns (1400-200 B.P.) 447

Terminal Prehistoric Settlement Patterns (200 B.P. - Contact) 450

RELEVANCE TO THE NUMIC SPREAD 457

SUMMARY OF DISSERTATION RESULTS 461

Spatial and Temporal Distributions of Obsidian Sources 462

Long-Term Changes in Flaked Stone Technology 463

Truman-Queen Hydration Rate 465

Projectile Points as Time Markers 466

Settlement Ranges in Eastern California and Western Nevada 467

CONCLUDING REMARKS 471

REFERENCES CITED 474

APPENDIX A - XRF DATA 530

APPENDIX B - SITE CHARACTERISTICS INVENTORY 568

APPENDIX C - OBSIDIAN SOURCE AND HYDRATION DATA 576

LIST OF TABLES

Table 3.1. Hydration rates for Casa Diablo, Coso, Fish Springs, Truman-Queen, and Bodie Hills obsidians 91

Table 4.1. Visual and chemical assignments for obsidian artifacts from Owens Valley, Long Valley, and Nevada 113

Table 4.2. Visual and XRF assignments for tool and debitage samples 123

Table 4.3. Provenience of obsidians used in trace element (XRF) analysis 128

Table 4.4. Discriminant function assignments for standards pellets 131

Table 4.5. Trace element concentration values for obsidian source groups 133

Table 4.6. Source assignments by current methods and by R. Hughes 135

Table 4.7. Source assignments for tools and debitage by current methods and by R. Hughes 136

Table 4.8. Results of hydration test by sample type, source, and operator 141

Table 4.9. Hydration statistics for Desert Series and Elko Eared projectile points 142

Table 4.10. Artifacts subjected to visual and XRF sourcing programs by artifact class .. 146

Table 4.11. Projectile points for obsidian hydration by typological class 148

Table 4.12. Obsidian items for hydration by artifact class 150

Table 5.1. Select characteristics of Enfield site records 162

Table 5.2. Size, location, and content of Slough survey transects 168

Table 5.3. Collection totals for Slough survey by transect unit 169

Table 5.4. Size, location, and content of Plateau survey transects 174

Table 5.5. Estimates of useable land surface within the Fish Slough valley 202

Table 5.6. Artifact assemblages and select attributes by site type for all formally investigated locations in the study area 208

Table 5.7. All study sites by project and type 211

Table 5.8. All study sites by spatial quad, survey project, and type 215

Table 5.9. Select site attributes from survey data by quadrant 222

Table 6.1. Areas of surface collection and volumes of excavation at Fish Slough 228

Table 6.2. Select artifact classes for all formally investigated locations, 1993 and 1995-96 Fish Slough programs 230

Table 6.3. Inventory of major constituent classes by locus, unit designation and type at sites MNO-1992 and 533 234

Table 6.4. Inventory of major constituent classes by unit at Fish Slough study sites, 1995-96 244

Table 6.5. Surface and subsurface collection totals for the Plateau survey by site and unit type 267

Table 6.6 Fragment types by flaked stone tool class, 1993 and 1995-96 testing programs 269

Table 6.7. Material types by flaked stone artifact class, 1993 and 1995-96 testing programs 270

Table 6.8. Preliminary technological profiles for obsidian debitage by site and reduction group 277

Table 6.9. Flaked stone assemblages by site type for Fish Slough sites and MNO-1992 279

Table 6.10. Diagnostic projectile points by site type from Slough and Plateau surveys .. 281

Table 7.1. Artifact Totals and Adjusted Residuals for Enfield, Slough, and Tableland Sites (Without Bone and Debitage) 294

Table 7.2. Catalogued Enfield obsidian artifacts by site 298

Table 7.3. Obsidian artifacts by site from the Far Western 1987-89 cooperative project 302

Table 7.4. Obsidian artifacts from investigated sites, 1993, 1995-96, and 1997 field programs 303

Table 7.5. Obsidian artifacts for potential analysis from all project collections 306

Table 7.6. Classifications of obsidian projectile points by project 307

Table 7.7. Obsidian bifaces by reduction stage group and project 308

Table 7.8. Obsidian flake tools by technological group and project 309

Table 7.9. Analyzed obsidian debitage by technological group and project 310

Table 8.1. Analyzed obsidian debitage by technological group and project 313

Table 8.2. Visual source assignments by artifact type 318

Table 8.3. Artifacts subjected to XRF sourcing by artifact class 319

Table 8.4. Visually examined obsidian artifacts by XRF source assignment 320

Table 8.5. Visual indeterminates traced by XRF to Casa Diablo, Truman-Queen, and Fish Springs 321

Table 8.6. XRF source assignments by site and isolate locations 322

Table 8.7. Obsidian source assignments by artifact class on the Volcanic Tableland .. 327

Table 8.8. Relative proportions of obsidian sources by site types and artifact groups .. 329

Table 8.9. Artifact groups and site types with relative proportions of obsidian sources 336

Table 8.10. Obsidian sources by spatial quadrant and direction from study area 338

Table 8.11. Tool:debitage ratios for obsidian sources by quadrant 344

Table 8.12. Proportions of obsidian source groups by spatial Quad and select artifact categories 347

Table 8.13. Source group profiles for Slough and Plateau sites 349

Table 8.14. Relative percentages of obsidian sources by major site type for Slough and Plateau areas 350

Table 8.15. Source assignments for obsidian projectile points from the Volcanic Tableland 353

Table 8.16. Proportions of hydration rim readings for sourced debitage in obsidian source groups 356

Table 8.17. Totals and proportions of hydration rim readings for tool classes in micron groups 362

Table 8.18. Technological data for select tool classes by hydration rim groups 364

Table 8.19. Debitage by reduction group and micron class 370

Table 9.1. Micron ranges for Truman-Queen assigned to temporal periods by Weaver (1992) 377

Table 9.2. Hydration data for select projectile point types by obsidian source 381

Table 9.3. Hydration ranges, means, and standard deviations for Truman-Queen projectile points 383

Table 9.4. Micron values, age estimates, and age differences between values for Truman-Queen 387

Table 9.5. Hydration data for Casa Diablo projectile points from Long Valley (Hall and Jackson 1989) and the Volcanic Tableland 389

Table 9.6. Hydration data for Mt. Hicks projectile points from the Dry Lakes Plateau (Halford 1998) and the Volcanic Tableland 392

Table 9.7. Hydration data from Tableland sites by micron group and site type 411

Table 9.8. Hydration data from excavated Type 3 and Type 1 sites by micron group .. 413

Table 9.9. Hydration profiles for debitage and bifaces at Slough and Plateau sites 415

Table 9.10. Hydration profiles for Plateau sites with threshing floors 416

Table 10.1. Archaeological representation of major obsidian sources for select locations in the western Great Basin 424

Table 10.2. Totals and proportions of diagnostic Truman-Queen projectile points by project location relative to the Volcanic Tableland 430

Table 10.3. Frequency and proportion of obsidian sources by major site type and micron-age group 444

Table 10.4. Major projectile point series by site type on the Volcanic Tableland 460

LIST OF FIGURES

Figure 2.1. Dissertation Study Area 13

Figure 2.2. Fish Slough Valley and Drainage 17

Figure 2.3. Map of Obsidian Sources 51

Figure 5.1. Fish Slough Survey Universe 165

Figure 5.2. Plateau Survey Universe 171

Figure 5.3. Site Types and Spatial Quads on the Volcanic Tableland 212

Figure 5.4. Sites by Type in Quad 1 217

Figure 5.5. Sites by Type in Quad 2 218

Figure 5.6. Sites by Type in Quad 3 219

Figure 5.7. Sites by Type in Quad 4 220

Figure 6.1. Excavated Sites at Fish Slough 229

Figure 6.2. Site MNO-1992 232

Figure 6.3. Fish Slough Site 533 238

Figure 6.4. Fish Slough Site 10B-2 250

Figure 6.5. Fish Slough Site 14D-1 257

Figure 7.1. Tool Classes and Artifact Totals for Enfield, Slough, and Tableland Site Groups 287

Figure 7.2. Enfield vs. Controlled Surface Collection with Debitage and Bone 288

Figure 7.3. Enfield vs. Controlled Surface Collection without Debitage and Bone 290

Figure 7.4. Log of Sample Size vs. Class Richness with Debitage and Bone 291

Figure 7.5. Log of Sample Size vs. Class Richness without Debitage and Bone 292

Figure 8.1. Quad 1 Obsidian Sources 339

Figure 8.2. Quad 2 Obsidian Sources 340

Figure 8.3. Quad 3 Obsidian Sources 341

Figure 8.4. Quad 4 Obsidian Sources 342

Figure 8.5. Debitage Source groups by Spatial Quadrant 346

Figure 8.6. Relative Proportions of Diagnostic Projectile Points by Spatial Quadrant .. 351

Figure 8.7. Relative Proportions of Diagnostic Projectile Points by Obsidian Source Group 355

Figure 9.1. Micron Ranges for Diagnostic Truman-Queen Projectile Points 395

Figure 10.1. Early-Middle Holocene Settlement Ranges (8000-3500 B.P) 438

Figure 10.2. Early Late Holocene Settlement Ranges (3500-1400 B.P.) 442

Figure 10.3. Late Holocene Settlement Ranges (1400-200 B.P.) 449

Figure 10.4. Terminal Prehistoric Settlement Ranges (200 B.P. - Contact) 452

Chapter One

INTRODUCTION

Over the last decade, archaeologists in California and the Great Basin have begun to rely more and more heavily on studies of obsidian artifacts. The main reasons for this emphasis have been threefold: (a) to clarify recognized temporal changes in flaked stone technology; (b) to improve temporal control in areas where the development of either regional and/or local radiocarbon chronologies is not possible or has not yet been sufficient; and (c) to improve models of raw material acquisition and settlement mobility in past hunter-gatherer adaptive systems. This renaissance in obsidian research has been fostered by recent advances in both sourcing and hydration studies. In the former, the precision of source assignments has narrowed considerably, analysts now being able to recognize different chemical types within the same obsidian source area. The hydration analysis techinque has benefitted from computer and video technology, while our understanding of the hydration process has improved due to continued research in glass science. Progress in both of these areas has resulted in more thoughtful use of hydration data and in the development of more accurate rate formulations.

Despite these advances, the use of obsidian data in cultural resources management archaeology (CRM) has not progressed very far beyond the basic. Normally, samples of obsidian artifacts are sourced to give some indication of where from and how far raw materials are being transported, with some hydration analysis completed to provide a rough measure of chronology. In most cases, however, project budgets are severely limited, allowing for only a few samples to be examined. This does not mean that the conclusions of such studies are necessarily in error, but artifact sample sizes are often insufficient to serve as representations of larger site assemblages or provide suitable data for statistical manipulation. The same situation is also evident in most current academic

research, where even smaller samples of obsidian artifacts are used to support temporal sequences or to address modes of toolstone acquisition and reduction technology.

This study attempts a departure from the norm by employing large sets of obsidian source and hydration data to reconstruct spatio-temporal changes in use of the Volcanic Tableland, a broad arid plateau situated just north of Owens Valley in eastern California. Geographically, this formation is centrally located between several areas that have seen considerable archaeological research (Owens Valley, Long Valley, White-Inyo Mountains) and is surrounded by four major obsidian sources at near-equal distances (Casa Diablo, Mono Glass Mountain, Truman-Queen, and Fish Springs). Obsidian artifacts from these and other, less prominent sources (Mt. Hicks, Mono Craters, Bodie Hills, and some unknowns) have already been identified on the Tableland (Basgall and Giambastiani 1995), suggesting the area was used by people who regularly traveled great distances throughout the Inyo-Mono region. Although the Volcanic Tableland was occupied for at least 8,000 years and contains a rich and diverse archaeological record, it probably never held a resident population, in sharp contrast to neighboring Owens Valley which at least during ethnohistoric times was inhabited by quite dense native populations. Presumably due to its limited subsistence resource base, near-absence of water, and scarcity of flakeable toolstone, the Volcanic Tableland was probably a "marginal" environment as compared to surrounding habitats, particularly Owens Valley. In this sense, it may have been a sort of "no man's land", an interstitial zone used seasonally by populations residing in areas like the Mono Basin, Long Valley, Adobe/Benton Valley, Owens Valley, and eastward into Nevada.

Given this situation, the Volcanic Tableland is an ideal place to begin identifying and characterizing the timing and spatial extent of inferred shifts in prehistoric settlement patterns within the Inyo-Mono region. Because the area has an archaeological record uncomplicated by intensive, long-term residential occupancy, and because it was used by groups from many different surrounding areas, the Tableland should reflect changes in outlying subsistence-settlement systems more clearly

than do locations nearer the core areas of those systems. If contemporary subsistence-settlement reconstructions are correct in recognizing an increase in population circumscription and centralization through time in Owens Valley, and if the same occurred to even a lesser degree in more northern localities, such changes should have affected the use of the Volcanic Tableland. It is presumed that the effects of any long-term changes in aboriginal settlement patterns should be represented by spatial and temporal variations in the archaeological record of the study region.

GENESIS OF THE DISSERTATION

This doctoral study results from a combination of many field programs on the Volcanic Tableland with which I was involved in either a professional or graduate student capacity. The first of these was a series of excavations conducted by Mark Basgall and Robert Bettinger over the course of three summers between 1987-1989, a project designed as a cooperative agreement between the Bureau of Land Management, Far Western Anthropological Research Group, Inc., and the University of California, Davis. I only participated as a volunteer in the last two field seasons, but the full effort culminated in the testing of seven archaeological sites. Data and research from this project, now published in monograph form (Basgall and Giambastiani 1995), provide the archaeological backbone for the present document. Two of my own studies conducted with the help of the U.C. Davis Archaeological Field School, in the summers of 1993 and 1996, provided opportunities for additional excavations at a key site at Fish Slough (MNO-1992), for limited testing at ten additional sites along the slough, and for a surface survey that encompassed the entire Fish Slough Valley and margins of the surrounding Tableland plateau as well. A second survey, conducted in 1997 with the aid of the California State University, Sacramento (CSUS) Archaeological Field School, completed transects which, for the most part, were placed in archaeologically unknown areas of the Tableland plateau.

Obsidian artifacts recovered during all of these projects are employed in the current research, figuring prominently in different ways in technological artifact analyses and in various obsidian studies. This study also relies heavily upon the use of the Enfield collections, a massive group of archaeological materials recovered by avocationalists Grace and Rollin Enfield. A subset of this collection, which derives from 150 sites on the Volcanic Tableland, had been donated to the Inyo National Forest and was loaned to me for study. Artifacts from these collections were catalogued and analyzed during this project and have been critical to expanding the spatial and temporal coverage of obsidian sourcing and hydration programs.

In all, the database of cultural materials assembled for this research includes more than 130,000 artifacts from 196 site locations, including more than 4000 flaked stone and 1600 ground stone implements, over 125,000 pieces of assorted debitage, and a wide array of other items including faunal and shellfish remains, ceramics, beads, and other bits of ornamental stone. Obsidian source samples consist of visual and/or chemical assignments made on over 8000 pieces and obsidian hydration measurements were obtained from nearly 2000 artifacts. Those artifacts subjected to obsidian study derive from surface and subsurface associations or from museum collections, and were used according to the scope and intent of each analysis.

RESEARCH GOALS

Both primary and secondary research aims are pursued in this study. The primary aims are necessarily broad in scope, attempting to address regional issues in Inyo-Mono prehistory, while the secondary aims relate more to refining aspects of the local prehistoric record. In combination, this suite of different objectives will be pertinent to a variety of archaeological interests, those generally oriented to understanding prehistoric man-land relationships on the Volcanic Tableland and across

eastern California, and others specifically concerned with long-term changes in lithic procurement and flaked stone technology.

Primary Research Aims

The most important and far-reaching goals articulate directed obsidian studies with hunter-gatherer settlement research in an attempt to both recognize and describe temporal and spatial shifts in settlement systems within and beyond northern Owens Valley. Despite the fact that many broad-scale patterns in prehistoric land-use have already been documented among aboriginal populations in eastern California (Basgall and McGuire 1988; Bettinger 1977, 1982a, 1982b, 1989a; Hall 1983; Delacorte 1990), such trends can only be applied in a general sense and pertain only to settlement systems that remain vaguely understood in terms of their overall spatial and temporal boundaries. Though it is impossible to ever track the movements of a specific cultural group across space and through time, it should be feasible to recognize major, long-term population movements in and out of a given area, and to build a rough chronology around those events.

To accomplish this, I intend to document patterns of obsidian source distribution on the Volcanic Tableland, compiling spatio-temporal profiles that result from extensive visual/chemical sourcing and obsidian hydration analyses. Proceeding from the position that raw material distributions can be indicative of settlement mobility (cf. Basgall 1989), different artifact forms are examined in large numbers and from many contexts in order to achieve maximum sample sizes. It is presumed that trends seen on the Tableland should be representative of changes occurring externally where larger, resident populations felt the effects of regional circumscription (e.g., decreased mobility and increased resource competition) during the terminal prehistoric era.

The second major goal of this research is to identify changes in flaked stone technology that may have accompanied the introduction of the bow-and-arrow to eastern California around 1400-1300

B.P. Obviously, there were some direct transformations in the makeup of aboriginal weaponry, but current evidence from replicative studies and from field research throughout the Inyo-Mono region (e.g., Basgall and Giambastiani 1995; Basgall and McGuire 1988; Delacorte and McGuire 1993; Delacorte et al. 1995) implies that the importance of other tool types may also have shifted slightly over time, biface forms decreasing in relative abundance to flake-based tools. This makes sense if it is assumed that bifacial preforms were normally used in dart-point production, and that only smaller flake blanks were required to fashion arrow-points. This issue, however complicated, can be addressed at a local level through a rigorous obsidian hydration program that generates temporal profiles for large samples of bifaces, flake tools, and technologically diagnostic debitage.

A late-Holocene trend toward regional population circumscription presumably had additional effects on the organization of lithic economies. For instance, a gradual decrease in overall settlement mobility may have, at some point, required aboriginal groups to make adjustments to their lithic procurement and transport practices. It has long been held that hunter-gatherers generally obtain lithic raw materials in the context of subsistence pursuits, an acquisition mode that is "embedded" within the organization of subsistence-settlement moves (Binford 1979). Rather than being able to freely move consumers to lithic sources, groups facing pressure against long-distance mobility may have resorted more frequently to obtaining stone by making specific, logistic forays to quarry locations rather than slight diversions from their normal rounds.

Secondary Research Aims

Of three secondary objectives, the most important is to describe and evaluate the results of archeological surveys and excavations on the Volcanic Tableland and at Fish Slough. Intensive surface surveys were conducted at Fish Slough in 1993 and across the Tableland in 1997, these programs resulting in the identification of over 50 archaeological sites (42 previously unrecorded).

Information gathered from these sites is used to: (a) produce a general site typology for the study area, based on variations in the structure and constituents of site deposits; (b) assess the spatial distribution of archaeological sites on the Tableland via comparison with site distributions resulting from the Enfield surveys; and (c) identify any spatial or temporal patterns in landform use that might reflect trends in the function and orientation of occupations within the study area. Test excavations implemented at Fish Slough in 1993 and 1996 investigated a total of eleven sites, including both large and small lithic scatters, a pair of small rockshelters with associated midden, and a few sites with fairly rich midden deposits. Collection activities at most locations were geared mainly to retrieving samples of obsidian debris; a total of 12,379 sq m was surface collected and some 43.3 m^3 of matrix was removed from project sites. The combined effort recovered more than 67,000 artifacts that include a wide range of obsidian tools and waste flakes. These materials are used primarily to develop the temporal structure for obsidian source and technological profiles but also to foster refinement of local hydration rates.

Another secondary objective is to describe how this study used an existing body of archaeological collections amassed by avocationalists between the mid-1960s to the early 1990s. Rollin Enfield, Grace Enfield, and Norm Weller conducted unsystematic surveys on the Tableland in which they recorded over 150 sites and recovered samples of artifactual debris. The collection, most of which was donated to the Inyo National Forest in the late 1980s, was catalogued and analyzed by the author and was employed in the present study. Although the materials lack intrasite provenience, the Enfields were careful to recover a wide range of artifacts and debris, including obsidian debitage. For this reason, Enfield collections figure prominently in the research, helping to boost dramatically the spatial and temporal coverage of obsidian studies. It will be worthwhile to describe the rationale and methods employed in using the Enfield materials, as they provide a good example of how outdated museum collections can still serve modern research needs.

The last of the secondary goals is simply to use obsidian hydration data from this research to assess the accuracy of Inyo-Mono hydration rates on the Volcanic Tableland. In particular, the Truman-Queen hydration rate developed by Basgall and Giambastiani (1995) can be tested with larger samples of projectile points, especially those of older vintage. Because several other obsidians (Casa Diablo, Mono Glass Mountain, Mt. Hicks) are also prevalent among projectile points in subject collections, there is some potential to address inter-source variability in hydration rates. On a local level, it remains possible that variations in temperature and relative humidity between Fish Slough and the Tableland plateau have affected the rate of obsidian hydration development somewhat differently (Giambastiani 1996). These issues must be explored in order to solidify chronological relationships throughout the study locale and to place local temporal sequences within a broader regional context.

CONTRIBUTIONS TO SETTLEMENT ARCHAEOLOGY

Probably the most important benefit of this study is its contribution to hunter-gatherer settlement research. Prehistoric settlement studies, having been important in American archaeology since the 1950s, seem to have hit a recent impasse. Despite major advances in the development of computerized geographic information systems (GIS) and geographic positioning systems (GPS), the focus of current settlement research has narrowed considerably. In fact, most contemporary hunter-gatherer studies now labeled with the word "settlement" are either directed to promoting new models of residential mobility, showing trends in the use of local landscapes (e.g., "uplands versus lowlands"), or demonstrating correlations between archaeological sites and natural habitats. The early goals of settlement archaeology (e.g., Willey 1956), aimed at revealing information about prehistoric land-use, population densities, and the "districting" or boundaries of ancient settlements, have been neglected recently in favor of more specific and more manageable studies of local land-use patterns.

A key factor prompting the move away from large-scale settlement studies has been the inability of archaeologists to adequately control for time. In the Great Basin, most regional archaeological projects must rely heavily on projectile point chronologies in constructing temporal frameworks, as dateable organics are rare and project analysis budgets stunted. If projectile points are uncommon in a given area, or if cultural deposits are complicated by depositional mixing, the determination of site age becomes problematic. The use of hydration analysis has improved controls somewhat where obsidian is prevalent, but many research programs are forced to restrict hydration to diagnostic projectile points which almost always occur in less than desirable numbers. In the southern deserts, where obsidian is rare, projectile point chronologies are even more tenuous than in other parts of the Great Basin. For this reason, attempts have been made to correlate shifts in flaked stone material selection and in lithic reduction strategies with specific temporal intervals. Better success has attended the former, but with conclusions restricted primarily to local levels.

It is hoped that the present study can revisit some of the original goals of settlement archaeology, by combining survey and excavation data with an extensive obsidian sourcing and hydration program. Along with diagnostic artifacts, hydration data provide the temporal controls necessary to demonstrate long-term change in human settlement patterns. Technological analyses are based strongly on hydration data so that shifts in raw material use, tool manufacture, and artifact discard may be correlated with spatial settlement trajectories. By knowing when and where archaeological deposits were created across the Volcanic Tableland, a settlement model for the project area can be developed that speaks to issues of hunter-gatherer mobility, land-use, and raw material acquisition within the Inyo-Mono region. This research provides a methodology for identifying and understanding long-term shifts in the settlement ranges and territories of prehistoric populations in the Great Basin, and is relevant to the study of hunter-gatherer populations in other parts of the world.

ORGANIZATION OF THE DOCUMENT

This dissertation is organized into ten chapters. The goals and contributions of the study have been discussed in this chapter (One). The intent of Chapter Two is to provide background information about the natural and cultural history of the project area. Chapter Three focuses on the theoretical principles and assumptions guiding the research, and Chapter Four outlines the analytical and sampling strategies and methods used in treating the archaeological collections. The next two chapters offer descriptions and interpretations of the fieldwork programs under my direction that recovered cultural materials used in the study; the first focuses on surface survey (Chapter Five), the second on excavations (Chapter Six). Chapter Seven describes the genesis of Enfield museum collections and the construction of the obsidian database, and Chapter Eight presents the basic results of obsidian studies, focusing on trends of specific relevance to the Volcanic Tableland. Chapter Nine outlines all of the major spatio-temporal patterns in obsidian use and technology and emphasizes their regional implications. Finally, Chapter Ten evaluates the implications of these patterns for long-term changes in modes of obsidian procurement, lithic technology, and aboriginal settlement within the Inyo-Mono region and western Great Basin. A host of data appendices concludes the document, from which both site- and artifact-specific information can be obtained.

Chapter Two

NATURAL AND CULTURAL CONTEXT

To understand fully past use of the Volcanic Tableland, the local archaeological record must be placed in its broader environmental and cultural context. As in any other part of the world, prehistoric human adaptations in the Inyo-Mono region must have been strongly influenced by spatial and temporal variation in climate, the availability of water, and in the abundance of floral, faunal, and other material resources. To be sure, modern-day habitats in divergent elevational and landscape situations can support very different resource bases which are productive only during certain times of the year. Archaeological and paleoenvironmental evidence from all over the Inyo-Mono region clearly demonstrate that aboriginal populations had exploited a wide range of different environments since the end of the Pleistocene, despite both major and minor shifts in regional and local climatic conditions. As occupations on the Volcanic Tableland may have begun as early as 8000 years ago, and persisted until fairly recently, it is important to provide a framework for certain environmental changes that may have occurred during this period. The following chapter first outlines the physiographic, geologic, climatic, and biotic conditions which have characterized the project area, both past and present. Discussions of paleoenvironmental circumstances necessarily draw more heavily from regional rather than local datasets.

During the last several millennia, long-term environmental shifts have been paralleled by changes in human cultural adaptation. More ancient, broad-scale patterns have been documented in the Inyo-Mono region through archaeological research; more recent, local trends can be inferred through the use of ethnohistoric information and by comparison of these with archaeological data. The second part of this chapter briefly reviews the culture history of the region and then focuses on the study area itself through discussions of ethnographic data, previous archaeological work on the

Volcanic Tableland, the geographic placement of surrounding obsidian sources, and the archaeological distributions of each source material.

REGIONAL ENVIRONMENTAL SETTING

The Volcanic Tableland formation is a massive plateau of reddish-pink welded tuff located just north of the town of Bishop, California, bordered to the west by U.S. Highway 395 and to the east by U.S. Highway 6 (Figure 2.1). Measuring roughly 32 km north-south by 20 km east-west, the Tableland is physically bounded in the broadest sense by the Sierra Nevada on the west and the precipitous White Mountains to the east. Its immediate boundaries, however, are marked to the southwest by Round Valley, to the west by Casa Diablo Mountain, and to the northwest by the Benton Range. Blind Spring Hill delineates the northern end of the formation, while all along its east side the plateau descends gradually into Hammil and Chalfant valleys. The Owens River fronts the steep southern scarp of the Tableland, descending from the Crowley Lake basin and cutting a deep gorge through the west portion of the Tableland before eventually turning eastward to parallel the entire southern perimeter of the plateau. Elevations increase from southeast to northwest, ranging from about 1300-2000 m (4260-6560 ft). The only permanent water on the Tableland is available at Fish Slough, a narrow wetland corridor located in the southeast corner of the province. This oasis lies within a small, north-south trending valley that has been created by local faulting and from ancient erosional processes.

Geology and Geomorphology

This section is divided into two parts, the first discussing the broader mesa or "Plateau" of the Volcanic Tableland, and the second discussing Fish Slough. Details pertinent to the archaeology of

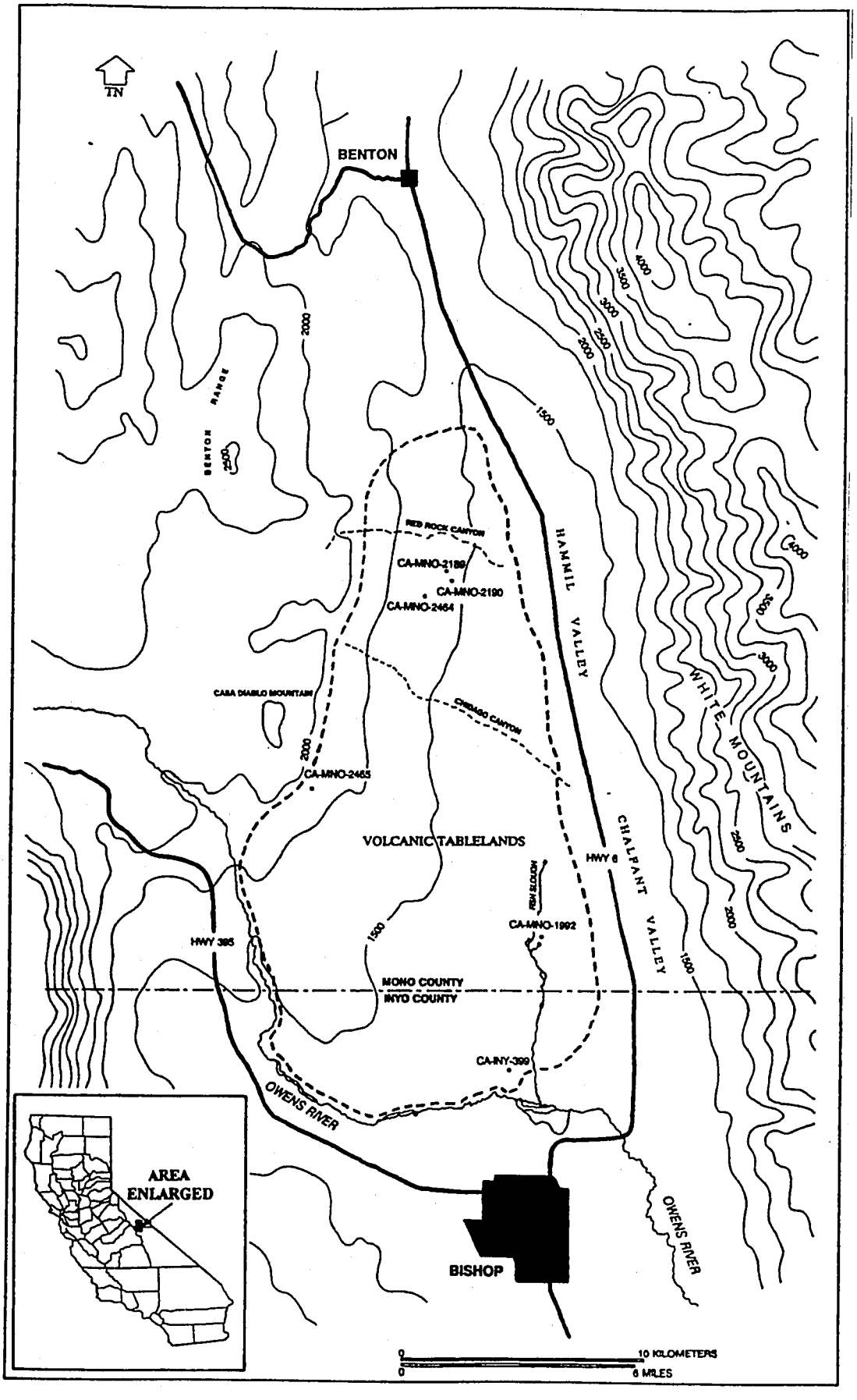

Figure 2.1. Dissertation study area (adapted from Basgall and Giambastiani 1995).

each locale require separate treatments here, if only to facilitate later comparisons between the two areas. Discussion of Fish Slough geology includes a short examination that debates the actual age of the slough waterway, this having implications for the age of its archaeology as well.

The Volcanic Tableland

Approximately 740,000 years ago, the Volcanic Tableland was formed by the explosion and collapse of the Long Valley caldera magma chamber (Izett et al. 1988; Sheridan 1975). Two major volcanic events were responsible for the development of the Tableland, both probably occurring within several hundred years of each other. The first was a massive, windblown ashfall episode that spewed material across much of the southwestern United States, ultimately contributing a five-meter thick basal pumice layer to the current location of the Volcanic Tableland. The second was a huge ashflow event that poured hot, glassy, but viscous liquid material out of the caldera and into surrounding topographic depressions as far west as the Sierra Nevada, north to the Mono Basin, east to the White Mountains, and south across the present Tableland province. Once cooled, the mass of tuff material produced by this event became agglutinated or "welded", solidifying but still remaining somewhat porous (Bateman 1965). This geologic unit, now referred to as Bishop Tuff, varies considerably in thickness from less than a centimeter at topographic high points in Long Valley to more than 550 meters deep within the Owens Gorge (Sheridan 1975). Most exposed Bishop Tuff is pink to red-orange in color, being quite distinct from other rocks in the surrounding region. The tuff is generally lightweight but varies considerably in hardness and tensile strength. Occasionally, small pebbles of obsidian can be seen protruding from the surfaces of recently fractured tuff boulders.

Topographic relief on the Volcanic Tableland is minimal across the plateau, though some deformation has occurred through faulting and warping of the larger tuff sheet. Shifts in the unconsolidated substrate well below the Tableland have produced an extensive series of north-south

trending fault scarps where the tuff slab has fractured and pushed upward or has slipped downward on one side or another. Though most of the Tableland is characterized by numerous linear fault scarps, the largest fault scarp runs along the east side of Fish Slough, reaching 150 m in height and extending for nearly 10 km. Steep talus slopes are also common across the plateau, often formidable features with boulders approaching 30 m in diameter.

Erosional forces have also played a central role in shaping the Tableland. Most surfaces across the plateau are characterized by decomposed tuff sediments that have eroded away from tuff bedrock cores. In general, these sediments comprise a loose, sandy matrix with a mixture of cobbles and pebbles. In some parts of the Tableland, tuff sediments can reach up to several meters in depth, but archaeological excavations have shown that prehistoric encampments often occur where such sediments are relatively thin (less than 50 cm). In the eastern and central portions of the plateau, bedrock remnants such as knobs and ridges are quite common, having been shaped by both aeolian and rainfall erosion. Tuff sediments remain abundant in the eastern area, but the central part of the Tableland has been fairly well stripped of its unconsolidated material through sheetwash removal and alluvial transport. In sum, the Plateau can be considered an erosional environment where sediment accumulation and stability are relatively low.

In terms of available toolstone, the surface geology of the Tableland is again quite uniform. Beyond the ubiquitous Bishop Tuff, there are few other kinds of material present anywhere. Cobbles of granitic, quartzite, schist, and various igneous stones are sometimes found in secondary geologic contexts around the Tableland. However, these materials normally occur in alluvial drainages and canyons, having washed down from higher elevations to the northwest (e.g., Benton Ranges, Chidago Flat, Casa Diablo Mountain). Some areas of the plateau, however, particularly in the extreme northeast, have small knolls of granitic sands literally poking out from surrounding tuff sediments. Cobbles lying on these more ancient, exposed landforms include materials that are similar to those

found at many archeological sites across the Tableland. On the other hand, quality toolstones suitable for knapping are almost non-existent. Obsidian, found usually as large pebbles or nodules and occasionally as small cobbles, does occur with regularity in loose tuff sediments across many portions of the Tableland. A large sample of these was collected during the 1997 survey and was chemically sourced, nearly all pieces assigned to the Mono Glass Mountain source some 38 km to the north (Giambastiani n.d.). As expected, nodules are more prevalent in the northern half of the study area, particularly in the northeast. Archaeological sites on the Tableland do show evidence of nodule reduction, most examples involving nodules too small for the production of anything but small flakes.

Fish Slough

In contrast to the Plateau, Fish Slough is a depositional rather than erosional environment. The slough waterway lies within a narrow, north-south trending valley that measures roughly eleven kilometers long and a maximum of three kilometers wide (Figure 2.2). The valley bottom is generally flat, elevations decreasing only about 30 m from north to south ends, an average of 2.7 meters per square kilometer in length. The west side of the valley is bounded mainly by the edge of the continuous Tableland plateau, which terminates in steep cliffs and talus slopes along much of this front. The entire east side of the valley consists of a massive, 150 m high fault scarp created by the eastward tilting and dropping of the block underneath Fish Slough; this has resulted in the eastward movement of the waterway, its current route following along the base of the fault scarp. Sediments along margins of the Fish Slough valley are somewhat varied, as the area has received both granitic alluvium from the Benton Range and decomposed tuff sediments from Tableland bedrock, but surfaces across the valley floor are exclusively Quaternary alluvium made up of fine-grained, silty sands (California Department of Water Resources [CDWR] 1964). At the extreme north end of the valley, alluvial surfaces have developed from the sedimentary output of some large drainages, and a

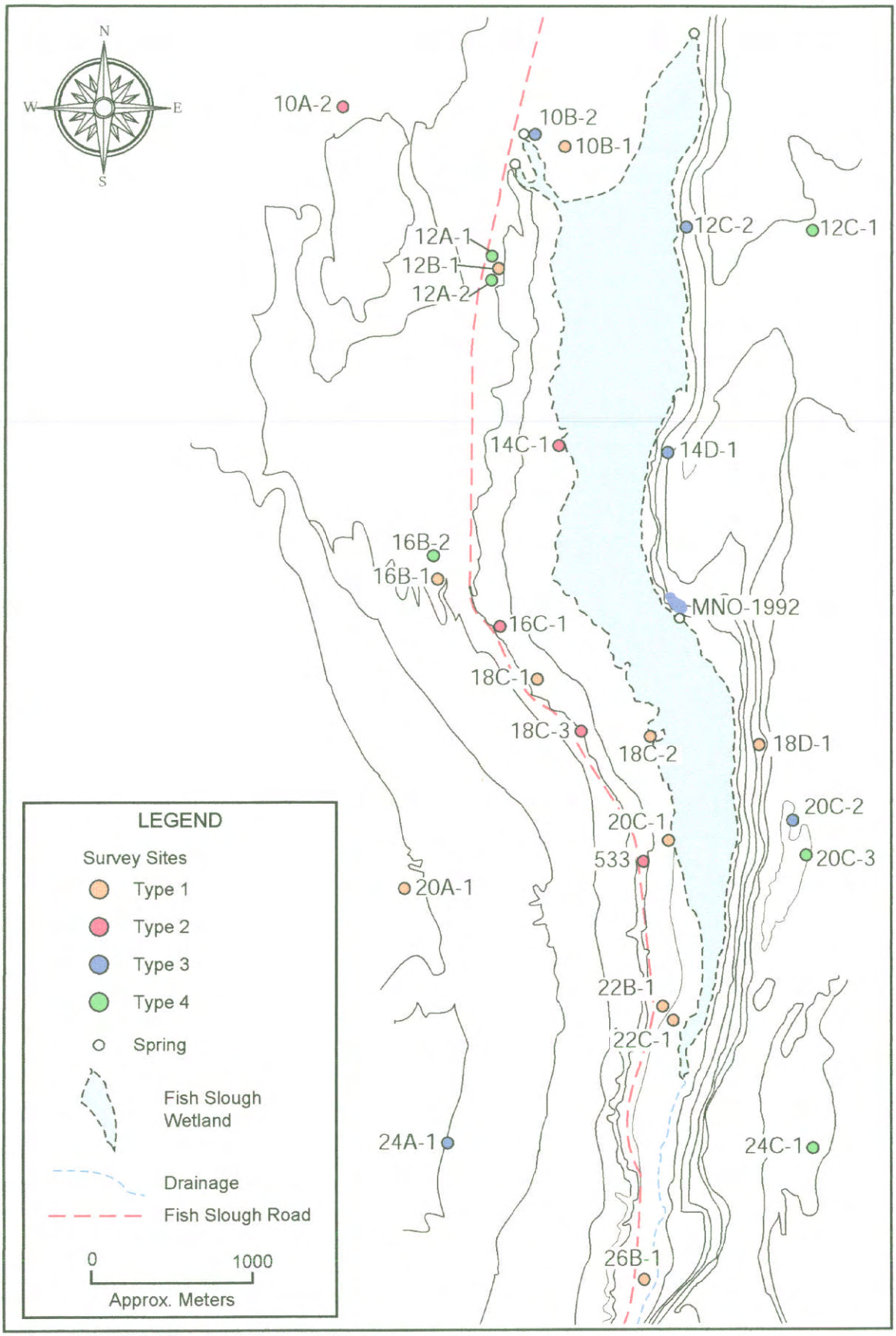

Figure 2.2. Fish Slough Valley and Drainage.

long arm of like sediments enters Fish Slough Valley at about its midpoint. This latter corridor, which has also created a broad embayment in the tuff cliffs, received materials from subsidiaries of an extensive Pleistocene-age drainage system that once brought tons of granitic sediments down through Chidago Canyon. Across the valley along the base of the eastern scarp, more grayish sediments are predominantly tuff-derived, having formed a low, narrow bench along the eastern perimeter of the slough. Through erosion, western cliffs have contributed pink tuff sediments to the valley, mainly to the southwestern reaches of the slough drainage.

Other interesting geologic features of the Fish Slough Valley are two series of broad, low dune features, one of aeolian and the other of fluvial origin. The first set of dunes is located between the northwest and northeast springheads, being most visible on the east side of the northwest spring. Archaeological sites found during the Slough survey (Chapter Five) lie atop and around these small dunes, those covering dune surfaces appearing to be relatively recent in age. Pinter and Keller (1991:III-7) also suggest a recent origin for these dune features. The other major series of dunes is situated along the western edge of slough just below its midpoint, roughly between UTM lines 414900-4146000 m N. In this area, the western cliffs of the valley become constricted, pushing eastward more than a kilometer toward the opposite fault scarp. Dune features, consisting mainly of granitic materials, have developed between the encroaching cliffs and the west edge of the slough, extending for approximately 2.5-3.0 km along its margin. Through this stretch, Fish Slough Road runs directly between the pinker, tuff-derived sediments to the west and the tan-grey dunes to the east, enhancing an already obvious depositional contact. The slough itself is broadest and deepest in this location, "Fish Slough Lake" being situated between the 4147500-414800 m N UTM lines, but this is probably also in part due the presence of a small dam farther downstream (Ferren and Davis 1991). South of the dune system, land surfaces on the west slough margin are dominated by a thin mantle of tuff sediments, and many extensive bedrock surfaces are exposed along both sides of the watercourse.

All this considered, it appears that the geomorphology of Fish Slough Valley is fairly complex. The overall shape of the valley was formed by three major processes: (a) faulting, which presumably created an original depression and continues to lower and tilt the valley floor; (b) long-term erosion of the Tableland core, which expanded the breadth of the valley; and (c) long-term alluviation, which brought loads of both local and external sediments into the valley. The fact that bedrock margins constrict dramatically toward the southern end of the valley suggests that erosional forces were generally weak or normally lost strength upon reaching this location. Also, the buildup of dune features in this zone, and the relative dearth of sediment farther south, together imply that the bedrock narrowing may have served as a "bottleneck" to trap materials that were not propelled by strong alluvial or gravitational forces. More recent aeolian forces have also affected some landscapes at Fish Slough, creating small dune features in the north/northwest portion of the valley.

Antiquity of the Fish Slough Drainage

The above scenario has implications for the age of Fish Slough and the land surfaces surrounding it, and for the archaeological record along its margins. Two positions have been stated concerning the age of Fish Slough (Ferren and Davis 1991). Pinter and Keller (1991) and Ferren (1991) hypothesize that Fish Slough is no more than two or three thousand years old, having emerged as the surface of the Fish Slough block dropped below the existing water table. This claim is based on three sediment cores taken along the slough, one each from the northwest and northeast springs and one from BLM spring (see Climate and Hydrology, below), and by the presence of ash layers in them that are assumed to derive from recent eruptions of the Inyo and Mono Craters. The authors note that previous researchers (no citations are given) have argued a contrary position, that Fish Slough is a fossil landscape at least 10,000 years old, but they interpret the coring results as indicating an aggregation of sediments imported by fluvial processes in the recent past.

There are two main problems with the inferences drawn by Pinter and Keller (1991) and Ferren (1991). First, although published core diagrams are not well detailed, the sedimentary history of Fish Slough seems not as simple as portrayed above. In all three cores there are numerous, alternating layers of different sediments, including ash deposits separated by up to 80 cm of other matrix. Some of these ash zones are also subdivided into as many as five parts, though no discussion of this sectioning is provided. It is reasonable to assume that minor variations in the character of the ash were being denoted here, but it remains possible that some of the ash in these different sublayers derives from separate sources and/or events. Unfortunately, none of the ashes were geochemically traced or dated, a fact that should have precluded any assessment of their origins and ages.

Second, Pinter and Keller (1991:III-7) state that "...several meters of sedimentary fill overlies Bishop Tuff altered to a white clay by groundwater". It is claimed that the two deeper cores, reaching 3.2 m (northwest spring) and 4.5 m (northeast spring), terminated in such matrix, though resulting profiles do not distinguish between "ash" shown at the bottom and "ash" encountered at shallower depths. The authors also maintain that their observations are consistent with those from coring excavations conducted during a feasibility study for a proposed dam and recreational reservoir project at Fish Slough (CDWR 1964), but the results from that project suggest otherwise. For the proposed construction (which was ultimately abandoned), a linear series of six cores was excavated east-west across the valley near its southern end at the dam location, core depths ranging between 99-185 feet. Two of these, core C-1 and C-2, were placed directly within the slough channel. The westernmost, C-1, encountered "peat" up to a depth of 12.5 feet (3.8 m) and alluvial sands and gravels until 22 feet (6.7 m) where Bishop Tuff was finally encountered (CDWR 1964:43). Thus, alluvial sediments reached more than 2.0 m deeper than in the core excavated by Pinter and Keller at the northeast spring. The issue here is not whether Pinter and Keller (1991) misidentified the basal ash in that sediment core, but that they simply assumed no deeper (and older) sediments exist at Fish Slough.

There are also two other lines of evidence that imply a considerable age for Fish Slough. Haller's (1991b) phytogeographic study compared Fish Slough with several other major Great Basin wetlands to outline geographic distributions of various plants and to determine the diversity of taxa in each location. Fish Slough was found to contain 126 wetland taxa, 34% of which did not occur in any other area examined. This study, detailed more specifically later in this chapter (Contemporary Flora and Fauna), also showed that the flora of Fish Slough was extremely diverse relative to that of other locations. Borrowing principles from ecology (Pianka 1974), the development of species diversity must be in part a function of time, with older, stable environments generally having more taxa than younger ones. If Fish Slough originated no longer than 3000 years ago, as suggested by Ferren and Davis (1991), in order to achieve the current total of 126 taxa a new one must have successfully colonized the slough every 24 years or so, on average. While not impossible, this is certainly an unlikely time frame. Hence, it is hypothesized here that either the taxonomic study is in error, or that Fish Slough is much older than just a few thousand years, the latter of which is clearly favored. In fact, archaeological evidence from Fish Slough implies that the waterway is probably of early Holocene age and perhaps even older. Along with obsidian age profiles offered elsewhere (Basgall and Giambastiani 1995), current data suggest that some artifacts from Fish Slough sites are probably on the order of 8000 years old, if not older. Many sites border the slough quite closely, being situated on alluvial sediments and manifesting surface and subsurface artifacts of said antiquity. The actual age of the slough seems more likely to be 10,000 years than 2000 years.

Climate and Hydrology

The climate of the Volcanic Tableland is continental and arid, the Sierra Nevada range effectively cutting off the flow of cooler, Pacific air that would otherwise have a moderating effect on local temperature. Current seasonal temperatures at Fish Slough reach an average low of -15° C (5°

F) during the winter, with hard nighttime frosts occurring regularly between the end of October and the beginning of May (Haller 1991a). Peak summer temperatures are quite hot, though, reaching an average high of 38° C (100° F) with many days at 40° C (104° F). In the spring and early fall, daily temperature normally range around 23° C (73° F), with extremely cold nights followed by mild to warm days. Even though Fish Slough may be one of the warmer spots on the Volcanic Tableland, being at a low elevation within a broad valley, elevational differences even to the extreme northwest are not dramatic enough to significantly alter local temperatures. By comparison, long-term temperature data for the Bishop area assembled by Powell and Klieforth (1991) show a relatively cool mean annual temperature of 13.3° C (56° F), and seasonal averages ranging from a low of 2.9° C (37.2° F) in January to a high of 24.9° C (76.9° F) in July. While Bishop certainly experiences peak summer temperatures around 38° C (100° F), its seasons are generally milder than those on the Volcanic Tableland.

Precipitation patterns are of Mediterranean character, over half of all annual rainfall occurring between December and February and less than one tenth between June and August. According to Haller (1991a), the mean annual precipitation rate for Bishop is 5.61 inches (142 mm). Occasional summer rainfall is produced by the movement of sub-tropical air masses from the Gulf of California into the area, often creating dramatic thunderstorms. Because of its relatively isolated geographic position, the Tableland receives minimal runoff from only a few sources. Casa Diablo Mountain contributes some excess water to the southern lobe of the Tableland, while Chidago Canyon and Red Rock Canyon are routes for runoff from the Benton Ranges and Chidago Flat. Movement of such water must have considerably more consistent and/or of larger volume, as both canyons are quite deep and cross the entire width of the Tableland, ultimately emptying into Hammil and Chalfant valleys. In cold winters, snowfall may reach the northwest margin of the Tableland but does not remain long.

Such climate and rainfall parameters clearly have a major effect on patterns of plant growth

and environmental productivity. In arid zones like the Tableland, most precipitation occurs when temperatures are too low for plant germination, and when temperatures increase sufficiently to stimulate growth, there is only a limited period of time in which adequate soil moisture is available (Young et al. 1977; Haller 1991a). Thus, plant growth is limited mainly to the late spring/early summer, and productivity is highly variable from year to year depending on whether there is little moisture left when temperatures warm early in spring or rainfall continues after February and extends the growth season.

Beyond what rainfall is captured temporarily by natural tuff basins, there are no sources of water anywhere on the Tableland outside of Fish Slough. This unique wetland stretches for about 10 km, running due south through the southeastern quarter of the Tableland to finally join the Owens River just beyond the plateau's edge. Fish Slough is fed by three major springthroats, two at its northern end (northeast and northwest) and one mid-course at the base of the eastern scarp (BLM Spring). When discharge from Fish Slough is highest, between December and May (averaging about 10 cubic feet/second [cfs]), the waterway widens considerably; when discharge decreases from June to November (mean of about 8 cfs), the slough contracts its margins, exposing moist, white alkali-covered mudflats along much of its length. Annual output is fairly regular, but Pinter and Keller (1991) suggest that at least one half of all water entering the slough between June-September is lost to evaporation. Water from Fish Slough is potable but slightly alkaline, containing major solutes such as calcium, sodium, bicarbonate, and sulphur.

Contemporary Flora and Fauna

As the Volcanic Tableland is only minimally variable in terms of its topography, geomorphology, and hydrology, its biotic characteristics are also fairly homogenous. Plateau environments support a basically uniform expanse of Desert Scrub vegetation (Billings 1951;

Cronquist et al. 1972; Spira 1991), similar to that in surrounding zones at like elevation except for having more sparse and less taxonomically diverse populations. Though no systematic evaluations of Tableland plant communities have been completed, useful impressionistic data were gathered during archaeological surveys by the Enfields and by the author.

There are many important shrubs in the Desert Scrub community of the Plateau, including shadscale (*Atriplex confertifolia*), spiny hopsage (*Grayia spinosa*), sagebrush (*Artemisia* spp.), Nevada ephedra (*Ephedra nevadensis*), rabbitbrush (*Chrysothamnus* spp.), bitterbrush (*Purshia tridentata*), cottonthorn (*Tetradymia axillaris*) and smokebush (*Psorothamnus polydenius*). Sagebrush, ephedra, and bitterbrush all occur more often at higher elevations on the Tableland, sagebrush being most prevalent along the northwestern margin of the plateau. A few cacti also inhabit the northern upper reaches of the Tableland, the most conspicuous of these being jumping cholla (*Opuntia bigelovii*). Among the many herbs and grasses in the area, those that were important to aboriginal subsistence include native buckwheat (*Eriogonum* spp.), ricegrass (*Oryzopsis hymenoides*), blazing star (*Mentzelia* spp.), ashy wildrye (*Elymus cinerus*), needlegrass (*Stipa* spp.), and primrose (*Oenothera* spp.). Ricegrass and native buckwheat appear to have the broadest spatial distributions on the Tableland plateau, but are probably slightly more abundant at lower elevations.

Many different types of mammals, birds, and reptiles inhabit Desert Scrub environments like the Volcanic Tableland or use them on a seasonal basis (Carey and Wehausen 1991; Johnson and Cicero 1991; Macey and Papenfuss 1991). Large ungulates such as mountain sheep (*Ovis canadensis*) and pronghorn antelope (*Antilocapra americana*) were present in scrub environments prior to local extirpation, while mule deer (*Odocoileus hemionus*) are still found commonly today. Smaller mammals include a host of carnivores such as the coyote (*Canis latrans*), gray fox (*Urocyon cinereoargentus*), bobcat (*Lynx rufus*), badger (*Taxidea taxus*), and striped skunk (*Mephitis mephitis*), common lagomorphs such as the black-tailed jackrabbit (*Lepus californicus*) and the Nuttall cottontail

(*Sylvilagus nuttali*), and rodents like the antelope ground squirrel (*Ammospermophilus leucerus*), pocket gophers (*Thomomys* spp.), kangaroo rats (*Dipodomys* spp.), woodrats (*Neotoma* spp.), and mice (*Perognathus* spp., *Peromyscus* spp.). Rabbits are clearly the most abundant mammal on the Tableland but woodrat nests are also common throughout the area, these being large mounds of twigs, tuff cobbles and pebbles built often in open, exposed situations. More prevalent on the Plateau than mammals are various species of reptiles. Lizards are plentiful everywhere, particularly the sagebrush lizard (*Sceloporus graciosus*), western fence lizard (*Sceloporus occidentalis*), and western whiptail (*Cnemidophorus tigris*). Various snakes like the sidewinder (*Crotalus cerastes*), speckled rattlesnake (*Crotalus mitchelii*), striped whipsnake (*Mastichophis taeniatus*) and western terrestrial garter (*Thamnophis elegans*) are also common, preferring rocky areas rather than exposed, sandy terraces.

The environment at Fish Slough is very different from other parts of the Tableland. Uplands surrounding the slough corridor are dominated by Shadscale and Big Sagebrush Scrub, but low terraces bordering the slough have shadscale communities that include two saltbush species (*Atriplex confertifolia, Atriplex parryi*), rabbitbrush (*Chrysothamnus nauseosus*), greasewood (*Sarcobatus vermiculatus*), and desert blite (*Suaeda moquinii*). Perennial grasses on these terraces may include ricegrass (*Oryzopsis hymenoides*), saltgrass (*Distichlis spicata*), or rye grass (*Elymus cinerus*). At the slough margins but beyond alkali mudflats, Alkali Scrub associates include the same major shrubs found on nearby terraces but may include the occasional aster (*Aster intricatus*), iodine bush (*Allenrolfea occidentalis*), goosefoot (*Nitrophila occidentalis*), wild rose (*Rosa woodsii*), or willow (*Salix lasiolepsis*). Grasses like *Oryzopsis hymenoides* and alkali dropseed (*Sporobolus airoides*) are also common to alkali scrub vegetation (Forbes et al. 1988; Odion et al.1991).

The uniqueness of such distributions, however, pales in comparison to the vast array of plant species found in marshland environments at Fish Slough. Outer margins of the waterway are characterized by alkali flats and meadows, many of these areas being inundated with several inches

of water during winter months. These situations still manifest many Alkali Scrub associates, but in addition host an immense range of other shrubs, grasses, and vascular plants. Many of these were probably important to native subsistence economies; among those not already mentioned are sedge and tule (*Scirpus* spp.), cattail (*Typha* spp.), and grasses such as spike-rush (*Eleocharis* spp.), rush or wire-grass (*Juncus* spp.) bluegrass (*Poa nevadensis*), and arrow-grass (*Triglochin debilis*). Inner slough margins are riparian in nature, containing denser populations of tule and cattail along with additional major plants such as water parsnip (*Berula erecta*), pondweed (*Potamogeton* spp.), duckweed (*Lemna* spp.), and ditch-grass (*Ruppia maritima*). Beyond these more prominent species, the slough hosts over two hundred other vascular plant taxa (271 in all), making for an incredibly diverse wetland habitat matched nowhere else in the Great Basin (Forbes et al. 1988). In fact, a comparative study of nine major Great Basin and Mojave Desert wetlands by Haller (1991b) shows that 34% of all vascular plants at Fish Slough are unique to that drainage. With 126 strictly wetland taxa, Fish Slough also held by far the richest flora of any wetland, the next highest location being Deep Springs Valley (52 taxa).

Faunal populations at Fish Slough are not as dramatically varied as floral communities. Beyond the coyotes, deer, rabbits, and other mammals that routinely visit the slough, there are a number of animals inhabiting the slough area that are rare on the Plateau. Most notably, various avifauna are concentrated at Fish Slough, especially numerous species of waterfowl (Johnson and Cicero 1991; Yokel 1991). Among major types observed during a recent census by Yokel (1991) are mallard (*Anas platyrhynchus*), northern pintail (*A. acuta*), cinnamon teal (*A. cyanoptera*) and green-winged teal (*A. crecca*), and coot (*Fulica americana*). Other, less abundant birds include eared grebe (*Podiceps nigricollis*), pied-billed grebe (*Podilymbus podiceps*), gadwell (*A. strepera*), redhead (*Aythya americana*), buffle-head (*Bucephala albeola*), and ruddy duck (*Oxyura jamaicensis*). Several kinds of fish and shellfish also inhabit the slough. Populations of Owens pupfish (*Cyprinodon*

radiosus), Owens tui chub (*Gila bicolor snyderii*), and Owens sucker (*Catostomus fumeiventris*) were once abundant in the waterway but have been impacted by historic land-use practices (Kratz et al. 1991; Taylor 1981), the former being seriously endangered. Freshwater mussel (*Anodonta* spp.) was once present in abundance, as evidenced by dense quantities of detritus at archaeological sites on the Tableland, but it appears to have been completely extirpated.

All this said, Fish Slough is obviously a much different place in comparison to environments on the surrounding Tableland. Water, though probably important to animal populations, may not have been the major draw for prehistoric human groups given the proximity of Owens River. Instead, diverse floral and faunal populations at the slough were probably of significance to native subsistence economies, both for food and raw materials. Fish Slough contains an extremely varied habitat within a relatively confined area and many many different microenvironments exist along its margins. During the course of a year, some areas grow more or less saline, while others are inundated with water in winter but dry up in summer. In this sense, the sheer diversity of slough flora probably indicates that there are seasonal differences in plant growth, some related to either water and or alkalinity levels, and that plant productivity probably occurs year-round. Given also the presence of different migratory animals at various times of the year, Fish Slough probably always has some resources available, with salt-loving plants being abundant in the summer and water-dependent taxa growing more plentiful in winter. Nelson (1999) posits that occupations at Fish Slough Cave (MNO-2381), which clearly targeted wetland resources, probably occurred during late fall or winter. Farther afield, Wheat (1967: 15) also notes that, after first snowfall, some Paiutes of western Nevada "left the forest for their camps near the marshes" and took advantage of cat-tail and nutgrass seeds throughout the course of winter.

Paleoenvironments

Proxy data amassed mainly over the last two decades from numerous localities in eastern California demonstrate important shifts in climatic trends since the end of the Pleistocene era (Elston 1982; Hall 1983; Hall and Basgall 1988; Mehringer 1986). These changes are normally of interest to archaeologists in considering their effects on the distribution and relative abundance of economic resources within any given area. In order to understand the "effective" past environment of the Volcanic Tableland, it is necessary to outline what we know of major changes in past climates in the western Great Basin. The following discussion draws structure from Hall (1983), but benefits from recent data acquired from the Volcanic Tableland and the White Mountains (Basgall and Giambastiani 1995; Jennings 1988, 1989; Jennings and Elliott-Fisk 1991) and from summaries by Grayson (1993) and Halford (1997).

From a regional perspective, the beginning of the Holocene (10,500-8500 B.P.) corresponds to the first of several major glacial events, the Hilgard advance (Curry 1971). Climates were generally cooler and moister than at present, despite a number of short-term warming episodes that occurred within this time frame. Batchelder (1970) suggests that Black Lake reached its post-Pleistocene high stand during this interval (about 9000-8500 B.P.). Based on the contents of packrat middens, Thompson (1990) estimates that summer temperatures in the east-central Great Basin were roughly 7-9° F cooler than at present. More locally, a packrat midden from the southern end of the Volcanic Tableland, dated to about 9800 B.P., also implies more mesic conditions as it contains plant taxa now typical of White Mountain woodland communities (Jennings 1989). Two other early Holocene middens from Falls Canyon in the White Mountains, dated to roughly 8800 and 7800 B.P., appear essentially modern except for the presence of *Juniperus* which is lacking in the present community (Jennings 1989); it is suggested that the presence of juniper in the middens may reflect increased summer precipitation.

However, by about 8000-7000 B.P., Great Basin climates reached a temperature optimum, or Hypsithermal, that lasted until sometime around 6000 B.P.; this change correlates roughly with Antevs' (1948) famous "Altithermal" period (7000-4500 B.P.). Hall (1983) favors more current but broad-scale reconstructions which suggest the terminal end of the Hypsithermal was punctuated by minor glaciations and periods of increased effective moisture (cf. Denton and Karlen 1973; Mehringer 1977). In either case, there are numerous data which support the idea of a warmer middle Holocene. In a classic study at Sheep Mountain in the southern White Mountains, LaMarche (1973) dated scores of dead bristlecone pines, all located well above the current treeline. Dates fell between 6500 and about 4200 B.P., implying the existence of warmer-than-modern conditions during that period. Mid-Holocene rat middens from the White Mountains, dating to about 5650 and 4500 B.P., also imply a higher elevation for woodland zones, this being consistent with warmer temperatures inferred for this period (Jennings 1989; Jennings and Elliott-Fisk 1991). Despite this general warming trend, Hall (1983) suggests that climates again became relatively cool and moist between 6000-5300 B.P., followed by a return to warm/dry conditions until about 3500 B.P.

At about this time, a suite of paleoclimatic indices signals the onset of a major cool/wet period. Such conditions evidently prevailed at Black Lake between 3600-2100 B.P. (Batchelder 1970), and to the southeast shallow lakes apparently formed at Little Lake (Mehringer and Sheppard 1978), Searles Valley (Smith 1967, 1968), and in Death Valley (Hunt and Mabey 1966). Across the continent, this increased glacial activity may have reached a maximum around 2800-2600 B.P. (Denton and Karlen 1973), correlating with the Recess Peak advance in the Sierra Nevada (Curry 1969). Bristlecone pine data from the White Mountains (LaMarche 1973) corroborate this trend, showing a drop in the treeline between 2700-2200 B.P. that probably reflects cooler and moister conditions. The formation of meadow deposits at Mammoth Lakes was also synchronous, occurring at around 2500 B.P. (Wood 1975). At Mono Lake, Stine (1990) showed a highstand occurring at

around 3700 B.P., while Wigand (1987) showed that Diamond Pond in southeastern Oregon attained its deepest levels at ca. 3750-3450 B.P. and between 2800-2050 B.P. Wigand also demonstrated increases in juniper and grass pollens between 3750-2050 B.P. which are attributed to increased effective moisture and cooler temperatures.

Most paleoenvironmental reconstructions show a waning of neoglacial activity after 2200 B.P., with a terminus around 1000 years ago. LaMarche (1974) shows a slowing of tree-ring growth in the White Mountains during this time. Black Lake may have dried almost completely after 2100 B.P. (Batchelder 1970), while the Little Lake area saw the return of saltgrass meadow and marsh (Mehringer and Sheppard 1978). Also, Stine (1990) suggests that water levels in Mono Lake were at their lowest between 2000-1800 B.P. Packrat midden data are consistent as well. A sample from the central part of the Volcanic Tableland dated to about 2100 B.P. contains stems of indigo bush (*Psorothamnus* spp.), a plant typical of modern Desert Scrub environments (Jennings 1988, 1989).

During the most recent prehistoric era, fluctuating bristlecone treelines in the White Mountains reflect a period of warming between 950-750 B.P. (LaMarche 1973). Along the Walker River in eastern California, Stine (1990, 1994) correlates shifts in the river course with a continental warm-dry trend during this same interval; this he termed the "Medieval climatic anomaly" (Stine 1994), though it is also known as the "Little Altithermal" (Eckerle 1996; Bettinger 2000). This period of relative aridity was not as severe as during the middle Holocene, or Altithermal, but it appears to have had varying regional effects and probably lasted until about 600 B.P. (Bettinger 2000). After this time, between about 650-190 B.P., a fairly minor glaciation ensued, termed the Matthes advance in the Sierra Nevada (Curry 1969). Across the continent, this neoglacial event may have peaked around 350-200 years ago (Denton and Karlen 1973).

As touched upon briefly in the previous discussions, changes in paleoclimate resulted in vegetational shifts on both regional and local levels. Considering the present study area, one question

of import relates to the timing of the development of modern Desert Scrub vegetation community. Packrat midden data from the Volcanic Tableland show that current associations were in place at least by 3300 B.P. (Jennings 1989; Jennings and Elliott-Fisk 1991). However, as mentioned earlier, other middens from the White Mountains show essentially modern constituents as early as the middle Holocene, between 5600-4500 B.P. Pollen spectra from Black Lake (Batchelder 1970) also show no major temperature changes since the mid-Holocene. Furthermore, such records from lakes near Steens Mountain, Oregon (Mehringer 1985), and from nearby Diamond Pond (Wigand 1987) again show relatively unchanging temperature regimes after 5000 B.P.; at Diamond Pond, sagebrush and *Atriplex* had replaced a *Sarcobatus*-dominant community by this time. There are also several studies from the Mojave Desert that are in agreement (Spaulding 1990, 1991; Van Devender 1990), all implying that Desert Scrub vegetation in the Great Basin is at least of mid-Holocene antiquity. Even in light of the paleoclimatic outline presented above, minimal variations in fossil and modern plant components imply that any late-Holocene climate changes were relatively short-lived and inconsequential in regards to their effects on the basic constituents of vegetation communities.

REGIONAL CULTURAL SETTING

The Volcanic Tableland lies within the Inyo-Mono region east of the Sierra Nevada, an area that stretches north to the Mono Basin and south to China Lake. Decades of archaeological research have been conducted in this part of the Great Basin, but most major efforts and regional syntheses have focused on areas such as Mono Basin, Long Valley, Owens Valley, the White Mountains, Deep Springs Valley, Little Lake, and China Lake (Basgall and McGuire 1988; Bettinger 1975, 1977, 1989a, 1991; Bettinger and Baumhoff 1982; Davis and Panlaqui 1978; Delacorte 1990; Hall 1983; Harrington 1957; R. Jackson 1985) while other important programs have been completed on the

Volcanic Tableland (Basgall and Giambastiani 1995), at the Coso obsidian quarries (Elston and Zeier 1984; Gilreath and Hildebrandt 1995), at the Rose Spring site (Yohe 1992), and in the vicinity of Owens Lake (Delacorte et al. 1995). Though eastern California contains one of the more well-studied sections of the Great Basin, the archaeological record here remains complicated. Indeed, for a host of reasons relating mainly to regional geomorphology, late Pleistocene/early Holocene sites are relatively rare in eastern California and more common in the southern deserts and in Nevada. Hence, the following discussions of early prehistoric adaptations draw heavily from work accomplished in the Mojave Desert, while ensuing sections provide a more local focus.

Late Pleistocene Prehistory

Setting aside claims for extremely ancient human presence in the arid west (Budinger 1983; Leakey et al. 1972; Schuiling 1979; Simpson 1958, 1980), more compelling evidence exists for human occupation at the end of the Pleistocene. In general, occupations prior to the Holocene era have been identified based on the presence of fluted-base projectile points similar to the well-known Clovis forms typically associated with ancient cultures of the Great Plains that have been fairly well-dated to between 12,000-10,000 B.P. Termed "Western Clovis" (Tuohy 1974; Willig and Aikens 1988), "Black Rock Concave Base" (Clewlow 1968) or "Great Basin Concave-Base" (Pendleton 1979), many types of Clovis-like points have been found in various locations throughout the western Great Basin and in California. Many of the earliest discoveries were made in the southern deserts, at Lake Mohave (Rogers 1939), China Lake (Davis 1975; Davis and Panlaqui 1978), Tiefort Basin (Brott 1966; Davis and Shutler 1969), and Little Lake (cf., Warren and Phagan 1988), but others came from western Nevada at Lake Tonopah and Mud Lakes (Campbell and Campbell 1940; Tuohy 1968, 1969; Kelly 1978; Pendleton 1979), from Owens Lake (Campbell 1949), from central California at Tulare Lake (Riddell and Olsen 1969) and northern California at Borax Lake (Harrington 1948; Meighan and

Haynes 1968). Though many of these were surface finds, sites at China Lake contained fluted points in apparent association with burned fragments of extinct faunal material (Davis and Panlaqui 1978); these locations remain among the more convincing for the Pleistocene age of fluted point occupations.

Indeed, more recent discoveries of fluted points have increased the spatial distribution of these artifacts but have not contributed much to solidifying their placement in time. Finds from the Mojave Desert have multiplied (Skinner 1984; Basgall and Hall 1991; Warren et al. 1989), as have those in the northern (Willig 1984, 1988; Fagan 1984, 1986) and western Great Basin (Basgall 1988; Hutchinson 1988; Zancanella 1988). While examples from radiocarbon-dated deposits remain lacking, artifacts from a few surface localities have been roughly dated by relative methods. For example, investigations at the Komodo site, MNO-679 (Basgall 1988) disclosed a number of "Komodo" type fluted points. Though no radiometrically dateable organics were recovered from the site, obsidian hydration of Komodo points places the site assemblage conservatively at about 9000-7000 B.P. (Basgall 1988). Elsewhere, geoarchaeological research at the Dietz site in south-central Oregon (Willig 1984, 1988, 1990) shows a stratigraphic separation of fluted and stemmed complexes that implies a greater antiquity for fluted points. At the same location, Fagan (1988) makes claims for technological distinctions between fluted and stemmed point flaked stone assemblages, while Basgall and Hall (1991) argue for a cultural division between fluted and stemmed point traditions in the Mojave Desert. Unfortunately, none of these studies had available the means to directly date fluted points; still today, the exact temporal position of fluted points in the Great Basin remains largely inferred. There are still some authors, however, that challenge the position of Western Clovis as the sole representative of late Pleistocene occupation in the far west. In particular, Bryan (1979, 1980, 1988) has continued to insist that stemmed point complexes at Fort Rock Cave (Bedwell 1973) and Smith Creek Cave (Bryan 1979) pre-date the Holocene era. In particular, Bryan has argued that stemmed points in the Mt. Moriah occupations at Smith Creek are associated with cultural materials

radiocarbon-dated to over 11,000 B.P. Grayson (1993) also suggests that early radiocarbon dates from Smith Creek Cave and from the Connley Caves (Bedwell 1973) make a valid case for stemmed point occupations being as old as 11,200 B.P. Nonetheless, as few other data imply similar antiquity for stemmed point assemblages, current perceptions maintain that such components, though perhaps older than considered historically, are probably not of late Pleistocene age.

Even though fluted points in the west occur frequently as isolated finds (cf., Basgall and Hall 1991), where cultural assemblages are associated with them these consist largely of flaked stone artifacts including bifaces and a range of formally-shaped, unifacial flake tools. The prevalence of bifaces in paleoindian (Clovis) assemblages has been interpreted as signifying a need for a generalist, portable technology among extremely mobile groups (Dincauze and Curran 1983; Kelly and Todd 1988; Meltzer 1993; Simms 1988). The notion of high Paleoindian mobility has drawn support from innumerable examples of long-distance lithic transport and from models that predict high raw material source variation in lithic assemblages of mobile groups (Basgall 1989; Goodyear 1979; Torrence 1986) and that associate extensive tool curation and reuse with high residential mobility (Nelson 1991; Shott 1989). The common perception that Clovis peoples were "Big Game Hunters" focused solely on the pursuit of extinct megafauna is being replaced by reconstructions of Paleoindian lifeways that portray ancient human adaptations as more variable and complex than previously thought.

Early Holocene Prehistory

In the western Great Basin, various stemmed projectile point forms have been fairly well dated to the early Holocene, roughly between 10,000-7500 B.P. Generally subsumed under the broader appellate "Great Basin Stemmed", these artifacts are elongate, lanceolate forms often with subtle, sloping shoulders, but there are many slightly different regional styles. In southeastern Oregon, point types such as Cougar Mountain, Haskett, Parman, and Casacade have been recognized in the Fort

Rock Valley (Layton 1970; 1972); in southern Idaho the Windust type is found (Ames 1988); in the Mojave Desert and in arid regions of eastern California classic forms such as Lake Mohave and Silver Lake are prevalent (Amsden 1937; Hunt 1960; Davis and Panlaqui 1978; Warren 1984; Basgall and Hall 1990, 1991; Delacorte et al. 1995; Basgall 1993); and in Nevada both northern and southern forms are found (Hutchinson 1988; Pendleton 1979; Price and Johnston 1988; Rusco and Davis 1987; Tuohy 1969). Further complicating this scheme is the recent discovery of another early point type in eastern California, "Fish Slough Side-notched", that appears to be about 7500-8000 years old based on hydration age estimates (Basgall et al. 1995; Basgall and Giambastiani 1995).

Because of their tendency to be found along the shorelines of extinct lakebeds, stemmed point assemblages were once considered to represent a unique, lacustrine-based subsistence adaptation. The term "Western Pluvial Lakes Tradition" (WPLT), originally coined by Bedwell (1973), was applied to stemmed point sites in ancient lakeshore contexts across the Great Basin. Lithic assemblages of the WPLT were found to be fairly comparable to Clovis materials, and in many cases points of both kinds occur together in the same sites (cf., Basgall and Hall 1990; Davis and Panlaqui 1978; Willig 1988, 1990). Flaked stone "crescents" (Amsden 1937; Tadlock 1966; Wardle 1913) were found primarily in such lakeshore assemblages, leading many archaeologists to draw associations between crescents and lacustrine environments. Davis and Panlaqui (1978: 61) note one prevalent hypothesis at the time, that crescents were "lateral bird bunts", or "specialized implements, capable of glancing off the water when used against waterfowl". For lack of a better alternative, this opinion still persists today. However, support for the WPLT has faded in recent years, as more and more stemmed points sites are discovered in locations away from extinct bodies of water, and the landform bias in early survey programs becomes increasingly clear; along these lines, bias in the differential preservation of ancient land surfaces along fossil washes and in the center of dry lake basins has also been recognized (Basgall and Hall 1991; Waters 1988, 1991).

A fairly complex picture of early Holocene adaptations in the western Great Basin has emerged from a number of current research efforts. Focused mainly at Fort Irwin in the Mojave Desert, work with stemmed point sites has revealed considerable variability in lithic assemblages and in raw material profiles, at the same time documenting relative stasis in early and middle Holocene faunal assemblages (Basgall 1990b, 1991, 1993; Douglas et al. 1988; Hall 1992; Jenkins 1985; Warren et al. 1986). Bifaces and formed flake tools, though quite common in Lake Mohave period sites, are shown to have had diverse uses (Jones 1991, 1992), while milling implements appear as regular parts of lithic assemblages. While raw material diversity among flaked stone artifacts still implies a considerable amount of residential mobility, patterns in some tool classes show preferences for certain kinds of materials. Finally, a focus on the procurement of small game, rather than large mammals, is demonstrated by most early Holocene faunal collections at Fort Irwin (Douglas et al. 1988; Basgall 1991; Basgall and Hall 1992).

Middle Holocene Prehistory

Archaeological assemblages dating to this period in western Great Basin prehistory are typified by varieties of projectile points bearing weak shoulders and indented or split-stem bases. Historically, gracile split-stem points termed Little Lake (Harrington 1957; Bettinger and Taylor 1974), Gatecliff Split-stem (Thomas 1981) and Bare-Creek Eared (O'Connell 1971) have been associated with this time period. These forms appear to reflect a more northern distribution in the western Great Basin, however, and are morphologically distinct from Pinto points (Amsden 1937; Campbell and Campbell 1935; Rogers 1939), a more robust form with a concave or notched base that demonstrates a southern geographic affiliation that includes the Inyo-Mono region (Basgall and Hall 1993; Delacorte et al. 1995). In addition to these distinctions, Little Lake/Gatecliff and Pinto points also diverge considerably in time, the former dated mainly to between 3500 and 5500 B.P.

and the latter between 5500 and 8500 B.P. (Basgall 1993). The antiquity of Pinto points in the western Great Basin is still debated, but some sites have produced radiocarbon dates of mid-Holocene age on materials associated with such artifacts. For example, Gilreath et al. (1995) reported a date of 6740 ± 90 B.P. for Pinto materials at INY-4554. Schroth (1994) also presents pre-8000 B.P. dates on shell beads in association with Pinto points at Little Lake, but these dates are held suspect for a host of reasons too involved for discussion here.

Beyond projectile points, flaked stone assemblages of this period are characterized by leaf-shaped bifaces, formal unifaces, flake tools, and consistent quantities of core-cobble implements (Campbell and Campbell 1935; Hunt 1960; Rogers 1939; Basgall 1993; Delacorte et al. 1995). Raw material variability is higher than in assemblages of more recent age, presumably indicating a high degree of residential mobility in mid-Holocene settlement systems. In the southern deserts, current descriptions of Pinto assemblages have acknowledged broad similarities to Lake Mohave patterns (Basgall and Hall 1990, 1992; Hall 1992) but argue for a greater abundance of ground stone artifacts in these complexes (Basgall and Hall 1994; Basgall et al. 2000). Milling equipment is clearly an important part of mid-Holocene assemblages, its morphology reflecting the importance of portability and less concern for intensive shaping.

Conventional wisdom finds the middle Holocene period to have been characterized by drier climatic conditions than either preceding or subsequent temporal intervals. Though few studies anymore make the case for an extremely arid Altithermal (Antevs 1948), or the complete abandonment of Great Basin environments during this time, some recent archaeological summaries still refer to a decrease in environmental productivity associated with the period between 7500 and 4500 years ago. In fact, Grayson (1993) attributes an apparent increase in Pinto-age seed grinding implements to the loss of more favorable habitats (with their better faunal resources) and a resultant expansion of human diet breadth to include seed grasses (see also Warren 1980, 1984; Warren et al.

1984). However drastic the Altithermal may have been, it is generally held that Pinto-period population densities remained low, and that subsistence adaptations were still focused on game animal procurement but were shifting gradually toward the more regular use of vegetal resources.

Late Holocene Prehistory

Dramatic changes in Great Basin subsistence adaptations during the Late Holocene produced a wide variety of temporal and spatial differences in archaeological patterning. Not only does the number of archaeological sites dating to this period increase markedly over the previous interval, but the attendant material remains diversify considerably in terms of functional specialization and stylistic/cultural affinity. If there are two main themes that can be drawn from this period in the western Great Basin, the first would relate to an intensification of native adaptive strategies that included or related to environmental shifts, population growth, and technological innovations; the second would relate to a supposed expansion of Numic populations (and cultural tradition) across the west during the more recent end of the late Holocene.

Throughout California, and in many parts of the intermountain west, there are clear archaeological examples of shifts in subsistence organization that relate to the increased use of plant resources after about 1500 B.P. (Basgall 1987; Basgall and Giambastiani 1995; Basgall and McGuire 1988; Bettinger 1989a, 1990, 1991; Delacorte 1990). These shifts were characterized by a diversification of diet breadth to include more low-return or labor-intensive foodstuffs (both faunal and floral), and were accomplished through the development or incorporation of new technology (use of water in leaching acorns; seedbeater, specialized baskets, and extensive milling features for bulk seed procurement; use of bow-and-arrow instead of atlatl-and-dart; pottery for cooking and storage) and/or by the adjustment of plant collection and processing techniques in an effort to extend plant harvests (green-cone collection and roasting pine nuts; green-seed collection and flash-burning;

dry storage). Population pressure, in combination with small-scale environmental changes, has been given much of the credit for increasing resource competition among Great Basin hunter-gatherers, thus necessitating some alteration of subsistence strategies. In addition to the above changes in material technology and extractive methods, evidence of extensive trade during the late Holocene was another mechanism that allowed human groups access to resources that may have been unavailable because of geographic population circumscription.

In an effort to explain many of these developments, a number of researchers have gathered linguistic and archaeological evidence to argue for the occurrence of a Numic population spread throughout the western Great Basin around 1000 years ago (Aikens and Witherspoon 1986; Bettinger 1994; Bettinger and Baumhoff 1982, 1983; Lamb 1958; Layton 1985; Sutton 1986). Amidst much debate, the various models would have Numic populations spreading north and east through the Great Basin, perhaps originating in southern Owens Valley or entering the basin from there. Armed with the more intensive adaptive strategies outlined above, Numic groups either replaced or assimilated through resource competition any pre-Numic populations already present. Still a topic of contention (see Madsen and Rhode 1994), the Numic Spread hypothesis remains so primarily because attempts to show clear-cut cultural replacement have not been totally convincing.

Ethnographic Period

There are only a few sources of data concerning the ethnolinguistic affinity of peoples that inhabited the study area prior to Euroamerican contact. In broad terms, the Volcanic Tableland places within the expanse of Western Numic, a branch of the Uto-Aztecan language family. This grouping is further subdivided into two distinct languages, Northern Paiute and Mono (Fowler and Liljeblad 1986). According to both Kroeber (1925) and Steward (1933), both of these languages were spoken by a population they labeled simply as "Northern Paiute" who occupied portions of northern Nevada

(south of Yerington) down through eastern California to the south shore of Owens Lake; this expanse would include groups living in Mono Basin, Long Valley, and Owens Valley. Steward (1933) also suggests that the western front of the White Mountains was the territory of "Paiute" groups but does not attribute the area specifically to any of the above groups. Merriam (Heizer 1966: Map 5) recognized a dialect boundary dividing the western part of the Tableland (affiliated with Long Valley *Pahng'-we-hoo'-tse*) and the eastern half (affiliated with Owens Valley *Kwe'-nah-pat'-se*). However, Kroeber's map of native dialects (Heizer and Whipple 1951: Map 1) shows the entire Tableland as part of the Owens Valley Paiute territory. Unfortunately, this information is largely unhelpful, though it does imply that more than one cultural group may have regularly used the study area.

The only specific information about native use of the study locale is found in Steward (1933, 1938). In his "Ethnography of the Owens Valley Paiute", Steward (1933: 305) mentions that the Bishop Paiute band (*Pitana- patu*) owned ricegrass (*wai*) on the Volcanic Tableland. In the same volume, a map outlines a large area of "wild seed lands" on the Tableland, extending from Fish Slough about seven miles west and at least five miles north-south (Steward 1933: 327). Also, this map places a *wai* camp on the eastern margin of Fish Slough Lake (midpoint along the slough) and plots a native cemetery a bit west of the slough about halfway between the camp and the southern end of the wetland. In his other work, "Basin-Plateau Aboriginal Sociopolitical Groups", Steward (1938: Figure 7) presents another map that shows not only an *Oryzopsis* zone and a seed-gathering location at the southern end of the Tableland, but also a root-collection area which, based on its plot, probably represents Fish Slough. On this same map, Steward has drawn a "band boundary" line that initiates at the western map border, cuts through the northern end of Round Valley, crosses the Owens River at its junction with Rock Creek and veers northward, terminating in the aforementioned *Oryzopsis* area. This division would appear to correlate somewhat with Merriam's dialect boundary (Heizer 1966: Map 5), supporting the notion that at least some portion of the western Tableland was used by

Long Valley groups. Each of these maps also notes a location with rock rings, pottery, petroglyphs and pictographs on the southern edge of the Tableland.

In the absence of more specific detail concerning aboriginal use of the project area, it remains to outline data from surrounding regions and to draw inferences and make comparisons between them. Ethnographic data from throughout the Inyo-Mono region depict the existence of two different kinds of subsistence-settlement regimes. More typical of Paiute groups was a forager-like system, probably present among the *Kuzedika* in Mono Basin and in Long Valley (Davis 1965) and among the *Koso* (Kroeber 1925) south of Owens Lake. These populations were fairly small and were organized into family bands, each of which was an economically independent unit (Steward 1938, 1955; see also Fowler 1966). Steward (1938) felt that the patchy distribution of Great Basin natural resources could not support larger groups during much of the year. Related bands probably came together in the winter months at seasonal villages and on special occasions, both for social (marriage, religious) and subsistence reasons (communal hunting or gathering events), but for most of the year families moved around by themselves. Resource exploitation was not socially mediated; several villages or family units shared common procurement areas, while individuals also had free access. Leadership roles were not rigidly defined, being realized only for ceremonial purposes and during communal subsistence events which required some organization of labor (Bettinger 1978; Davis 1965).

Such foraging Paiute groups practiced a "seasonal round" settlement strategy, shifting residence into different environmental zones to acquire resources that became available in different seasons (Bettinger 1977, 1982; Steward 1938, 1955; Wheat 1967). Nuts of the pinyon pine (*Pinus monophylla*) were an important autumn resource, prompting native groups to take up residence in the upper foothills and mountains during the fall and early winter. Seeds from many plants, including a few such as ricegrass (*Oryzopsis hymenoides*), needlegrass (*Acnatherum* spp.), and native buckwheat (*Eriogonum* spp.) were available in scrub environments during the spring and summer. Populations

of game animals such as mountain sheep (*Ovis canadensis*), pronghorn antelope (*Antilocapra americana*), and mule deer (*Odocoileus hemionus*) could have been taken throughout the year but in varying environments, herds moving into the mountains in summer and down into valley bottoms in winter. Residence at one location may have been of some length during pinyon harvest and through winter, but spring and summer camps were probably short term, at the most a few weeks.

In contrast, groups residing in Owens Valley were large, semi-sedentary social units (Bettinger 1978). Census estimates offered by Steward (1933, 1938) suggest that the Owens Valley region was one of the more densely populated parts of the Great Basin. Totals compiled by Major H.C. Egbert for the year 1870 reach 1000 individuals, while U.S. census figures at ten-year intervals from 1880 to 1930 range between about 600-1000 people (Steward 1933: 237). Later figures from Kroeber (1925: 586) are still comparable, accounting for 1200 Paiute in Mono and Inyo counties in that year. At first, Steward (1933: 237) claimed that Owens Valley population densities had remained around one person per 2.5 square miles, but he later changed his estimate to one per 2.1 square miles (ibid, 1938: 48). Still, a review of Steward's (1938: 48-49) census table shows that only the Reese River Valley had a higher density among Great Basin populations, reaching one person per 1.7 square miles.

According to Bettinger (1978), Owens Valley groups resided at lowland village sites for much of the year; Steward (1938) suggested that the relative abundance of natural resources in the valley allowed people to live in such aggregates. Village locations were occupied by 25-250 people, the total comprised of multiple families that were further integrated within larger social and spatial "districts" (Steward's Figure 7 [1938] shows a linear, parallel arrangement of adjacent "band boundaries" extending through Owens Valley). In each district, which encompassed one to several villages, hereditary headmen or "chiefs" controlled access to specific resource tracts (pine nut groves, ricegrass zones, fishing areas) in surrounding environments (Steward 1933: 304-305). According to some sources (Steward 1933; Lawton et al. 1976; Bettinger 1982b; Bouey 1979), Paiute in the Bishop and

Big Pine areas also practiced some level of agriculture within irrigation plots "owned" by each district. Lawton et al. (1976) concluded that Owens Valley agriculture was more complex than Steward had intimated, insisting that soil tilling and cultivation must have been involved rather than simply increasing irrigation to otherwise unmodified lands. In either case, some kind of group organization was needed to provide adequate labor for these efforts, a task also relegated to local headmen.

All things considered, it seems likely that no population ever occupied the Volcanic Tableland on a permanent or even semi-permanent basis. Given the dearth of subsistence resources on the Tableland relative to more productive environments in the region, and given the lack of ethnographic coverage it has received, one is tempted to characterize the landform as a sort of "no man's land", a marginal zone that was probably used at least seasonally by populations from surrounding areas. However, if, as ethnographic data suggest, the Volcanic Tableland was used by foragers to the north and more sedentary, land-owning groups to the south, one should expect to see differences in the archaeological record across the plateau. While previous studies have shown hints of this pattern (Basgall and Giambastiani 1995), this is really an empirical question to be addressed as a result of this study. Comparisons of the above models with late-period archaeological trends will help measure of the accuracy of post-contact ethnographic data from the Inyo-Mono region.

PREVIOUS ARCHAEOLOGICAL RESEARCH IN THE INYO-MONO REGION

Scientific interest in eastern California prehistory began in the late 1950's and early 1960's. Building upon developments in archaeology occurring in the southwest and in other parts of California, Riddell's work at INY-2 (1951) and elsewhere in Owens Valley (ibid, 1958; Riddell and Riddell 1956), Meighan's (1953) excavations at Coville Rockshelter and his (1955) surveys throughout Mono County, and Harrington's (1957) efforts at Little Lake were among the first

substantial studies to have been conducted in the Inyo-Mono region. Accompanied by a resurgence in ethnographic work (Davis 1965; Heizer 1966; Kelly 1964; Kroeber 1959), much of the baseline archaeological data for the western Great Basin was accumulated during the 1960's. In addition to important contributions made by archaeologists in other parts of the Great Basin (e.g., Jennings 1957; Heizer 1951; Heizer and Baumhoff 1961), among the more significant works at this time in Mono and Inyo counties were Lanning's (1963) efforts at INY-372 (Rose Spring), Hunt's (1960) initial surveys in Death Valley, Davis' (1964) survey and excavations in Mono Basin and her work throughout the 1960's in Panamint Valley (Davis 1970). By the early 1970's, western Great Basin archaeologists had a projectile point chronology supported by radiocarbon dates (Baumhoff and Byrne 1959; Clewlow 1967; Clewlow et al. 1970; O'Connell 1967; Bettinger and Taylor 1974), the beginnings of obsidian hydration dating and chemical sourcing methods (Friedman and Smith 1960; Friedman et al. 1966; Jack and Heizer 1968; Matson 1960; Michels 1965; Stross et al. 1968), a notion of past linguistic changes (Lamb 1958; Miller 1966), and a few working hypotheses about Great Basin paleoclimate (Antevs 1948, 1952; Aschmann 1958) and prehistory (Jennings 1964; Steward 1955), all backed by a renewed worldwide interest in hunter-gatherer anthropology (Lee and De Vore 1968).

Though summarized only briefly here, this background of archaeological work, which itself could not have been possible without the prior construction of culture-historical frameworks in the Southwest (Kidder 1924; Kroeber 1916, 1939; Nelson 1914, 1916), was essential to the major developments in Inyo-Mono archaeology that began in the 1970's. In the midst of debate between Jennings' (1957, 1964; Jennings and Norbeck 1955) "Desert Culture" strategy and Steward's (1955) model of Shoshonean cultural ecology, archaeology in eastern California moved away from its traditional site-specific focus to a more regional orientation. Influenced mainly by the work of Thomas (1971a, 1971b, 1972, 1973) in the Reese River Valley, the reconstruction of "subsistence-settlement" systems (Struever 1968) became the first real long-term goal of Inyo-Mono archaeological

inquiry. Survey programs by Bettinger in Owens Valley (1975) and Long Valley (1977b) were directed at acquiring data to correlate site types with landscape situations in each area. At the same time, the effects of a "revolution" in the use of sampling in archaeology (Asch, 1975; Binford 1975; Mueller 1974, 1975) were also manifested in Bettinger's surveys, allowing for statistical analyses to serve in interpreting spatial patterning observed among survey data (Bettinger 1975, 1977a). These works served as the impetus for Bettinger's later (1979, 1981) treatises of settlement data and statistics, and, more importantly, provided the baseline data for his characterizations of Inyo-Mono settlement ecology (Bettinger 1982; see Late Holocene Prehistory, above).

Building on Bettinger's efforts, archaeological field work expanded dramatically throughout eastern California during the mid 1970's-mid 1980's. Notable academic efforts were few, including Singer and Ericson's (1977) study of the Bodie Hills obsidian quarry, Hall's (1983) examination of prehistoric volcanism and human settlement in the Long Valley-Mono Basin area, Peak's (1975) surveys and excavations along U.S. 395, and Bouscaren's (1985) excavations southwest of the Volcanic Tableland. In contrast, professional cultural resource management (CRM) efforts became increasingly common, most consisting of small-scale surveys or test excavations. Across the Inyo-Mono region, spot surveys took place near the Bodie Hills quarry area (Hall 1980), around Mammoth Lakes (Bettinger et al. 1983), in the Long Valley/Glass Mountain Ridge area (R. Jackson 1985), near the Casa Diablo geothermal zone (Hall 1986), and on the northern front of the White Mountains (Hall 1982). Excavations were equally prevalent, occurring in the Mono Basin (Bettinger 1978a, 1980, 1981), around Mammoth Lakes (Basgall 1983, 1984; Bouscaren et al. 1982), near Casa Diablo (Hall 1987), in the Fish Springs area (Burton 1986), and along lower Cottonwood Creek in southern Owens Valley (Wilke 1983). Highway developments required linear surveys and excavations along U.S. 395 in both Mono (Garfinkel 1980b; Garfinkel and Cook 1979) and Inyo counties (Bettinger et al. 1984a; Garfinkel 1980a; Warren and Hearne 1974), while transmission line projects fostered a set of corridor

surveys in the Casa Diablo area (Cowan and Wallof 1974; King 1973a, 1973b). These projects, along with a host of others implemented up until the mid-1980's, were useful in compiling small datasets from various localities but did little to test Bettinger's (1982a) model of Inyo-Mono settlement systems.

In truth, it was not until the late 1980's that more significant excavation projects were really able to assess the accuracy of Bettinger's Inyo-Mono settlement model. Perhaps the most important of these was the excavation of site INY-30 in southern Owens Valley (Basgall et al. 1988b; Basgall and McGuire 1988), where rich archaeological deposits spanned some 7000-9000 years of occupation. Results of the work at INY-30 implied some considerable differences in settlement mobility through time, contrasting certain elements of the Bettinger model. In fact, Bettinger's own (1989a) excavations at Crater Middens in central Owens Valley and his ongoing work in the White Mountains (Bettinger 1990, 1991) have resulted in the refinement of some earlier hypotheses (see Late Holocene Prehistory, above). While other important archaeological programs were completed during this time, in parts of Mono County (Basgall 1988; Bouscaren and Wilke 1987; Burton and Farrell 1990; Mone 1986), on the Volcanic Tableland (Basgall and Giambastiani 1992), near Bishop (York 1988), and in the Coso area (Elston and Zeier 1984; Gilreath 1987, 1988; Gilreath and McGuire 1987; Hildebrandt and Gilreath 1988), perhaps the most significant developments beyond those at INY-30 and Crater Middens came out of obsidian studies. In particular, the work of Hughes (1988, 1989), Basgall (1989), Bettinger (1989b), Ericson (1989), and Hall and Jackson (1989) with various eastern California obsidians did much to refine and update existing notions of hydration rates and source parameters. Studies such as those by Hall (1983), R. Jackson (1985), and Basgall and McGuire (1988) were among the first archaeological programs in the Inyo-Mono region to employ chemical sourcing and hydration studies on a large scale.

Recently, archaeological studies in eastern California have grown considerably in number and in scope, many contributing valuable data to both regional and local prehistories. Important non-CRM

efforts include Delacorte's (1990) synthesis of Deep Springs Valley prehistory, Halford's recent (1997) surveys on the Bodie Hills plateau, Reynolds' (1996) examination of the Papoose Flat area, and Yohe's (1992) excavations at INY-372. Several major professional projects have also been completed. In Owens Valley, surveys along U.S. 395 by Burton (1990) led to test excavations at 23 sites by Delacorte and McGuire (1993) between Lone Pine and Little Lake. Another 12 sites were examined along U.S. 395 north of Lone Pine (Delacorte et al. 1995), and in Mono County, Gilreath et al. (1994) tested 13 sites at Ash Creek while McGuire (1994) reports on the excavation of three sites at Rush Creek. More recently, data recovery excavations were completed at three sites near Big Pine (King et al. 2001). A few efforts have focused on obsidian source localities, Goldberg et al. (1990) examining four stoneworking sites at Casa Diablo and Gilreath and Hildebrandt (1995) completing excavations at 34 sites in the Coso Volcanic Field. In addition to the current study, a number of other research efforts are presently underway. In Long Valley, Basgall has recently excavated several sites (Jurich et al. 1998), and Overly (2003) has conducted transect surveys across Little Hot Creek. Elsewhere, Ramos (2000) has completed survey fieldwork at the Truman/Queen obsidian quarry, Eerkens (2001; Eerkens et al. 1999) is working with chemical sourcing of pottery from the Inyo-Mono region. Camboia (2000) and Martinez (2000) have begun survey programs at the Bodie Hills and Mt. Hicks obsidian quarries.

On one level, this discussion has read much like a laundry list of archaeological projects in eastern California over the last 50 years. The intent here has not been to cite every bit of fieldwork that was undertaken, but to mention a number of key projects and form an outline of major trends that occurred in the development of Inyo-Mono archaeology. Hopefully, these details have provided some measure of historical background to the present study, at the same time demonstrating the necessity for programs such as this one. While there is certainly a long history of archaeology in the study region, there exist only a few important syntheses of local prehistories (Basgall and McGuire 1988;

Bettinger 1989a; Delacorte 1990; Hall 1983; Gilreath and Hildebrandt 1995) despite the growing frequency and scale of archaeological projects. In this sense, research on the Volcanic Tableland has much to build from, but still stands to make a significant contribution to our understanding of northern Owens Valley prehistory.

Prior Efforts on the Volcanic Tableland

The study of petroglyph sites attracted the first scientific interest in the project area. As far back as the late 19th century, Mallery (1886, 1893:56-59) made note of rock art on the "northwestern boundary of Owens Valley", and in particular the "Chalk Grade" petroglyph site (MNO-5 at Chidago Canyon). Presumably due to its abundance of panels and roadside location, this same site has also been discussed by Steward (1929), Heizer and Baumhoff (1962), who also present designs from three other Tableland sites (MNO-6, MNO-66, INY-267), Von Werlhof (1965), who also mentions INY-399 (see below), and by Heizer and Clewlow (1973). More recently, Mundy (1981) conducted an analysis of site MNO-7 on the east edge of the Tableland, but it was Raven (1986) who produced the most complete record of petroglyphs in the area. At one of the sites he examined, "BE-233" (MNO-2189), later excavations (Basgall and Giambastiani 1992) led to a discussion of rock art associations and function at that location (Giambastiani and Basgall 1990).

By comparison, relatively little attention has been paid to the archaeology of the Volcanic Tableland. Steward (1933) made several brief references to the Volcanic Tableland, indicating the presence of a "wai camp" at Fish Slough and a cemetery nearby (Map 2), and petroglyphs and rock rings on the southern edge of the Tableland (Maps 1 and 2; pg. 334; Plate 2b). He also discussed a site on the Tableland called "Bayonet Camp" (MNO-2300, Enfield site 9N-4) where Mr. Charles Forbes identified fifty "house rings" and found numerous fragments of pottery (Steward 1933:267, 334). Steward's Map 2 also shows a large ricegrass territory west of the slough that he claimed was

owned by the Bishop Paiute. However, the first real discussion of archaeology on the Tableland was by Meighan (1955), having completed a judgmental survey of about seven square miles in the Chidago Canyon area. This effort resulted in the identification of 36 sites, but evidently not all were located on the Tableland. Looking at the layout of his survey area (Meighan 1955: Map 1), it is shown in two separate sections that are oriented along a north-south axis. Maps provided by the Bureau of Land Management (BLM) show two such groups of site plots with consecutive numbering, a northern group paralleling the east edge of the Tableland and a southern concentration lying well within Chalfant Valley. This is confusing only because Meighan (1955:7) claims that site MNO-52 is "apparently the location of the seed-gathering (wai) camp mentioned by Steward". Clearly, Steward's "wai" camp is placed on the east margin of Fish Slough Lake (Steward 1933:Map 2) and probably corresponds to MNO-1992 or survey site FS14D-1 (see Chapter Five), while MNO-52 is plotted on BLM maps within a residential zone in Chalfant Valley. Despite this inconsistency, Meighan provided some details of constituents at Chidago Canyon sites, along with a brief comparison of local projectile points with types then recognized in other parts of Mono County.

Primarily between the early 1960's-late 1980's, judgmental archaeological surveys were carried out on the Volcanic Tableland by Rollin Enfield, Grace Enfield, and Norm Weller, avocationalists residing in Bishop, California. Though it is impossible to gauge exactly how many acres or square kilometers the Enfields surveyed, it seems clear that they targeted areas with relatively easy access, following roads, drainages, and canyons across the Plateau and around Fish Slough. In the end, the Enfields recorded over 150 archaeological sites on the Tableland, making collections of artifacts at and producing a site record for each place they visited. Their efforts, detailed more specifically elsewhere in this document, have proved critical to the current study. In fact, the first round of major excavations on the Tableland in 1987-1989 (Basgall and Giambastiani 1992, 1995) targeted six sites identified by the Enfields. These excavations were conducted as a volunteer, co-

operative agreement between the Bureau of Land Management, Far Western Anthropological Research Group, and the University of California, Davis, focusing on three sites at the northern end of the Tableland (MNO-2189, MNO-2190, and MNO-2464), one to the west (MNO-2465), one to the south (INY-399), and one at Fish Slough (MNO-1992); excavations were also completed at Fish Slough Cave (MNO-2381) during this project, but the results of this effort are summarized elsewhere (Nelson 1999). Following excavations by Garfinkel and Cook (1979) on the extreme western edge of the plateau, and prior to work by the author at Fish Slough, Basgall's excavations (Basgall and Giambastiani 1995) constitute the most intensive testing program yet conducted in the study area. It is from this work that the present study draws much of its background and hypotheses concerning occupation of the Volcanic Tableland.

GEOGRAPHIC AND ARCHAEOLOGICAL CONTEXT OF OBSIDIAN PROCUREMENT

One of the benefits in conducting a large-scale obsidian study on the Volcanic Tableland is the placement of the project area in relation to known sources of toolstone-quality obsidian (Figure 2.3). At least 11 known obsidians are present in archaeological assemblages there. Sources in southern Owens Valley (Fish Springs) and beyond (Coso) as well as those in the Saline Range (Queen Impostor, Saline Valley) lie to the south and southeast of the project area. The Fish Springs source is located a few miles south of the town of Big Pine, about 40 km from the center of the Tableland, while the Coso Volcanic Field just north of Little Lake is the most distant of all sources, approximately 180 km away. Both Queen Impostor and Saline Valley sources are roughly 100 km afield, the former located primarily on the west flank of the Saline Range and the latter on the east. West of the Tableland, obsidian outcrops in the Casa Diablo source area near Mammoth Lakes lie about 40-45 km distant. To the northwest, the Mono Glass Mountain source is the most proximal of

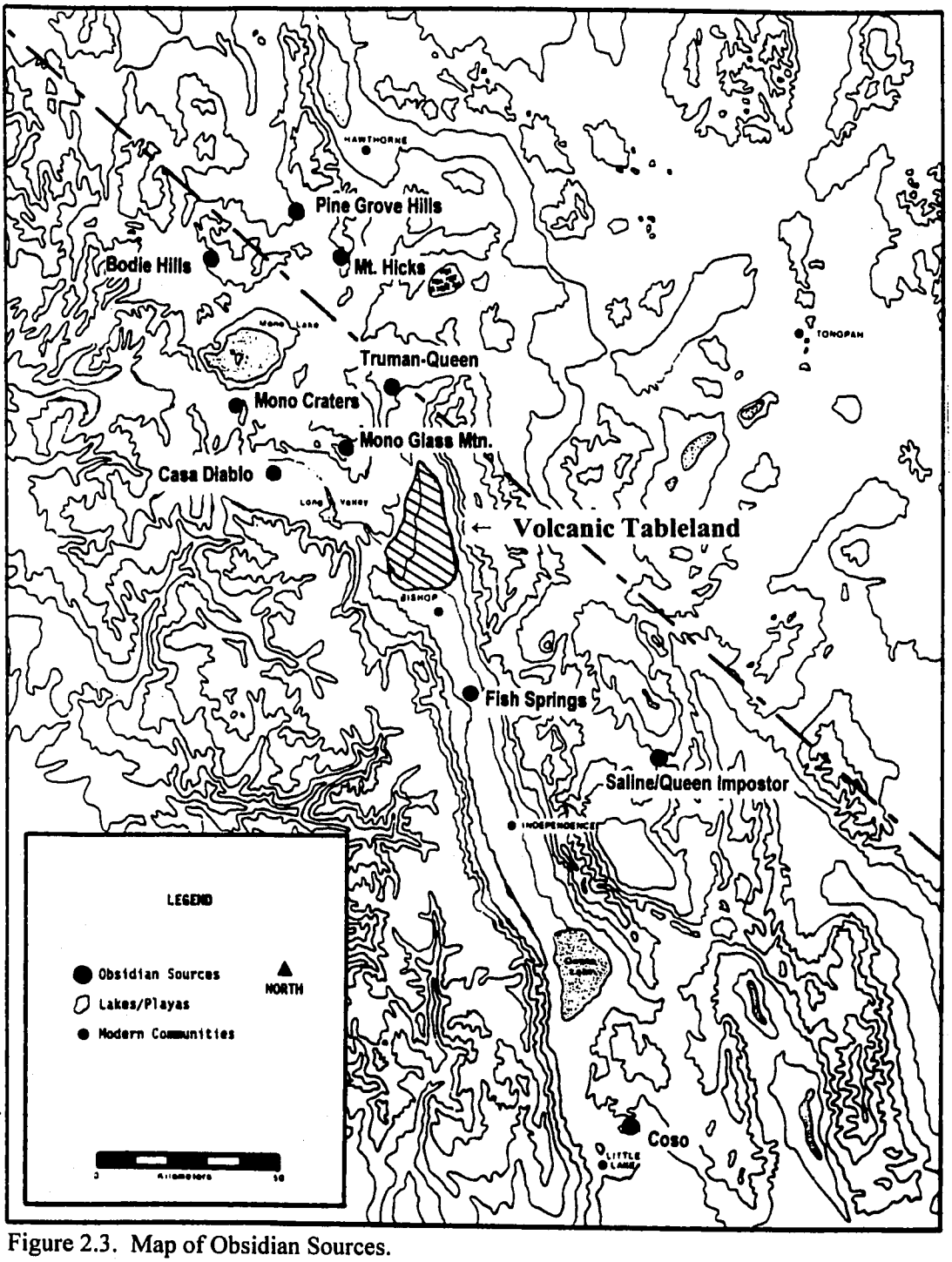

Figure 2.3. Map of Obsidian Sources.

all glasses, situated on the east side of Long Valley some 38 km away, while the presumed source of Mono Craters obsidian (Panum Crater) fronts the southern edge of Mono Lake at a distance of approximately 68 km. The Truman-Queen source is the closest glass to the north/northeast, lying about 48 km away just beyond the California-Nevada border and the northern end of the White Mountains. The last three obsidians remain at much greater distances to the northwest. Two are in Nevada, Mt. Hicks some 90 km afield and Pine Grove Hills at about 130 km, and the last is Bodie Hills, situated roughly 100 km from the study area and about 12 km east of Bridgeport. Each obsidian source is fairly easy to access on foot, but some are located at greater vertical heights (e.g., Bodie Hills, Pine Grove Hills, Mono Glass Mountain, Truman-Queen) and others are exposed in lower formations (Casa Diablo, Mono Craters, Fish Springs). There are also many differences in the spatial layout and types of exposures found at each source, and in the volume and size of available toolstone packages, both of which probably influenced aboriginal use of Inyo-Mono obsidians.

Bodie Hills

According to Singer and Ericson (1977), the Bodie Hills obsidian source area is situated at about 12 kilometers east of Bridgeport, California at approximately 2500-2600 meters elevation. Raw obsidian and quarrying debris at the source cover an expanse of at least eight square kilometers. Three major outcrops contain terrace deposits of angular material and ridge deposits of rounded cobbles. Hall (1980) also notes the occurrence of Bodie Hills obsidian well south of the main source, present as small- to medium-size nodules in both colluvial and alluvial deposits. Singer and Ericson (1977:174-175) note spherical nodules reaching up to 20 cm in diameter at the source proper, with several visual types including "..clear-gray, banded, and dense black varieties, occasional pieces of mottled reddish-brown and black ("mahogany obsidian"), and a clear variety with crystalline inclusions...". A visit to Singer and Ericson's T_3 outcrop by the author in 1997 confirms these basic

characteristics of obsidian at the main source. However, recent fieldwork west of Singer and Ericson's study area has identified several other outcrops that have not yet been examined (Camboia 2000).

Casa Diablo

One of the largest obsidian source areas in the western Great Basin, the Casa Diablo locality is situated within the Long Valley Caldera just east of the town of Mammoth Lakes, California. Elevations in the area range between 2200-2500 meters. The source area encompasses an area of about 65 square kilometers and contains a number of separate outcrops of various size. Goldberg et al. (1990) estimate that at least 16 such locations exist, while Hughes (1991, 1994) obtained geologic samples from 26 different exposures and indicates that there are numerous others. Hughes (1991) notes that Casa Diablo obsidian is found in a wide variety of natural exposures, in bedrock formations,. mountain outcrops and ridgetop cobble fields, knoll and slope outcrops, and in the borders of creeks and gullies. Goldberg et al. (1990) identify four major outcrop and quarrying localities, Lookout Mountain and Dry Creek Canyon in the northern part of the caldera, Sawmill Ridge along the west, and Obsidian Hill to the south. Obsidian at Casa Diablo sources occurs primarily as cobbles and boulders, the latter often reaching 50 cm in diameter and occasionally up to 1 meter in length. Glasses are generally opaque and of a grey to black color. However, Hughes (1992) has noted a myriad of visual types, including red, red and black (mahogany), brown, grey-green, black with banding, and purplish. Textures are basically glassy but some Casa Diablo exhibits nearly fine-grained surfaces, and most obsidian is free of inclusions though some is charged with phenocrysts.

Coso Volcanic Field

Situated in the southwestern reaches of the Coso Range just north of Ridgecrest, California, the Coso Volcanic Field is the largest obsidian source area in eastern California, spanning an area of

about 80 square kilometers. Local topography constitutes a variety of mountains, hills, and knolls, all lying between ca. 1200-1570 meters elevation. Massive, primary obsidian outcrops protrude from the steep slopes of at least two dozen large and small rhyolitic domes. The largest of all is Sugarloaf Mountain, located in the approximate center of the volcanic field and rising some 300 meters above the surrounding terrain (Elston and Zeier 1984; Gilreath and Hildebrandt 1995). Other notable primary localities are Cactus Peak at the north end of the field, West Sugarloaf near Sugarloaf Mountain, and Joshua Ridge to the south. In addition to these extensive primary sources are numerous other, more accessible secondary deposits, many of these having been exposed on ridgetops as lag formations after cap sediments eroded away. Gilreath and Hildebrandt (1995) suggest that surface obsidian generally occurs as cobbles and pebbles, the former reaching a size of 30 cm diameter, while Elston and Zeier (1984:21) indicate that larger boulders were mined. Descriptions of obsidian from some parts of the Sugarloaf area indicate the presence of "vesicules" (Ericson et al. 1976) and a "cheesy" or "foamy" quality depending upon the size of internal gas bubbles (Elston and Zeier 1984), with certain obsidian exposures offering tabular material as well. However, Elston and Zeier (1984:20-21) claim that artifact-quality glass could be easily obtained from lag and colluvial deposits which originated in flow breccia throughout the Coso area. The authors also note that clear, non-vessicled obsidian was the most often selected for tool production (1984:105). According to Burton (1996:944-945), Coso obsidian is "...clear black, opaque black with inclusions, silvery black, and gray/black banded", and may appear "cloudy or speckled with a bluish tint".

Fish Springs

This obsidian source is limited to a small perlite dome located about 15 kilometers south of the town of Big Pine and west of the Poverty Hills in southern Owens Valley. The dome protrudes from a broad alluvial fan formation and sits at an elevation of about 1500 meters. According to

Wickstrom et al. (1994), the primary source area encompasses less than a half square kilometer, with considerable amounts of float material found in downslope alluvial and colluvial sediments. A field visit to the primary source in 1992 indicated that available obsidian occurred in pebble and cobble form, the latter achieving a maximum diameter of about 12 cm (Wickstrom et al. 1994:A1-8). It is likely, however, that prehistoric consumers had a greater selection in cobble size, and that the current volume of obsidian present at the Fish Springs source is much reduced from its original quantity. Visual attributes of Fish Springs obsidian are unique among Inyo-Mono glasses and have frequently been described (Bettinger 1982b, 1989b; Bettinger et al. 1984; Burton 1996; R. Jackson 1985; Wickstrom et al. 1994). It is most notable for its greenish cast and for the presence of feathery brown inclusions (see Chapter Four). Wickstrom et al. (1994:A1-8) notes that the exterior cortex on Fish Springs glass is also unique, demonstrating "..multiple, well-rounded intersecting facets."

Mono Craters

Obsidian from the Mono Craters source is found within a chain of fairly young (late Holocene) volcanic cones extending some 15 kilometers from the south edge of Mono Lake. Highway 120 cuts across the northern end of the chain through a divide which separates Panum Crater to the north from the rest of the formation. It is generally assumed that Panum Crater, which is situated at approximately 2000 meters elevation, was a primary source for Mono Craters obsidian as it manifests a large volume of material and is easily accessed. During a visit to this location by the author in 1997, primary obsidian was available directly from the central dome of Panum Crater, in large sheets and cobbles, while surrounding colluvial deposits held cobbles of about 15 cm in maximum diameter. Mono Craters obsidian is semi-translucent and generally black in color, but has a grayish tint produced by the near-homogenous blending of minute white and black threadlike bands. Wickstrom et al. (1994:A1-10) maintained two sets of visual criteria for Mono Craters glass, one "Dull dense black,

opaque, but sightly translucent along thin edges" and the other "Smoky black with pumice bands, semi-translucent."

Mono Glass Mountain

The primary Mono Glass Mountain obsidian source sits atop the crest of Glass Mountain (ca. 3390 meters) some 18 kilometers northeast of Crowley Lake in Long Valley. Immediately west, Glass Mountain Ridge is a steep-sided formation that fronts the northern edge of the Long Valley caldera, with highest elevations between 2700-3000 meters. R. Jackson (1985:107) indicates that the ancient eruption of the Mono Glass Mountain volcano "...spread small to medium obsidian nodules at least two to three miles east and northeast of the source as well as along the Glass Mountain Ridge, where entire drainage banks are composed of low-quality obsidian." This would suggest that obsidian from Mono Glass Mountain is available within an area of roughly 12-15 square kilometers. In 1992, Wickstrom (Wickstrom et al. 1994:A1-12) made visits to two source localities at Mono Glass Mountain, O'Harrel Canyon on the south slope of Mono Glass Mountain and Glass Mountain Ridge. At O'Harrel Canyon, Wickstrom found "Numerous cobbles of obsidian, ranging from small- to medium-size, roundish cobbles, were observed in the alluvial outwash." In contrast, Wickstrom notes that obsidian atop Glass Mountain Ridge and generally in most of the northern portion of the Mono Glass Mountain source area, "...is found as rounded medium to large cobbles ranging up to approximately 25 pounds, in alluvial context."

Evidently, the visual properties of Mono Glass Mountain obsidian are highly variable. Obsidian from Sawmill Meadow, southeast of the peak, has been characterized by Ericson et al. (1976:225) as "occasionally porphyritic, varies from red, brown, mahogany, and black." R. Jackson (1985:108) states that Mono Glass Mountain occurs as "...translucent black and black banded obsidians, as well as opaque black with white inclusions". Reynolds et al. (1992) add that this source

comes in "...clear, translucent and semi-translucent black banded varieties, some with a faint lacy pattern and phenocrysts, and some mahogany." Wickstrom et al. (1994:A1-12) suggest that materials from O'Harrel Canyon is "...dense black and glassy...ranges from completely transparent to completely opaque." They also note a lack of phenocrysts in obsidian from this location. In contrast, obsidian from Glass Mountain Ridge does contain phenocrysts; it is also "...slightly translucent to transparent, and sometimes has opaque bands."

Mt. Hicks

Located in western Nevada about 32 kilometers northeast of Mono Lake, the Mt. Hicks source is the least well-known of any obsidian contributing significantly to archaeological deposits in eastern California. Even the size of the source area and volumes of its obsidian are poorly understood. Ericson et al. (1976) state that obsidian is present on the east slope of Mt. Hicks, and R. Jackson (1985:106) notes that Mt. Hicks glass occurs as small to medium cobbles and blocks within colluvium. It seems a general consensus that the Mt. Hicks source is of comparable size to Bodie Hills, but an upcoming study of the Mt. Hicks quarries should shed some light on the nature and distribution of obsidian at this locality (Martinez 2000). In terms of its visual characteristics, Bettinger et al. (1984) claim that Mt. Hicks glass "..seldom occurs in large pieces, greater than 2 cm. in diameter, without some inclusions in the form of banding or clouding." They go on to note "...quantities of small phenocrysts readily visible upon magnification" and banding which is "...invariably contorted and individual bands frequently intersect each other." R. Jackson (1985) calls Mt. Hicks obsidian "translucent/banded", and Wickstrom et al. (1994) follow Bettinger by considering it "Glassy, with contorted black bands that intersect each other in a transparent to translucent matrix."

Pine Grove Hills

Another western Nevada source, the Pine Grove Hills are located roughly 45 kilometers northeast of the town of Bridgeport, California and about 25 kilometers west of Walker Lake, Nevada. As with Mt. Hicks, little is known about the spatial disposition and raw quantity of obsidian at this source, though impressions are that it was not a major outlet for obsidian such as nearby Mt. Hicks or Bodie Hills. Cobbles obtained by the author from U.C. Davis collections for use in XRF analyses were quite small, reaching about 7 cm in maximum length. Discussions with other contemporary researchers support this characterization of Pine Grove Hills obsidian (M. Delacorte, C. Skinner, personal communication 1999).

Queen Impostor and Saline Valley

These are two obsidian sources recently documented within the Saline Range, a volcanic tableland situated at approximately 1500-1600 meters elevation which separates Saline Valley from Eureka Valley to the north (Johnson 1999, 2002). The Saline Range lies about 50 kilometers northeast of the town of Independence, east of the Inyo Mountains and west of the Cottonwood/Last Chance Range. According to Johnson et al. (1999a), obsidian nodules eroded out from rhyolitic tuffs and flows have mixed into alluvial deposits and have been transported up to 20 kilometers away from their primary source, particularly on the east side of the range. "Queen Impostor" (or Saline Variety 1) occurs on both west and east flanks of the Saline Range but is the only geochemical type found on the west where obsidian-bearing units offer pebble- to boulder-sized packages (Johnson 2002; Johnson et al. 1999a). On the east side of the Saline Range, Variety 1, Variety 2 (an unknown), and Variety 3 ("Saline Valley") obsidians can all be found, often in close proximity to each other. Primary outcrops of Saline Valley obsidian are known only on the east side of the range, although this obsidian is available in alluvial deposits some distance from the main source.

As implied by its name, both visual and chemical properties of Queen Impostor obsidian are similar to those of Truman-Queen glass. Source specimens obtained by the author demonstrate the high degree of translucency and golden-brown cast typical of Truman-Queen, and some pieces even exhibit the tight, parallel black bands common to that obsidian. Three main differences are apparent, however. The first is in the makeup of outer cortex. On cobbles of Queen Impostor, cortex is often nearly identical to inner material, being smooth, unweathered, and free of incorporated sediments, crust, or other obscurities. Cobbles of Truman-Queen often manifest a thicker outer skin that is dull and heavily pitted, often weathered and full of ashy inclusions, and quite distinct from glossy cobble interiors. Second, the frequent presence of light, wispy clouding, this occurring often in extremely thin bands but also as contorted streams. Finally, the density, depth of black color, and homogeneity of parallel bands in Queen Impostor obsidian are all less profound than in Truman-Queen. When samples of Queen Impostor are paired against pieces of Truman-Queen these distinctions are easily recognized, but when viewed alone or within varied obsidian samples they are quite difficult to perceive. As for Saline Valley obsidian, in most respects it is similar in appearance to Queen Impostor, though it seems to have a higher frequency and density of unpatterned, blotchy cloudiness.

Truman-Queen

Though it has long been considered to be a California obsidian, the Truman-Queen source locality actually lies more within Nevada, being situated some 12 kilometers north of the town of Benton, California. Most of the primary obsidian deposits at Truman-Queen are distributed across a series of upland ridges with elevations between 1900-2305 meters (Ramos 2000), with secondary deposits spread across a broad lowland fringe around the base of the upland zone. Primary quarry loci in the uplands cover an area of roughly eight square kilometers, lowland quarries occurring within about a six-square kilometer area defined by two major drainages. The largest of these, Truman

Canyon, has transported obsidian cobbles and pebbles down into Benton Valley (Halford 1997; Ramos 2000) and as far south as Blind Spring Hill (Giambastiani 1998b). According to Ramos, most obsidian occurs in the form of small cobbles averaging between 10-15 cm in diameter, with maximum size occasionally reaching 30 cm across; Wickstrom et al. (1994) have noted oblong cobbles attaining weights of up to 35 pounds. Truman-Queen obsidian is most notable visually for its near-transparency and lack of inclusions, golden-brown hue, and for the presence of tight, parallel black banding. Some Truman-Queen obsidian may also exhibit minute gas bubbling within band-free zones. Its cortex is usually rough, with lots of pitting and sediment inclusions; some cobbles in primary context having developed an orange patina due to weathering. Wickstrom et al. (1994:A1-13) suggest that Truman-Queen obsidian occurs in a myriad of other visual types as well, including opaque red and black, opaque orange and dark green, smoky silverish-black with a silver sheen, solid opaque orange, and solid opaque red.

Other Obsidians

Though not well represented at archaeological sites within the Inyo-Mono region, there are a few additional western and southern Nevada obsidians which occasionally turn up in eastern California assemblages. For example, pieces of Garfield Hills obsidian from western Nevada were identified at sites on SR-158 near June Lake (Richman and Basgall 1998). Roughly six kilometers northwest of Mt. Hicks is the Fletcher or Aurora Crater source, specimens of which were identified recently at site MNO-2122 on the eastern shore of Mono Lake (Arkush 1995). Obsidians from the Mt. Majuba source in northwest Nevada (Hughes 1983b) and from the Silver Peak locality in western Nevada have been found in the White Mountains, the latter also present in Deep Springs Valley (Delacorte 1990). Even obsidians from as far away as Wild Horse Canyon, Utah (Hughes 1986a) and the Montezuma Ranges in Arizona sometimes occur in eastern California sites (Richman and Basgall

1998). However, none of these glasses ever occurs in any more than trace quantities, and it is very unlikely that they would be present on the Tableland given their extreme distances alone.

Archaeological Distributions of Major Obsidians

The last issue to be examined here involves the known spatial distributions of each material across the Inyo-Mono region. As indicated above, not all obsidian sources are equal in terms of overall expanse, available volume of obsidian, and the size of the obsidian masses they offer. These factors have undoubtedly played a role in determining how heavily each obsidian source was used by aboriginal groups and how far each material was transported from its source location. Complicating simple distance-decay models, however, are a variety of other human factors influencing the spatial extent and directions to which obsidians were moved. While theoretical discussions of toolstone transport are left to Chapter Three, a brief summary of current knowledge about the horizontal distributions of obsidians and of temporal patterning in regional obsidian use are is pertinent here.

The last 10-15 years of archaeological research have led to a fairly good understanding of obsidian distributions in eastern California. Generally, it is agreed that there were a few sources which were very important to aboriginal consumption and many which were of moderate to little significance. The "Big Three", moving from north to south, were Bodie Hills, Casa Diablo, and Coso. These obsidians not only had ample distributions throughout the Inyo-Mono area, they also had considerable distributions into and across the Sierra Nevada. The first source, Bodie Hills, is quite common in archaeological sites within Bridgeport Valley and throughout the Mono Basin, though found primarily north of Mono Lake (Richman and Basgall 1998). Bodie Hills also makes significant contributions to sites in Long Valley (Basgall 1989), but does not reach much farther south than that in any quantity. However, it does have a strong representation on the western flank of the Sierra Nevada, particularly within the Stanislaus National Forest where Bodie Hills glass makes up 84% of

all sourced artifacts (Miksicek et al. 1993). T. Jackson (1974) and Singer and Ericson (1977) noted early on that Bodie Hills obsidian can be found as far away as central and southern California. Hughes (1983a, 1985a) has also shown that Bodie Hills has some distribution to the east, being present at Gatecliff Shelter and Hidden Cave in Nevada.

Casa Diablo obsidian has perhaps the largest distribution in eastern California, being especially prevalent in Long Valley but having some presence in the Mono Basin the north, a strong showing in Owens Valley to the south, on the Volcanic Tableland, and in the White Mountains to the east. Sites representative of extensive stoneworking with Casa Diablo obsidian are abundant in Long Valley (Basgall 1983, 1984; Goldberg et al. 1990; Hall 1983; R. Jackson 1985, 1986), while the use of Casa Diablo obsidian in Owens Valley was related mainly to the pursuit of tool maintenance and subsistence activities (Basgall 1989). Again, it is clear that Casa Diablo obsidian has a major distribution in the south-central Sierra Nevada, being dominant in obsidian assemblages at Yosemite National Park (Hull 1988), and is spread well west of the Sierra Nevada to the California coast (Ericson 1982; Hall 1983). Much less is known about the eastward distribution of Casa Diablo, but Hughes (1985a) has suggested that it did not spread much beyond the eastern end of Mono Basin.

Obsidian from the Coso Volcanic Field has a predominantly southern spread in eastern California, being common throughout southern Owens and Rose Valleys (Basgall and McGuire 1988; Delacorte et al. 1995; Delacorte and McGuire 1993; Gilreath and Hildebrandt 1995). Gilreath and Hildebrandt (1995) suggest that Coso obsidian reached as far north as Lone Pine (site CA-INY-30) in Owens Valley. Obsidian debris at archaeological sites in the north-central and south-central Mojave Desert is also made up primarily of Coso glass, indicating a wide distribution to the southeast as well (Basgall 1993; Basgall and Hall 1992; Giambastiani and Basgall 2000; Basgall and Giambastiani 2000; Norwood 1990; Sutton 1988; Warren 1990). Roper-Wickstrom (1992) and Garfinkel et al. (1980) note the presence of Coso obsidian throughout the southern Sierra Nevada, and there is clear

evidence that the Coso source accounts for what little obsidian exists in archaeological assemblages around Los Angeles (Gilreath and Hildebrandt 1995; Hall 1988; Koerper et al. 1986; Meighan 1978).

The extremely broad horizontal distributions of these obsidians, along with the common presence of marine shell beads in eastern California sites, has led many archaeologists to hypothesize the existence of far-reaching prehistoric exchange networks that moved goods back and forth over the Sierra Nevada (Basgall 1989; Bouey and Basgall 1984; Ericson 1977, 1981, 1982; Gilreath and Hildebrandt 1995; Goldberg et al. 1990; Hall 1984; T. Jackson 1974, 1984; King 1976; Moratto 1972; Singer and Ericson 1977). The exact timing and nature of these relationships, however, are not well understood or agreed upon. While most of the major Inyo-Mono obsidian sources have been used since the early Holocene, peaks in obsidian use at Bodie Hills, Casa Diablo, and Coso, as recognized through obsidian hydration study, occur between 3000-1000 B.P. (Elston and Zeier 1984; Gilreath and Hildebrandt 1995; Hall 1984; Singer and Ericson 1977). This interval is taken to represent a period in which bifaces and cores were manufactured primarily for export to locations in eastern California and beyond. The impetus for such an increase in quarry production, one related specifically to trans-Sierran exchange, has been assigned to various forces; the most favored has been an increased demand by central California consumers (cf. Ericson 1982; Goldberg et al. 1990; Moratto et al. 1978). Researchers favoring this viewpoint have suggested that aboriginal populations west of the Sierran crest were sufficiently dense and organized to support a regularized exchange network. However, Bouey and Basgall (1984) argue that, during the time period in question, eastern Sierran group settlement was characterized by fairly constant mobility and that population levels were not high enough to allow individuals to participate as specialists in an obsidian production system. Instead, they suggest that western Sierran groups obtained obsidian through direct access (Bouey and Basgall 1984:149). Recent interpretations of quarry production at Coso have taken a similar position (Gilreath and Hildebrandt 1995).

The reasons behind a drastic decline in obsidian production at Bodie Hills, Casa Diablo, and Coso after 1000 B.P. have also been hotly debated. Hall (1983) suggested that late Holocene volcanic eruptions in the Mono chain may have temporarily restricted access to Casa Diablo quarries and hindered the flow of obsidian over the Sierra Nevada. Ericson (1982) claimed that the introduction of the bow and arrow raised the demand for obsidian, arguing that ten times more arrows were needed per hunter than atlatl darts; failure of the trans-Sierran production network to meet increased needs led central California consumers to use obsidians from the North Coast Ranges. A number of strictly environmental causes have been put forth as well, but two hypotheses (in conjunction) remain very promising in the face of mounting archaeological evidence from eastern California. First, there is a wealth of evidence that aboriginal settlement systems became increasingly centralized following the Newberry interval (post 1300 B.P.) due to rapid population growth. Bettinger and Baumhoff (1982) would posit an incursion of Numic-speaking groups into eastern California as the cause of this growth, an occurrence which also increased territoriality in Owens Valley, but whatever the reason it certainly created conditions in which residential mobility became more and more restricted. Many recent archaeological studies have provided evidence of these changes, based on narrowing obsidian source profiles, an increased use of labor-intensive and low-return resources (especially seeds and nuts), and the emergence of bulk food procurement and processing techniques (Basgall and Giambastiani 1995; Bettinger 1989a, 1990; Delacorte et al. 1995; Delacorte and McGuire 1993; Gilreath and Hildebrandt 1995). The result of a decrease in overall settlement mobility was that direct access to obsidian sources became restricted. Coupled with the second premise, that changes in flaked stone technology with the onset of the bow and arrow actually *lowered* individual demand for obsidian (arrow-points require much less material to produce than dart-points), changes in late-period settlement and subsistence patterns ultimately led to a lowered demand for obsidian materials from the Bodie Hills, Casa Diablo, and Coso sources.

Other obsidian sources may not have been affected by these changes, as there is no real evidence to suggest they were involved in any major way with trans-Sierran exchange. Northern glasses like Pine Grove Hills and Mt. Hicks have primarily eastern distributions (cf. Hughes 1985a). Still, Pine Grove Hills obsidian has been found in trace amounts near Bridgeport (Fredrickson 1991), in Long Valley (R. Jackson 1985), and on the Volcanic Tableland (this document), and Mt. Hicks glass does occur with some regularity in the central Sierra Nevada (Giambastiani 1998a; Miksicek et al. 1993). Both of these obsidians are probably too far removed from the Sierra Nevada to have figured prominently in either direct procurement or exchange activities, and in the case of Pine Grove Hills this source may also have been too limited in size.

Mono Craters and Mono Glass Mountain obsidians also seem to have localized distributions (Basgall 1989; R. Jackson 1985; Richman and Basgall 1998). The former may have witnessed extremely little use given its relatively brittle nature (R. Jackson 1985), overshadowing Mono Glass Mountain on the eastern flank of Mono Lake (Arkush 1995) but perhaps not on the west (Hughes 1981). Not surprisingly, Mono Glass Mountain is prevalent throughout Long Valley, and though it is quite common on the Volcanic Tableland (this study) it does not enter Owens Valley in any great numbers (Basgall and McGuire 1988; Richman and Basgall 1998). Similarly, Truman-Queen obsidian has a limited presence in eastern California as well. Aside from a few hits here and there in the Mono Basin (Arkush 1995; Hughes 1981) and in Long Valley (Basgall 1988, 1989; Hall 1983; R. Jackson 1985), the archaeological distribution of Truman-Queen in eastern California is limited mainly to Benton and Adobe Valleys (Giambastiani 1998b; Halford 1997; Richman and Basgall 1998), the Volcanic Tableland (Basgall and Giambastiani 1995; Nelson 1999), and the White Mountains (Delacorte 1990). Sites in Owens Valley contain only a smattering of Truman-Queen glass (Basgall and McGuire 1988; Bettinger et al. 1984a; Bouscaren 1985; Garfinkel 1980b), as do few locations in Deep Springs Valley (Delacorte 1990). Instead, the spread of Truman-Queen glass shows

a decidedly eastern affiliation (Ramos 2000; Richman and Basgall 1998; Weaver 1992), being found in good numbers as far as Hidden Cave (Hughes 1985a), and Gatecliff Shelter (Hughes 1983a). Delacorte (1990) has commented that Truman-Queen may be common in Fish Lake Valley as well.

Farther south, the distribution of Fish Springs obsidian appears to have been restricted largely to Owens Valley (Basgall and McGuire 1988; Bettinger 1982b, 1989b; Burton 1986; Delacorte et al. 1995; Delacorte and McGuire 1993; Richman and Basgall 1998; Wickstrom et al. 1994). While it does reach the Sierra Nevada in limited amounts (Roper-Wickstrom 1992; Stevens 2001), it is particularly abundant north of Lone Pine and south of the Volcanic Tableland. Some Fish Springs glass does make it over into Deep Springs Valley but none has been identified in the White Mountains (Delacorte 1990). As for Queen Impostor and Saline Valley, the overall distribution of these obsidians is not known at present. Queen Impostor does occur with some regularity at sites in southern Owens Valley (Basgall 1989; Basgall and McGuire 1988; Delacorte et al. 1995; Delacorte and McGuire 1993; Gilreath and Nelson 1999; Richman and Basgall 1998). The geochemical type Saline Valley is even rarer, however, yet to be identified anywhere with any frequency (but see this study). It is likely that these obsidians have a primarily eastern slant, perhaps moving north through Eureka Valley and also into Fish Lake Valley.

Chapter Three

THEORETICAL BACKGROUND

The use of obsidian studies in the far west and throughout the world has grown considerably in the last two decades, from isolated efforts at understanding the process of obsidian hydration to broad-scale applications of sourcing and hydration techniques. The advance of CRM archaeology has improved the accessibility and frequency of such research, partly because obsidian dating is relatively inexpensive but also due to the strength of explanatory models that can be developed from obsidian source distributions. At least in the western Great Basin, it is difficult to find contemporary CRM research that does not involve some level of obsidian study. This is generally good for the discipline, as more and more data demonstrate the benefits of obsidian research and help to justify its continued use. This is particularly important for obsidian hydration, which has been subject to many negative criticisms since its inception as a chronometric tool.

As with anything, however, the more people use obsidian data the more often it is employed incorrectly. This is certainly a problem with obsidian source data, as archaeologists generally take source assignments made by professional geochemists at face value. Many more inconsistencies crop up in the interpretation of hydration data, primarily because rate parameters are still treated in a rather cavalier fashion by many researchers. The expansion of hydration study into the realm of induced experiments has opened the door to intense skepticism on both sides of a long-standing argument, glass scientists on one and archaeologists on the other.

While we still have farther to go in resolving problems with obsidian hydration, it appears for the moment that most Great Basin archaeologists are content with current schemes for the technological examination of flaked stone artifacts. A focus on understanding technological organization still pervades most flaked stone analyses, this avenue providing useful and testable

interpretations of artifact form, function, and use history. More importantly, data from such analyses are also amenable to discussions and predictions about the settlement systems that obtained raw stone, moved lithic tools across the landscape, and deposited them in various archaeological contexts. In the foreseeable future this will continue to be the most significant benefit from contemporary flaked stone studies, as archaeologists in the west draw ever more precise reconstructions of aboriginal settlement regimes and patterns of regional and local exchange.

OBSIDIAN SOURCING WITH ENERGY-DISPERSIVE X-RAY FLUORESCENCE SPECTROSCOPY (XRF OR EDXRF)

There are many techniques used to determine the elemental composition of obsidians, but the most popular among contemporary geochemists and archaeologists are neutron activation analysis (NAA), proton-induced X-ray emission spectroscopy (PIXE), and X-ray fluorescence spectroscopy (XRF). According to Glascock et al. (1998), the NAA method is capable of analyzing a much greater number of elements, is more sensitive and more accurate than the XRF method. Unfortunately, it is also destructive, requiring a small amount of sample material (about 10 milligrams) that, once irradiated, remains radioactive for many years. Shackley (1998) also indicates that NAA is not able to measure Ba and Sr as accurately as either PIXE or XRF, elements which can be significant in sorting out intra-source variability (Hughes and Smith 1993). The NAA method is also quite costly, its machinery fairly rare, and it is not readily available to most archaeologists. In contrast to NAA, the PIXE method is non-destructive and produces results similar to those comparable in accuracy to XRF but is more sensitive to surface characteristics of analyzed materials (Summerhayes et al. 1998). Because the proton beam used in this analysis only penetrates to ~50 μm into the surface of a given sample, artifacts must be cleaned by washing in freon or ethanol and placed on special mounting plates to provide the smoothest and flattest face for the beam. Weathered or cortical surfaces can also

affect the resolution of source assignments. Artifact size is evidently another consideration. According to Summerhayes et al. (1998:135), mounting plates are of limited dimensions (40x14 mm) and are not capable of accommodating larger items; an alternative technique is available for items too big for the irradiation chamber, but the precision and number of elements measurable are compromised when analyzing artifacts in this manner. Each sample examined with the PIXE method requires ten minutes of analytical time.

Requirements for non-destructive XRF are similar to those of the PIXE technique. Problems with irregularity in artifact surfaces are comparable (cf. Bouey 1991), but recent studies have shown that artifact size and thickness may cause more significant errors in measurement (Davis et al. 1998; Jackson and Hampel 1992; Shackley and Hampel 1992). Sample preparation is usually less rigorous, though artifacts are still cleaned prior to analysis and cortical surfaces avoided when placing items into sample trays. Depending upon the configuration of the analytical chamber, artifact size is again a consideration; for example, the Kevex 0700 machine used in the present study can only accommodate items between about 30-50 mm in height and about 60 mm in width or length. It has been argued that the non-destructive XRF technique is less precise than NAA (Glascock et al. 1998), particularly when source assignments are based on analyte/scatter comparisons or peak ratios (cf. Bouey 1991; Hughes 1988; Shackley 1992). In addition, it is often necessary to run obsidian samples under different sets of conditions (energy, intensity, and filters) when analyzing for groups of elements that are distant in atomic number (like Rb, Sr, Zr vs. Fe and Mn), particularly if intra-source determinations are desired.

Despite a few drawbacks, the main benefits of the XRF technique continue to be: a) its accessibility and low cost; b) the fact that it is completely non-destructive; c) its short analytical time. Unlike NAA facilities, professional XRF laboratories are fairly common across the country and machinery is freely available to students at many universities. In California, current XRF prices average about $30.00 per sample, with slight discounts offered for larger numbers of specimens. The

analysis of each sample takes only a few minutes, which was critical to the current study involving about two thousand samples. Also, data generated by the XRF method are precise enough to be stable between laboratories, allowing for consistency in trace element identification and source assignment.

Research in X-ray Spectrometry with California Obsidians

Building on previous studies (Jack 1971; Jack and Carmichael 1969), Robert Jack made the first systematic attempt to source California obsidians using X-ray fluorescence techniques (Jack 1976). For this study, Jack drew some 1567 artifacts from museum collections at the University of California, Berkeley, and examined them in order to determine which California obsidian sources had been exploited by prehistoric peoples. Rather than using a quantitative analysis program, which would have required the crushing and powdering of subject obsidian samples, Jack analyzed artifacts to detect trace elements Rb, Sr, Y, Zr, and Nb using a semi-quantitative technique that was completely non-destructive. According to Jack, not only was this technique highly discriminating, the fact that X-ray spectral lines for the desired elements were adjacent to each other allowed for intensities to be measured under identical conditions and in a short period of time (seven minutes). Also, because elements Rb, Sr, and Zr are typically present in obsidian in sufficient concentrations, Jack argued that high counting rates could be achieved which would result in precise measurements. By comparing spectra against a set of 18 source standards representing North Coast, Mono Basin, Western Great Basin, and Modoc Plateau obsidians, Jack was able to attain a 98.5% success rate in assigning obsidian artifacts to source locations. Unfortunately, artifacts analyzed by Jack included a variety of tool types that were not temporally diagnostic, and thus could not provide any measure of the timing of source use. A subsequent X-ray fluorescence study by T. Jackson (1974) used artifacts from Central California sites that had been roughly dated (by artifact types), but his research was again complicated by a lack of firm a chronology. Still, the two studies together provided a general outline

for obsidian use in California and, perhaps as important, speculated about patterns of obsidian transport and exchange on both sides of the Sierra Nevada.

At about the same time, Hughes (1977) initiated a long-term study to geochemically characterize obsidians from northeastern California. Surveys conducted by Hughes in the Warner Mountains documented a number of previously unreported obsidian sources that had been exploited by aboriginal stoneworkers, indicating that there were probably many similar obsidian sources throughout California that had not yet been accounted for by geologists or archaeologists (Heizer and Treganza 1944; Jack and Carmichael 1969; Jack 1976; T. Jackson 1974). According to Hughes (1986a), this first study gave rise to similar investigations in other parts of California (Hughes 1982, 1986b), and in Nevada and Oregon as well (Hughes 1983a, 1985a, 1985b, 1986c; Skinner 1983). Even today, obsidian sources in the west once used by prehistoric peoples are being newly reported or examined for the first time (Johnson et al. 1999a, 1999b; Shackley 1988, 1991, 1995), and that there are still many others that have never been geochemically traced.

By the late 1970s-early 1980s some researchers continued to rely on NAA to characterize obsidian chemistry (Ericson 1977, 1981; Ericson et al. 1976; Singer and Ericson 1977) but many others had begun to take advantage of the speed and low cost of XRF analysis. The XRF technique became critical to the study of obsidian hydration, as increasing effort was given to the development of source-specific hydration rates for eastern California glasses (Basgall 1983; Findlow et al. 1982; Friedman and Obradovich 1981; Hall 1983; Michels 1982; others). Obsidian sourcing was quickly adopted into the CRM sphere, as professional archaeologists in eastern California took greater interest in understanding the spatial distributions of different obsidians and in using hydration analysis for dating (Basgall 1983; Bettinger 1978, 1980, 1981; Bettinger et al. 1984; Garfinkel 1980; Garfinkel and Cook 1979; McGuire and Garfinkel 1980; many others). An appreciation for obsidian sourcing was developing at the same time in the North Coast Ranges of California (Amaroli 1982; Eisenmann

and Fredrickson 1980; Origer 1982) and in the California-Oregon border region (Hughes 1978, 1982, 1983b; Hughes and Bettinger 1984; Layton 1979; Skinner 1983).

In 1984, Hughes (1984b) provided a synopsis of the methods and problems associated with XRF studies in the Great Basin. Recognizing that XRF analysis was being completed by an increasing number of laboratories, Hughes' main goal was to evaluate the accuracy and replicability of source assignments. His critiques focused largely on the applications of statistical techniques, giving particular attention to the use of discriminant analysis and to criteria which must be considered in the interpretation of resulting data. This treatise was valuable in proposing some basic procedures to help standardize methods of XRF analysis, offering techniques and requirements for data presentation and cautions for statistical inference. Following Hughes' recommendations, it is now commonplace for XRF analysts to report machine specifications, excitation conditions, and full quantitative and/or semi-quantitative data for elemental values (see Appendix A).

Over the last 10-15 years, XRF studies have become a standard part of archaeological analysis for research dealing with collections of obsidian artifacts. This has been especially true for research in eastern California, where more than a dozen separate source locations exist, but it has also typified research in the southern North Coast Ranges and around the Modoc Plateau, regions which are also home to numerous sources of obsidian. In eastern California, contemporary XRF research has focused on identifying ranges of intra-source variability for different obsidians. Efforts by Hughes (1988, 1989, 1994) have paved the way for such research in this region, investigating source variability in Casa Diablo (1994), Mono Basin (1989), and Coso (1988) obsidians. Each of these source localities consists of a number of separate obsidian vents and formations (cf. Bacon et al. 1982; Bailey 1989; Bailey et al. 1976), but until recently archaeologists had assumed that obsidian from different outcrops within each locality was relatively homogenous in chemical makeup. In his XRF studies, Hughes shifted focus away from standard search elements Rb, Sr, and Zr to include scans for others such as

titanium (Ti), zinc (Zn), gallium (Ga), yttrium (Y), niobium (Nb), and barium (Ba). Though analysis for some of these elements required separate excitation conditions (e.g., Ba), necessitating multiple runs for each artifact (see also Davis et al. 1998), the cost of extended analytical times is sometimes worth bearing. For example, Hughes (1994) showed that for Casa Diablo obsidian ppm values for Ti and Ba could be compared against Sr ppm values to identify three different chemical signatures, Lookout Mountain, Sawmill Ridge, and Prospect Ridge; these types have obvious spatial segregation across the source area. For Coso glass, Hughes (1988) found the greatest contrasts in Zr versus Rb comparisons, and has disclosed the presence of four separate geochemical types within the Coso Volcanic Field (West Cactus Peak, West Sugarloaf, Joshua Ridge, Sugarloaf Mountain) that also pertain to specific landforms. For Mono Basin obsidians, Hughes (1989) demonstrated that glasses which were known to be geographically distinct (Mono Craters and Mono Glass Mountain) but were previously indistinguishable in terms of their chemistry could be separated via comparisons of Zr vs. Mn and of relative weight percents for iron oxide (Fe_2O_3). Though some research has questioned the precision of the XRF method in using artifacts to discriminate between obsidian subsources at Coso (cf. Bouey 1991; but see Davis et al. 1998), achievements by Hughes have been critical to the growth and improvement of obsidian source studies in California.

T. Jackson (1986, 1989) has conducted XRF studies of intra-source variability in the southern North Coast Ranges, focusing on two obsidian localities, the Sonoma Volcanics and Clear Lake Volcanics. In the more recent work (1989), he introduces several obsidian sources and quarries not previously reported and provides mean parts per million (ppm) values for eight different elements (Rb, Sr, Y, Zr, Nb, Ba, La [Lanthanum], and Ce [Cerium]) found in twelve distinct obsidians. T. Jackson (1989:92) also makes the important point that obsidian "sourcing" does not necessarily identify the location of the quarry or outcrop which provided the material being analyzed; it may simply denote a geochemical "type" that may derive from one or several different geographic locations within the

same region. Other studies in the North Coast Ranges have used obsidian XRF source data to investigate sociocultural relationships (Bouey 1986; Fredrickson 1985, 1989), but research in obsidian hydration has benefitted the most from XRF sourcing (Origer 1982; Parker 1993; Tremaine 1993; Tremaine and Fredrickson 1988). However, visual sourcing has regained popularity with Annadel, Borax Lake, Mt. Konocti, and Napa Valley glasses (e.g., Layton 1990; Lightfoot et al. 1991).

Research efforts by Davis et al. (1998) and Weisler and Clague (1998) serve as good examples of contemporary XRF sourcing studies. While it seems the non-destructive XRF analysis of obsidian artifacts may always be hampered by problems associated with sample surface irregularity, some recent experiments have shown that resulting errors may actually be less significant than previously thought (cf. Bouey 1991). Other successful techniques for measuring trace element quantities are used today (Glascock et al. 1998; Summerhayes et al. 1998), but California archaeology will probably continue to favor XRF analysis because of its non-destructive nature and generally low cost. This will certainly be the case for researchers interested in sourcing eastern California obsidians. In spite of the demonstrated effectiveness of visual sourcing, there are many broad similarities in macroscopic attributes which prevent the segregation of most Inyo-Mono obsidians. Davis et al. (1998:179) echo previous cautions by Hughes (1984b) by encouraging XRF analysts to publish details of methods and analytical conditions so that resulting data can be compared and assessed. This will be particularly important in the future, as XRF study has recently branched out into the examination of archaeological basalts (cf. Bloomer and Hall 1998; Day et al. 1996; Latham et al. 1992).

OBSIDIAN HYDRATION STUDY IN EASTERN CALIFORNIA

In 1960, Irving Friedman and Robert Smith published their landmark article in *American Antiquity* that introduced the phenomenon of obsidian hydration and proposed its use as an absolute

dating technique. Recalling previous research concerning the water content of volcanic glasses (Ross and Smith 1955; Friedman and Smith 1958), Friedman and Smith described how natural surfaces of obsidians examined by Ross and Smith (1955) had adsorbed thin, outer layers of water since their formation. This process, termed "hydration", caused the outer rim of an obsidian surface to become more dense, introducing mechanical strain to the region which doubled or split the refraction index of the water layer. Under a microscope, the resulting "strain birefringence" made the hydrated layer visibly distinct from the the inner mass of unhydrated obsidian, appearing as a darker, contrasting band under normal light and a luminescent band under polarized light. Friedman and Smith also discussed their discovery that the deuterium content of water within obsidians that were fully hydrated (e.g., perlite) was the same as the deuterium content in meteoric or atmospheric water, while the deuterium content of water normally present in unhydrated obsidians was different than in atmospheric water (Friedman and Smith 1958). This suggested that obsidian did indeed adsorb water from the atmosphere under normal conditions of temperature and pressure on the earth's surface.

What Friedman and Smith did not yet know was whether atmospheric water was adsorbed fairly rapidly during the cooling and hardening of obsidian, if it was taken up during other post-formation hydrothermal events, or if the genesis of a hydration layer was a longer, perhaps geologically significant process; while they knew that perlite is a fully hydrated obsidian, they had no notion of how long it took for a perlite mass to become saturated. In an attempt to gain some idea of the process of obsidian hydration, and if it occurred at a fixed rate, Friedman and Smith examined archaeological specimens whose ages had been estimated by other means (radiocarbon). Assuming that the chipping required to manufacture an obsidian artifact would expose fresh, non-hydrated surfaces to the atmosphere, these faces would then begin to hydrate; if present and measurable, the thickness of the resulting layer would be determined by the length of time passed since the item was fabricated, and would thus indicate the rate of hydration, or amount of thickness accumulated per unit

of time. Results showed that artifacts estimated to be only a couple thousand years old had indeed developed distinct hydration layers, or "rims", and that the relative thickness of the hydration layer correlated with the passage of time, supposedly older artifacts having thicker rims than younger items.

Beyond presenting these breakthrough findings, Friedman and Smith (1960) also described the tools and techniques used in preparing obsidian thin-sections for study and in measuring the width of hydration rims, the basics of which are still used today in modern hydration analysis. More importantly, the authors went on to discuss some of the physical factors that might affect the rate of obsidian hydration in varying environments: relative humidity, temperature, and obsidian composition. Friedman and Smith (1960:482) first concluded that relative humidity would not be a significant variable in determining hydration rates. Based on the assumption that hydration process was one of adsorption at the molecular level, the authors argued that water molecules would diffuse at a slow, constant rate into a body of obsidian. Next, in discussing the intrinsic water content of obsidians and perlites, they stated that most perlites naturally contain about 3.5% water and non-hydrated obsidians contain from 0.1-0.3% water, while hydration layers on obsidian surfaces never exceed about 3.5% water content. Because perlites are fully hydrated, Friedman and Smith argued that obsidian hydration layers were thus fully "saturated", having been infused with about 3.5% water. Given the incredibly slow rate of water adsorption, and the low saturation point of obsidian, it was suggested that the rate of obsidian hydration would be unaffected by the relative humidity in soil or atmosphere.

Friedman and Smith did expect that obsidian hydration, like any other diffusion process, would be strongly dependent upon temperature, and that the chemical composition or physical properties of an obsidian might also affect the hydration rate. Generally, they suggested that obsidian hydrates with the square root of time, as expressed by the diffusion formula:

$$x = kt^{1/2}$$

where "x" is the rim thickness, "t" is diffusion time, and "k" is the environmental and/or geochemical variable. To illustrate this, the authors presented a series of temperature-dependent hydration rates developed from a collection of rim readings taken on artifacts from North America (Alaska, California, Ohio, Utah), Central America (Ecuador, Mexico, Yucatan), the Middle East (Iraq), and northern Africa (Egypt). Friedman and Smith acknowledged that different temperature zones within a given region (e.g., highland vs. lowland) would probably have divergent hydration rates, but they were only able to distinguish ambient temperature on a macroclimatic scale, and ultimately configured hydration rates for several broad climatic zones (Arctic, Sub-Arctic, Temperate [1 and 2], and hot Tropical). They also calculated two rates for Egypt, one based on rhyolitic obsidian and the other on trachyitic obsidian, these rates serving as examples of how obsidian composition could influence the hydration process within the same temperature regime. These regional rates were understandably crude, but Friedman and Smith had shown a strong relationship between temperature and hydration that continues to be a critical factor in contemporary determinations of obsidian hydration rates.

The first archaeological evaluation of obsidian hydration as a dating tool was provided by Evans and Meggers (1960) in the same volume of *American Antiquity* as the Friedman and Smith article. Though they admitted that the method showed promise, Evans and Meggers were careful to point out certain limitations of its application to archaeological research, noting problems along technical (lack of knowledge about the physical and chemical factors affecting hydration rates) and archaeological lines (e.g., artifact re-use). In presenting a brief survey of known, independent archaeological dates and corresponding dates as predicted by obsidian hydration, Evans and Meggers indicated that the reliability of the obsidian hydration method was inconclusive; clearly, it would be necessary to resolve the various geochemical problems that hindered the establishment of reliable hydration rates if the method was to have any success in the future. On the heels of this review, Donavan Clark, a student who had worked closely with Friedman and Smith, completed a dissertation

that applied obsidian hydration analysis to archaeological materials from central California (Clark 1961a; 1964). Rather than examining materials from many different regions, as did Friedman and Smith, Clark analyzed burial artifacts from a number of different sites in the same region in order to test the comparability and consistency of obsidian hydration and to build a database that might be correlated with a chronometric scale of radiocarbon dates. Clark showed that the variance of rim measurements was significantly less within burial lots than between them, supporting the notion that obsidian hydration was fairly uniform and could be used to develop comparative age estimates. Using a radiocarbon chronology, Clark configured a "best fit" hydration formula for central California:

$$x = kt^{3/4}$$

a configuration that differed slightly from Friedman and Smith's original diffusion equation. Along other lines, Clark also studied two rhyolitic obsidians from Hidalgo, Mexico, gray- and green-colored varieties that occurred in the same archaeological context at a particular site. Upon discovering a significant variance in rim thickness, and having eliminated other potential causes, Clark concluded that the two obsidian varieties must be compositionally distinct, a fact that was altering the hydration rate between the two types. This was significant in light of claims by Friedman and Smith (1960) that rhyolitic obsidians were not chemically divergent enough to have separate hydration rates.

The achievements by Clark (1961a, 1961b; 1964) set in motion a series of attempts to develop obsidian hydration rates for specific archaeological settings, many based on Friedman and Smith's (1960) original diffusion equation (Dixon 1966; Evans 1965; Green 1964; Katsui and Kondo 1965; Meggers et al. 1965). Unfortunately, the absence of compositional controls hindered these efforts, and as Michels and Tsong (1980:419) note, the presumption among researchers at the time was that "composition differences of the magnitude of those that distinguish rhyolitic from trachyitic obsidian

were of the type that would affect the rate of hydration, whereas differences among rhyolitic obsidians were not regarded as significant." In fact, it was not until Michels' (1965) dissertation work that obsidian composition was at least partially accounted for in a hydration study. Excavations were conducted at the Mammoth Junction site, a scatter of flaked stone tools and debris situated in the heart of the Casa Diablo obsidian source area and within 100 meters of an obsidian float deposit. Given the site's location, Michels assumed that the chemical composition of the lithic debris would be fairly uniform and that differences in hydration rim values would be less affected by variations in obsidian type. In attempting to test the potential of obsidian hydration as a relative dating technique, Michels saw the need to examine a large sample of artifacts, selecting more than 400 specimens from various depths within several excavation units at the site. His work showed that, on balance, hydration rim thicknesses increased with depth in sampled units spread across different lobes of the site. In 1969, Michels used data from the Mammoth Junction site to discuss the utility of obsidian hydration in assessing the integrity of site stratigraphy and the degree of artifact re-use.

Despite the largely unsatisfactory results of hydration studies during the early 1960s, archaeologists appreciating the low cost and potential applications of absolute obsidian dating continued to discuss ways to develop useful hydration rates. In 1966, Friedman and Smith published the results of an experiment to induce obsidian hydration under laboratory conditions, arguing in support of their original diffusion equation. Researchers at the UCLA Obsidian Dating Laboratory, which had been recently established by Donavan Clark and Clement Meighan, disagreed with the claims by Friedman and Smith, arguing that their rate significantly overestimated the ages of known archaeological materials from California, the Southwest, and Mexico. In order to resolve these dating discrepancies, Meighan et al. (1968) proposed a new linear diffusion formula, $x = kt$, an act that spurred continued debate for several years (Friedman and Evans 1968; Friedman et al. 1969; Johnson 1969; Meighan et al. 1968b; Meighan and Haynes 1970), and up through the early 1970's

archaeologists worldwide continued to rely upon the Friedman and Smith diffusion formula without more than a nominal concern for the chemical makeup of the obsidians under study (Bell 1977; Davis 1972; Michels 1971, 1973; Suzuki 1973). Two master's theses at UCLA involving the relationship between obsidian chemistry and hydration (Aiello 1969; Kimberlin 1971) went virtually unnoticed by archaeologists outside of the Obsidian Dating Laboratory, where a number of collaborative studies eventually culminated in a collection of research papers edited by R. E. Taylor, entitled *Advances in Obsidian Glass Studies: Archaeological and Geochemical Perspectives* (1976). This effort clearly demonstrated that geologic sources of obsidian did vary in chemistry, and that chemical composition had a significant effect on the rate of hydration. Working with hydration values published later by Meighan and Bennett (1976), Ericson (1975) introduced a source-specific hydration rate for Bodie Hills obsidian configuring to 650 years/micron (cf. Singer and Ericson 1977). The need for source-specific hydration rates was no longer in doubt, but opinions were divided as to how these rates should be developed, either using archaeological materials (cf. Findlow et al. 1975) or subjecting geologic standards to induced hydration experiments (Ambrose 1976; Friedman and Long 1976). Ericson's (1977, 1978) evaluations of the many existing, generalized hydration rates continued to portray the original Friedman and Smith diffusion equation as the best physical model of the hydration process, though admitting the need and desire of archaeologists to develop source-specific rates.

Perhaps the most important development of late 1970's hydration studies was the notion of "effective hydration temperature" (EHT), an estimate of the average annual temperature to which a piece of obsidian was subjected during its period of hydration. As discussed by Friedman and Long (1976), temperature data could be acquired in several ways, most directly from measurements taken at a particular site with buried thermal cells or air thermometers, and less directly but still fairly accurately from local weather records. The authors (1976:347) suggested that obsidian might hydrate according to the Arrhenius equation:

$$k = Ae^{-E/RT}$$

a temperature-dependent formula normally used to describe chemical reactions, where "k is the hydration rate (micrometers squared per 10^3 years), A is a constant, E is the activation energy of the hydration process (calories per mole), R is the gas constant (calories per degree per mole), and T is the absolute temperature (degrees Kelvin)." According to Friedman and Long, the addition of pertinent temperature data into this formula would enable analysts to correct hydration readings for local and regional temperature variation and still maintain absolute dating within 10% of the true age.

Advances in geochemical source determination in the 1970s paved the way for a new wave of obsidian hydration research in the next decade. Building on early work by Jack (Jack and Heizer 1968; Jack and Carmichael 1969), the use of x-ray fluorescence (XRF) spectroscopy developed as a rapid, non-destructive method of chemical "finger-printing" which produced data that could be compared between laboratories (T. Jackson 1974; Jack 1976). Though some researchers pointed to problems of chemical overlap with x-ray fluorescence data, instead favoring the more expensive and semi-destructive neutron activation analysis (Ericson 1981, Bacon et al. 1981), the use of x-ray fluorescence paired with computer-based analyses eventually prevailed, perhaps due mainly to the speed and cost efficiency of the method over other approaches. Ericson, however (1977a, 1981; Singer and Ericson 1977), was able to use neutron activation analysis in conjunction with induced hydration experiments to produce a suite of source-specific hydration rates for a number of northern and eastern California and western Nevada obsidians. Although Ericson's rates were not adopted by most archaeologists due to their experimental origin, his studies were critical in demonstrating the necessity of chemical sourcing analyses.

Obsidian source studies with XRF became popular in professional archaeology across California (cf. Harbottle 1982; Hughes 1981, 1983b, 1984b), sparking a renewed interest in

developing source-specific hydration rates. Collections of projectile points, long held as chronological markers in the western Great Basin, could now be chemically sourced and used to generate specific hydration rates for each obsidian type. Working with a series of hydration readings on a variety of projectile point styles made from a particular obsidian, a mean hydration value was configured for each point type and correlated with the midpoint of each temporal period represented by those types. These micron-year pairs could then be used to generate a mathematically modeled hydration rate. This approach allowed archaeologists to calculate hydration rates in the absence of radiocarbon dates, a revolution that was particularly important for researchers in eastern California where dateable organics in feature contexts are relatively rare but obsidian was plentiful. Much of the new attention was focused on Casa Diablo, by far the most abundant and areally extensive source locality in the region; according to R. Jackson (1985), no less than twelve hydration rates were proposed for Casa Diablo obsidian within the span of a few years (Basgall 1983; Ericson 1977a; Findlow et al. 1982; Garfinkel 1980; Hall 1983, 1984; Michels 1982). Following work by Friedman and Long (1976), Findlow et al. (1982) also produced a hydration formula that attempted to account for temperature:

$$y = A1x^m + A2Sp = A3T^n + e$$

where A1, A2, A3, m, n, and p are constants, x is the hydration thickness (in microns), S is the mean annual absolute soil temperature, T is the mean annual atmospheric temperature, and e is an error term. This formula was the first to include a correction for soil temperature, a potentially important consideration that was largely dismissed by hydration researchers until the early 1990's (see below). Also at this time, the Coso Volcanic Field also began to witness a fair amount of scrutiny (Drews and Elston 1983; Friedman and Obradovich 1981; Meighan 1978, 1981; Michels 1983; Zeier and Elston 1984), with minimal attention given to other sources like Fish Springs (Bettinger 1980). Again, most

of these rates were configured using projectile points, though some were still supported by physical models (Friedman and Obradovich 1981; Michels 1983). Sourcing and hydration studies were also gaining popularity in northern California (Amaroli 1982; Eisenman and Fredrickson 1980; Hughes 1978; Origer 1982) and in the California-Oregon border region (Hughes 1982, 1983b; Skinner 1983), although the main thrust of interest in hydration rates did not occur until some years later, perhaps due to caution among researchers and a lack of concentrated effort in any one region.

A collection of papers edited by Hughes (1984a), *Obsidian Studies in the Great Basin*, summarized the state of sourcing and hydration efforts in eastern California and provided directions for future study. Several papers in this volume were of particular significance to obsidian hydration research in California at the time; Bouey and Basgall's (1984) discussion of trans-Sierran economic exchange and their review of Casa Diablo and Napa Glass Mountain hydration rates; Hughes' (1984b) summary of obsidian sourcing problems and prospects; and R. Jackson's (1984a, 1984b) contributions regarding the status and applications of hydration studies in the region. In response to the rising cost of XRF analysis, and in order to facilitate the use of larger samples, a paper by Bettinger et al. (1984b) in the Hughes volume compares the accuracy of macroscopic "visual sourcing" methods with that of the XRF method. This paper clearly demonstrates the increasing familiarity of California archaeologists with the physical properties of obsidian, and their desire to use obsidian studies as a tool for measuring the extent of prehistoric territorial boundaries and spatio-temporal variation in exchange networks (cf. Bettinger 1982a, Bettinger and Hughes 1984; Bouey and Basgall 1984). As discussed in detail earlier, visual sourcing is still in use today and has proven highly accurate when applied to certain kinds of obsidian.

The late 1980s also brought about some significant advances in hydration rim measurement techniques. Over the years, suggested modifications to the original binocular microscope used by Friedman and Smith (1960) have included an image-splitting eyepiece (cf. Dyson 1960; Stevenson

and Scheetz 1989), photographic enlargement (Findlow and De Atley 1976), and the use of a sputter-induced optical emission technique (Michels and Tsong 1980; Tsong et al. 1978). Perhaps the most valuable commentary relating to sample preparation and microscopic resolution has been offered by Scheetz and Stevenson (1988), while an optical technique promoted by Stevenson et al. (1989) has become widespread among contemporary hydration analysts. This technique, in which a gypsum wave plate (first-order red) is placed in the optical path of the microscope, shifts the normally grey color of an obsidian thin section to a pink hue while the birefringent hydration rim appears either blue or yellow, depending upon the angle at which the microscope stage is rotated. While Stevenson et al. (1989) recommended using the pink/blue color scheme while actually measuring the hydration band, modern practice favors the use of this scheme for locating and defining the band, with measurements taken under normal light.

Empirical (Natural) vs. Induced Hydration Rates

Research in experimental hydration studies continued to expand throughout the 1980s. Building on their work in Africa, Sardinia, and on Easter Island, Michels et al. (1983a) presented induced hydration age estimates they argued showed error ranges overlapping with expected dates on archaeological materials of one sigma standard deviation or less; other induced experiments with obsidians from outside California (Stevenson et al. 1989) made similar claims of accuracy. In the eastern Sierra, advances in determining geochemical variability at the Coso Volcanic Field (Hughes 1988; Ericson 1989) facilitated several induced experiments using Coso obsidian (Cleland 1988; Ericson 1989; Stevenson 1987; Stevenson and Scheetz 1989). However, Gilreath and Hildebrandt (1995:13) claim that the results of these experiments "raise serious questions about the replicability of induced hydration experiments." Probably most suspect were Cleland's (1988, 1989, 1990) attempts to induce hydration using liquid bath and vapor matrices, none of which produced results

internally consistent or wholly comparable between tests. Induced hydration experiments were also being performed with northern California glasses at this time (Tremaine and Fredrickson 1988; Tremaine 1989), but the weight of stones cast by archaeologists against laboratory hydration rates was perhaps best summarized by Hall and Jackson (1989) in a second obsidian volume edited by Hughes (1989a), *Current Directions in California Obsidian Studies*. In their article, Hall and Jackson (1989:32) responded to what they termed "a glaring lack of concern" among induced hydration proponents with the need to cross-check experimental rates against established archaeological chronologies. This was a problem that had resulted in the fabrication of induced rates which pushed the beginnings of obsidian exploitation in eastern California back beyond 25,000 B.P. (e.g., Michels 1983), a notion clearly at odds with most archaeological estimates. Even within the same volume of papers, Stevenson and Scheetz (1989) present induced hydration rates for Coso obsidians that are quite different from experimental rates derived by Ericson (1989) and others developed from the use of archaeological materials. However, other induced studies, like that of McGrail et al. (1988) using Mono Glass Mountain obsidian, acknowledged the continuing discrepancies in age estimates between obsidian hydration and other methods, proposing new formulae for hydration behavior based on more complex relationships than Friedman and Smith's (1960) linear square-root kinetics ($t^{0.5}$).

Beyond the dating problems, other complaints by archaeologists pertained to the "abnormal" lab conditions in which hydration was induced, since Friedman and Smith (1960) had maintained that obsidian should hydrate under "normal" atmospheric conditions of temperature and humidity. For example, many induced experiments have used crushed obsidian powder rather than artifacts in order to facilitate more rapid water adsorption (Ambrose 1976; Ebert et al. 1991; Stevenson and McCurry 1990; Stevenson and Scheetz 1989; Friedman et al. 1994; McGrail et al. 1988). According to Ambrose (1976:92), "increasing the surface area of a sample by reducing it to a powder makes it possible to detect the effects of surface reactions that would otherwise be too small, or require too

long, to produce measurable changes." While there are tests which have used actual flakes (Ericson 1981; Michels 1983; Stevenson et al. 1989; Tremaine and Fredrickson 1988) or cut discs (Mazer et al. 1991), the rapid adsorption of water onto obsidian powder may not necessarily replicate the process of hydration involving larger, more stable surfaces such as those on obsidian artifacts.

Another questionable technique of induced studies is the routine application of extreme temperature conditions to facilitate hydration. Just as the use of powders creates more surface area and quickens adsoprtion, increased temperatures have also been employed to speed up the hydration process to make it more easily observable to the analyst. Beginning with experiments by Friedman and Long (1976), which subjected obsidian to temperatures between 95-245°C (200-475°F), most of these studies have continued to create extremely high temperatures in order to induce hydration, usually in excess of 150°C, or about 300°F (Ambrose 1976; Ericson 1981; Mazer et al. 1991; Stevenson and Scheetz 1989; Stevenson et al. 1989). Some experiments have also pressurized ovens in which obsidians are heated, though with apparently little or no effects on the rate of hydration (Ambrose 1976; Ericson 1981; Friedman and Long 1976; Stevenson et al. 1989). The form of the water used in such experiments has also varied considerably. In some cases, test samples have been placed in deionized water (Cleland 1988; Mazer et al. 1991; Michels et al. 1983; Stevenson et al. 1989; Tremaine and Fredrickson 1988) in a mixture of deionized water and silica powder or gel (Stevenson and Scheetz 1989; Stevenson et al. 1989; Tremaine and Fredrickson 1988), or pressurized with water vapor (Cleland 1989; Ambrose 1976; Friedman and Long 1976). To their credit, Stevenson and Scheetz (1989) have noted that these kinds of differences, along with variance in the precision of optical measurement, may affect the results of hydration experiments and ultimately rate configuration. While the latter would apply to the development of natural rate formulations as well, the former requires laboratory conditions inconsistent with those of a normal atmospheric environment. Both Ericson (1981) and Michels et al. (1983) have recognized that the process of

accelerated hydration may not be equivalent to the process of natural hydration observed on obsidian artifacts. In fact, Stevenson et al. (1998:201) have recently called for a new laboratory approach in approximating the natural hydration process, one which involves "conditions of elevated temperature within a vapor environment maintained at 100% relative humidity." While contemporary archaeologists in California are still wedded to the use of natural rates, for both practical and historical reasons, the promise of current hydration research in New Zealand (Ambrose 1994, 1998; Stevenson et al. 1996, 1998), as suggested by Green (1998), may finally lead to a convergence of archaeological and induced hydration studies in the near future (see below).

Hydration Band Measurement

Final considerations about obsidian hydration techniques relate to the overall precision of rim measurement, the range of error inherent in the measurement technique, and the degree of replicability between analysts and laboratories. Following suggestions by Stevenson et al. (1987), the use of a gypsum waveplate has improved the operator's ability to determine the contact between hydration rim and unhydrated core. Scheetz and Stevenson (1988) have also investigated the resolution of microscopes commonly used in hydration analysis, concluding that the use of a filar micrometer (as in this study) imposed an error of 0.25 μm into the measurement process. They also suggest that errors in sample preparation, particularly those in which obsidian thin sections are ground and misaligned at an oblique angle to the microscope slide, can result in measurements that are too large. Nonetheless, a number of tests have shown that operators at independent laboratories can produce rim readings which are in close agreement and that operator error is the least significant of any potential error type (Green 1986; R. Jackson 1984a; Stevenson et al. 1989). A check on current methods indicates that combined errors may result in measurements varying between 0.1-0.5 microns, though most discrepancies are significantly lower and fall within expected error ranges (see below).

EMPIRICAL HYDRATION RATES FOR EASTERN CALIFORNIA OBSIDIANS

It was not until the late 1980s that any hydration rate for an eastern California obsidian proved to be empirically successful in a variety of locations and environments. Hall's (1984) curvilinear rate for Casa Diablo obsidian, later tested and supported by Hall and Jackson (1989), has produced the best results of any Casa Diablo rate and is still favored today:

$$129.656x^{1.826}$$

In 1988, excavations by Basgall and McGuire at CA-INY-30 (Basgall 1990a; Basgall and McGuire 1988) in the southern Owens Valley produced a series of ten radiocarbon-hydration pairings with Coso obsidian that were employed in developing a rate of:

$$_{\log} y = 2.32\ _{\log} x + 1.50$$

According to the authors (1988:127-128), this estimate yielded consistent dates for the latter half of the temporal sequence (post 4000 B.P.) but exaggerated age estimates for micron values larger than 8.0. The authors reasoned that the hydration process for Coso leveled out at approximately 6.0-7.0 microns, shifting from a curvilinear to a linear development. After witnessing a number of other attempts at producing an induced hydration rate for Coso obsidian (Cleland 1988, 1989, 1990; Ericson 1989), Basgall (1990a) reconfigured his original rate to include a correction factor for effective hydration temperature (EHT):

$$_{\log} y = 2.32\ (_{\log} x \cdot a) + 1.50$$

where "x" is the rim measurement (in microns), "y" is the date in years B.P., and "a" is a 6% EHT correction factor (in degrees Celsius). This is still the most commonly cited Coso rate, though some recent modifications have been suggested (King 2000) and revisions are in progress (M. Basgall, personal communication 1999).

In the last ten years, archaeologists working in eastern California have relied more heavily on obsidian hydration dating than ever before. Results from recent chemical sourcing studies have greatly improved our understanding of the geochemical variability at sources like Casa Diablo (Sawmill Ridge and Lookout Mountain), Mono Glass Mountain, and Mono Craters (Hughes 1989b, 1991, 1994). Many new archaeological investigations also provided collections for source analysis, enabling researchers to devise preliminary hydration rates for obsidians that had not been previously examined. Building from efforts by Bettinger (1980, 1989a, 1989b), Delacorte and McGuire (1993) used materials from southern Owens Valley to develop two provisional hydration rates for Fish Springs obsidian, one based on a linear diffusion model and one on a curvilinear model:

$$y = 465.68x - 474.11 \quad \text{(linear)}$$

$$y = 120.23x^{1.62} \quad \text{(curvilinear)}$$

The authors admit problems with both rates, ultimately preferring the curvilinear one despite a lower accuracy in assigning ages to older materials (Delacorte and McGuire 1993:73; cf. Basgall and McGuire 1988). More recently, Basgall (2000) devised a rate for Fish Springs obsidian based on artifacts from sites near Independence, California. This curvilinear rate, which Basgall (2000) notes works somewhat better than the Delacorte/McGuire rate, is:

$$y = 96.54x^{1.90}$$

On the Volcanic Tableland, Basgall and Giambastiani (1995) employed a set of projectile points to produce a provisional, curvilinear hydration rate for Truman-Queen obsidian:

$$y = 82.74x^{2.06}$$

Again, despite some problems in estimating the ages of purportedly older items, this rate performs better than formulas previously applied to Truman-Queen obsidian (Weaver 1992). As with the Fish Springs rate developed by Delacorte and McGuire (1993), this recent rate for Truman-Queen is still preliminary and requires additional testing on the Tableland (this study) and at other locations.

The first hydration rates for Bodie Hills obsidian were proposed by Ericson (1975; Singer and Ericson 1977), based on induced studies (Table 3.1). As with his proposed rates for Casa Diablo and Coso obsidians, Ericson's experimentally derived formulae have not proved successful when applied to archaeological chronologies. Michels' (1982b) Bodie rate failed to work within the parameters of projectile point time ranges at New Melones, as noted by Singleton (1983). A relative lack of interest in Bodie Hills obsidian by Inyo-Mono archaeologists left hydration studies of this glass in a state of limbo for more than ten years, until induced experiments by Tremaine (1991) indicated that Bodie Hills obsidian may hydrate at a similar rate to Casa Diablo. Citing this work, Bieling (1992) suggested that Hall and Jackson's (1989) power rate could be applied to Bodie Hills glass. Halford (1998) attempted this, concluding that Bodie Hills probably hydrates somewhat slower than Casa Diablo, and Giambastiani (1998a) also achieved reasonable results using the Casa Diablo rate. Unfortunately, no contemporary studies of Bodie Hills obsidian have been designed to generate an independent hydration rate. However, Origer (personal communication) claims that recent induced studies indicate different hydration rates for obsidians from the north and south Bodie Hills quarry outcrops.

TABLE 3.1. Hydration rates for Casa Diablo, Coso, Fish Springs, Truman-Queen, and Bodie Hills obsidians.

CASA DIABLO		
1.	$y = 1000x$	(Michels 1965; linear model)
2.	$y = 39.532x^2$	(Ericson 1977; Friedman and Smith [1960] diffusion model)
3.	$y = 127.806x^{1.33}$	(Ericson 1977; Clark [1961] California model)
4.	$y = 111.0x$	(Ericson 1977; linear model)
5.	$y = 47.126(x^2 - x)$	(Ericson 1977; Findlow et al. [1975] parabollic model)
6.	$y = 6.432x^3$	(Ericson 1977; Kimberlin [1976] cubic model)
7.	$y = 487.280x^{0.50}$	(Ericson 1977; square root model)
8.	$y = 386.189x^{0.671}$	(Ericson 1977; Bouey and Basgall 1984)
9.	$y = 200x$	(Meighan 1978; linear model)
10.	$y = 665.41x - 745.0$	(Garfinkel 1980)
11.	$y = 1000x^2/3.51$	(Michels 1982a)
12.	$y = 700.0x - 933.6$	(Basgall 1983)
13.	$y = 668.54x - 637.3$	(Hall 1983)
14.	$y = 229.002x^{1.475}$	(R. Jackson 1984; curvilinear model)
15.	$y = 129.656x^{1.826}$	(Hall 1984; Hall and Jackson 1989; curvilinear model)
COSO VOLCANIC FIELD		
1.	$y = 13.4\ \mu m^2/\ 1000$	(Friedman and Long 1976; Sugarloaf Mtn. [Hughes 1988])
2.	$y = 946x^2$	(Ericson 1977; Friedman and Smith [1960] diffusion model)
3.	$y = 344x$	(Ericson 1977; linear model)
4.	$y = 167.056x^{1.33}$	(Ericson 1977; Clark [1961] California model)
5.	$y = 38.372(x^2 - x)$	(Ericson 1977; Findlow et al. [1975] parabollic model)
6.	$y = 34.980x^3$	(Ericson 1977; Kimberlin [1976] cubic model)
7.	$y = 946.151x^{0.50}$	(Ericson 1977; square root model)
8.	$y = 220x$	(Meighan 1978; linear model)
9.	$y = 0.0014\ \mu m^2/\ 1000$	(Ericson 1977; Sugarloaf Mtn. [Hughes 1988])
10.	$y = 1000x^2/\ 8.0$	(Friedman and Obradovich 1981)
11.	$y = 340x$	(McGuire and Garfinkel 1980)
12.	$y = 490x$	(McGuire 1981)
13.	$y = 280x$	(Meighan 1981)
14.	$y = 190x$	(McGuire et al. 1982)
15.	$y = 1000x^2/\ 3.512$	(Drews and Elston 1983)
16.	$y = 10.8\ \mu m^2/1000$	(Michels 1983)
17.	multiple temp. specific rates	(Zeier and Elston 1984)
18.	$y = 400x$	(Basgall and True 1985)
19.	$_{log}\ y = (x + 13.69)/\ 2.6$	(Koerper et al. 1986)
20.	$_{log}\ y = 2.32\ (_{log}\ x) + 1.50$	(Basgall and McGuire 1988)

TABLE 3.1. Continued. Hydration rates for Casa Diablo, Coso, Fish Springs, Truman-Queen, and Bodie Hills obsidians.

COSO (Cont...)		
21.	$y = 38.7\ \mu m^2/\ 1000$	(Cleland 1988; West Sugarloaf)
22.	$y = 27.2\ \mu m^2/\ 1000$	(Cleland 1988; Sugarloaf Mtn.)
23.	$y = 12.9\ \mu m^2/\ 1000$	(Cleland 1989; West Sugarloaf)
24.	$y = 23.2\ \mu m^2/\ 1000$	(Cleland 1989; Sugarloaf Mtn.)
25.	$y = 10.9\ \mu m^2/\ 1000$	(Stevenson and Scheetz 1989; West Sugarloaf)
26.	$y = 28.5\ \mu m^2/\ 1000$	(Stevenson and Scheetz 1989; Sugarloaf Mtn.)
27.	$_{log}\ y = 2.32\ (_{log}x \cdot a) + 1.50$	(Basgall 1990a)
28.	$y = 10.9\ \mu m^2/\ 1000$	(Cleland 1990; West Sugarloaf)
29.	$y = 28.5\ \mu m^2/\ 1000$	(Cleland 1990; Sugarloaf Mtn.)
30.	$y = 62.51x^2 - 50$	(King 2000)
FISH SPRINGS		
1.	$y = 189.7x^2 - 12.11$	(Bettinger 1980; Friedman and Smith [1960] diffusion model)
2.	$y = 985.4x - 963.1$	(Bettinger 1980; linear model)
3.	$y = 800.3x - 811.2$	(Bettinger 1989a; linear model)
4.	$y = 806.7x - 827.4$	(Bettinger 1989b; linear model)
5.	$y = 465.68x - 474.11$	(Delacorte and McGuire 1993; linear model)
6.	$y = 120.23x^{1.62}$	(Delacorte and McGuire 1993; curvilinear model)
7.	$y = 96.54x^{1.90}$	(Basgall 2000)
TRUMAN-QUEEN		
1.	$y = 34.42\ x^{3.22}$	(Weaver 1992)
2.	$y = 2684.45\ (_{log}\ x) - 1571.44$	(Weaver 1992)
3.	$y = 82.74\ x^{2.06}$	(Basgall and Giambastiani 1995; curvilinear model)
BODIE HILLS		
1.	$y = 6.29\ \mu m^2/\ 1000$	(Michels 1982b)
2.	$y = 600x$	(Ericson 1975; Singer and Ericson 1977; linear model)
3.	$y = 420.687x^{1.33}$	(Ericson 1977; Clark [1961] California model)
4.	$y = 193.46(x^2 - x)$	(Ericson 1977; Findlow et al. [1975] parabollic model)
5.	$y = 30.611x^3$	(Ericson 1977; Kimberlin [1976] cubic model)
6.	$y = 1273.717x^{0.50}$	(Ericson 1977; square root model)

Note: y , years B.P.; x or μm, micron value.

As for other obsidians found on the Tableland (Mount Hicks, Pine Grove Hills, Mono Glass Mountain, Mono Craters, Queen Impostor, Saline Valley), very little or no study of their hydration parameters has been attempted. Ericson (1977, 1978) presented hydration rates based on various formulae for all of the above glasses save Queen Impostor and Saline Valley, but no follow-up efforts have either supported or opposed the utility of Ericson's rates in archaeological research. One goal of the present effort will be to compare and evaluate hydration values for these obsidians against those for which empirical rates exist to see if any trends in rate speed can be determined. This gap in knowledge provides a clear path for future directions of obsidian study in eastern California.

Continuing Problems in Obsidian Hydration

In the last decade, the use of temperature correction factors in the interpretation of hydration data has been of increasing concern to contemporary archaeologists. Lacking radiocarbon-hydration pairings from a project area, which together can imply the severity of temperature effects, corrections for site temperature can be devised in a couple of ways. Methods of measuring soil temperatures have been available to archaeologists for at least 25 years (Ambrose 1976; Bocock et al. 1977; Friedman and Long 1976; Norton and Friedman 1981; Vann and Cline 1975), the most common direct techniques involving the use of buried sucrose-hydrolysis cells or water diffusion cells (Ambrose 1976). These kinds of cells are implanted in soils at test locations and monitored for a period of several months to a year (see Trembour and Friedman [1984] for a full review of this process). Unfortunately, this technique has not proven very practical for archaeologists, who do not usually have access to research locations so far in advance of fieldwork. Most often, annual air temperature averages have been used to configure correction factors for hydration means. In most regions, average temperature figures are obtained monthly by local weather stations and published annually by national weather organizations (e.g., National Oceanic and Atmospheric Association [NOAA]). A correction

factor equaling the difference between the average temperature at the source location and that of the project location can be applied to hydration means from a particular project; after dividing the project area average by the source area average, the resulting figure is multiplied against the subject hydration means, increasing or reducing the means depending on the relative temperature at the project location. This method of applying air temperatures to correct obsidian hydration readings is based on the early work of Friedman and Smith (1960) but is accomplished on a much smaller, local scale. For example, Basgall (1990a) argued that a 6% correction could be applied to micron readings on Coso obsidian for each degree © of difference in EHT value between Lone Pine (Coso locality) and other areas:

$$x' = x\,(1 - 0.06\,[T' - T])$$

where x is the original micron reading, x' is the adjusted reading, T is the base EHT and T' is the EHT value for which the adjustment is made. King (2000) has discussed the good and bad of making temperature corrections in this manner, arguing instead for a logarithmic correction.

Archaeological research into the effects of soil temperature on obsidian hydration did not really commence until the mid-1980s, reaching a peak in the early 1990s (Leach and Hamel 1984; Onken 1990; Ridings 1991; Tremaine 1987; Trembour and Friedman 1984). Working from the premise that variations in soil temperature could affect the rate of hydration, some archaeologists have argued that temperature correction factors should be developed using estimates of soil temperature in archaeological sites rather than air temperature. In a study of soil temperatures in New Zealand, Leach and Hamel (1984) discuss temperature variations across space, coastal soils being generally warmer than inland soils and northern locations having warmer soils than southern ones; they cite a maximum difference of 8.4°C across the country. Similar conclusions had been reached by Friedman and Long (1976), and later findings by Tremaine (1987) and Onken (1990) tend to support these notions.

While most archaeologists would agree that soil temperatures do vary within regions, and probably at the local level as well, claims about the effects of soil temperature at increasing depths have not been as readily accepted. In many instances, it has been advanced that, as soil temperatures generally decrease with depth in a given landform, obsidian artifacts resting deeper in an archaeological deposit should hydrate relatively slower than artifacts lying near the surface (Friedman and Long 1976; Leach and Hamel 1984; Ridings 1991; others). For example, Leach and Hamel (1984) present data from Ambrose (1973, 1975) which show a drop in soil temperature with depth in Papua New Guinea, from 33.6°C at 18 cm to 30.2°C at 90 cm. Friedman and Long (1976) have shown temperature decreases of less than 1°C at locations in Montana and Oregon between depths of 90-180 cm and 30-60 cm, respectively. In the southwestern United States, Ridings (1991:83) measured a temperature drop from 15.5-12.3°C in thermal cells planted between depths of 10-120 cm; citing a difference of only about 1°C between 50-100 cm, Ridings indicates that corrected hydration rates for these depths could indicate an age difference of about 13%. Finally, at the Coso Volcanic Field, Cleland (1990) documented a 2°C temperature difference between 5-75 cm below surface, while Zeier and Elston (1984) found more than a 10° C decrease between the surface and two meters depth. Still other recent studies (e.g., Tremaine 1991) have produced similar results, indicating a slight temperature variation within the upper 100 cm or archaeological deposits. Such variations in ground temperature are caused by "the combined differences in soil-moisture content, sediment type, aspect and ground cover" (Mazer et al. 1991:510).

Although there is some evidence that obsidian artifacts in surface contexts hydrate substantially faster as a result of "solar heating" than those buried fairly deep in the ground (Clark 1984; Friedman and Long 1976; Friedman and Smith 1960; Layton 1973), other results raise questions about the effects of soil temperature change with depth on hydration (Friedman 1976; Findlow et al. 1982). In one case, Friedman (1976:179) suggested that for deeply buried artifacts (ca.

5 meters) effective temperature could be approximated from mean annual air temperatures, while for artifacts close to the surface a higher EHT correction would be required due to diurnal air temperature fluctuations. This was because increasing depth tended to dampen the effects of diurnal temperature fluctuations, making soil temperatures below 10 cm consistent with average diurnal air temperatures (Clark 1984; Friedman 1976). Similarly, Findlow et al. (1982:41) also indicated that temperature correction factors need only be applied when "relatively large temperature ranges are involved, i.e, mean annual temperatures range over 10 degrees F and soil depths varying by at least 100 cm." Perhaps the most damaging testimony against the effects of soil temperature on obsidian hydration has come from experimental research into the relationship between hydration and relative humidity. Recent hydration studies have argued that greater relative humidity does indeed increase the rate of obsidian hydration (Ebert et al. 1991; Friedman et al. 1994; Mazer et al. 1991; Stevenson et al. 1993; Tremaine 1991; Trembour et al. 1994). For instance, Friedman et al. (1994:188) describe studies of hydration rims on like-age artifacts taken from surface and buried contexts in which little or no difference was found. They suggest that the absence of a temperature difference in these cases "may be due to to the compensating effect of the lower rH (relative humidity) experienced by the surface samples, which tended to counter the effect of solar heating." Friedman et al. (1994) also state that relative humidity approaches 100% at only 10 cm below surface in most soils, and about 25 cm in hot, arid environments; a similar claim is made by Stevenson et al. (1998). Other studies have shown that, as temperature decreases with depth relative humidity increases (cf. Tremaine 1991); it appears that the two factors may, in essence, cancel each other out, deeper artifacts being subjected to a cooler but wetter environment and shallower items being enveloped in a warmer, drier environment.

Considering the many variables that can affect the formation of archaeological deposits, it is exactly this fact that makes one of the strongest arguments against applying temperature corrections with depth. Generally, it can be assumed that, with the exception of implements buried in caches,

lithic artifacts were eventually discarded onto natural land surfaces, some stable and some loose. Rejected items would remain in such contexts for varying amounts of time, depending on soil composition, weather, and both natural and anthropogenic processes of turbation. In many situations, artifacts can be moved vertically within a subsurface deposit due to animal burrowing (cf. Erlandson and Rockwell 1987; Johnson 1989; Pierce 1992; Wood and Johnson 1982) or human trampling (Gifford-Gonzalez et al. 1985; Nielsen 1991; Stockton 1973; Villa 1982; Yellen 1977); in some cases, particularly where topsoils or surface sediments are loose (as in arid environments), items may be repeatedly exposed to surface conditions, re-buried, and exposed again over extended periods of time, even millennia. Many kinds of artifacts, particularly utilitarian implements, may have complex use-histories, often being fabricated, used, and discarded only to be recovered (i.e., scavenged) at a later date and perhaps modified to suit an entirely different purpose, used, and discarded again. It might be prudent to consider the potential effects of vertical depth, soil temperature, and relative humidity on the development of hydration, but in any archaeological situation it is impossible to know the complete depositional history of an artifact and employ the appropriate temperature correction factors to account for its span of hydration time. In practice, only broad-scale temperature correction factors may ever be of utility in archaeological studies, based either on average air or soil temperatures.

Future Directions for Obsidian Hydration Rate Research

At the outset of the new millennium, archaeologists in California are confident enough to routinely employ obsidian hydration as a relative dating tool and have been achieving consistent results with current techniques. While the goal of using obsidian hydration as an absolute dating method, as originally envisioned by Friedman and Smith (1960), is still pursued by experimental hydration researchers, it unfortunately has not yet been achieved; due to the many minute variables involved, obsidian hydration may never prove to be a practical absolute dating method. Nonetheless,

its utility as a relative means of estimating artifact age is unequaled due to its cost-effective, non-destructive nature. Moreover, when paired with geochemical source studies (as in the present effort), obsidian hydration can also be a powerful tool in the delineation of cultural and/or population boundaries, group movements, and patterns of economic exchange.

Two recent developments in experimental hydration are notable for their potential to offer new directions to the formulation of useful hydration rates for eastern California obsidians. According to Stevenson et al. (1993, 1998), new experiments have shown that the intrinsic water content (H_2O^+) in obsidian is the dominant factor in determining hydration rate. Studies of Coso obsidian indicate that water content differs more than originally supposed within geologic flows, ranging from 0.31-2.34 wt% within the Coso Volcanic Field (Stevenson et al. 1993:379); this signifies that source-specific hydration rates for Coso are probably more variable than is realized, differing significantly between aboriginal quarry locations. For practical (archaeological) purposes, these results would tend to muddle the picture of Coso hydration rather than clarify it; however, they are intriguing because they suggest that more precise, independent dates can be obtained using hydration on a piece-by-piece basis. Stevenson et al. (1993:382) also point out that determinations of intrinsic water content can be performed on the same thin sections used to measure hydration rim widths, reducing the extent of artifact damage. Other discussions by Stevenson et al. (1998) suggest that hydration experiments conducted in an environment of 100% relative humidity would more accurately model the natural (atmospheric) process of hydration. This method also seems to represent a closer approximation of the conditions in which hydration occurs on archaeological obsidian, a fact which may ultimately lead to more consistent estimates of hydration rate between empirical and experimental studies.

Despite four decades of research the use of obsidian hydration analysis remains best suited as a relative dating method. This relates in part to the continued scarcity of extended radiocarbon-hydration sequences, but it may also pertain to the many physical and environmental variables in the

process of hydration, as demonstrated by induced hydration research. Although age estimates derived through obsidian hydration may not ever be as accurate as once hoped, the method works well enough to be useful in predicting age on a relative scale provided that at least some type of temperature correction is employed in interpreting rim readings. In particular, the success of obsidian hydration in eastern California cannot be underestimated, as project after project returns fairly consistent results in measurements taken on "time marker" artifacts (projectile points) and associated obsidian debris.

THE ORGANIZATION OF FLAKED STONE TECHNOLOGY

The present research is also directed to examining temporal variability in flaked stone technology. Archaeological work throughout the Inyo-Mono region has shown that at least one major technological change occurred within the last few millennia, the replacement of the atlatl-and-dart with the bow-and-arrow about 1400-1200 years ago (Basgall and Giambastiani 1995; Bettinger 1989a; Bettinger and Baumhoff 1982; Delacorte 1990; Delacorte and McGuire 1993; Gilreath and Hildebrandt 1995; Yohe 1992). It is uncertain as to how this shift in aboriginal weaponry affected the overall organization of flaked stone technology. Many researchers suspect it involved a switch from the use of bifacial point preforms to those made on simple flake blanks, which reduced the significance of fairly "specialized" biface technologies and raised the importance of more "expedient" tool production (Basgall and Giambastiani 1995; Bettinger 1989a, 1991; Delacorte 1990; Delacorte and McGuire 1993; Yohe 1992). Much evidence shows that flake tools supplanted bifaces as processing tools following the introduction of the bow-and-arrow, but available data generally lack chronological resolution of the kind provided by obsidian hydration.

As defined by Nelson (1991:57), the organization of technology is "the study of the selection and integration of strategies for making, using, transporting, and discarding tools and the materials

needed for their manufacture and maintenance." Following Jochim (1981) and Koldehoff (1987), technology consists of behaviors that are vital to human adaptation, rather than being merely a consequence of those adaptations or simply a mode of material production. Technological strategies are developed in the context of existing environmental, social, and economic conditions, and are designed to solve a variety of problems relating to acquiring subsistence resources. There are many different problems humans might need to overcome in various environmental and cultural contexts; among these are time stress (Torrence 1983), minimization of energy costs (Bleed 1986; Winterhalder and Smith 1981), requirements of settlement mobility (Binford 1979; Kelly 1983, 1988; Kuhn 1994; Shott 1986), and variance in raw material quality and availability (Andrefsky 1994; Bamforth 1986; Kelly 1988). By assessing the potential obstacles that might have existed in different adaptive situations, it is possible to predict which ones may have had most relevance for human groups and how they may have been resolved.

Hunter-gatherer societies are particularly suited to the study of technological organization as their strategies for resource extraction are often supported by a narrow range of tools that are fairly consistent in basic design. There is little doubt that mobile hunter-gatherer groups routinely carried with them a lithic tool-kit which contained a variety of stone cores, weapons, tools, and tool blanks. The specific design of such tool-kits, however, depended upon many variables such as the level of residential mobility, the overall abundance, layout, and quality of raw material sources in the environment, the size and form of suitable toolstone masses, and the technological requirements of a group's subsistence strategy and weaponry. With regard to hunter-gatherer mobility, Binford (1979), Bleed (1986), Kelly (1988), Shott (1986), Torrence (1983, 1989), and others have discussed aspects of lithic transport and tool design. Human groups characterized by a fairly high degree of residential mobility, or foragers (Binford 1980), face limits as to how much stone a person can efficiently carry from place to place. As Kelly (1988) notes, in environments where spatial

disjunctions exist between locations of food and raw material resources, stone tools must satisfy the logistical requirements of transport yet still be able to support a variety of processing functions. Foragers must also have practiced some degree of raw material and tool conservation, particularly when moving long distances or when the timing of next opportunity for lithic acquisition was uncertain (Gramly 1980; Kelly 1988; Kuhn 1994). Mobile hunter-gatherer tool-kits should thus be designed to emphasize portability (cf. Kuhn 1994), but at the same time the implements they contain must be useful in many tasks (versatility) or be easily adapted (flexibility [sensu Nelson 1991]) to a variety of processing situations (Goodyear 1979; Nelson 1991; Shott 1986). Bleed (1986) has also suggested that forager hunting technology must be maintainable in order to meet continuous needs but unpredictable schedules for tool use and repair.

Great Basin hunter-gatherers have employed bifacial technologies throughout prehistory to solve problems associated with raw material transport and to provide themselves with multifunctional and maintainable tools. According to Kelly (1988), bifaces easily meet the requirements of mobile technology, especially in environments where raw material is scarce. Core forms other than bifaces do occur among residentially mobile hunter-gatherer groups, such as the Ngatatjara and Pintupi in central Australia (Gould et al. 1971; Hayden 1979; O'Connell 1977), but such examples are normally found in locations where raw materials are widely abundant and accessible (Andrefsky 1994). Though considerable investment is necessary in their manufacture, bifaces can serve as both cores and tools, are easily resharpened and maintained, and have potentially long use-lives. Both Andrefsky (1994) and Kuhn (1994) have suggested that cores, despite their weight, may have functioned in mobile tool-kits as reserves for undetached flakes, to be removed and used as needed. Bifacial cores may be especially suited for flake production for several reasons. Kuhn (1994) indicates that bifaces have optimal weight/utility ratios, being relatively light while affording control over the size of flakes produced; this implies more potential flakes per core (greater utility). Others have argued that bifacial

flakes have greater edge-to-weight ratios (Goodyear 1979; Kelly 1988), a position that hints at more efficient use of raw material through decreased waste. Because of their shape, bifaces can also be resharpened easily for continuous use. Kelly (1988) also attributes sharpness and durability to bifacial edges, suggesting that the latter quality is superior on bifaces as compared to unifacial tools. In a high mobility situation, bifacial tools (like projectile points, bifaces, and biface cores) can be "curated" (sensu Binford 1979), kept in service for extended periods and moved long distances prior to discard.

The relative abundance, distribution, and quality of lithic materials in an environment, along with the size and shape of available toolstone masses, can also influence the organization and design of flaked stone technology. Research by Andrefsky (1994) has shown that the abundance and quality of available stone affects whether or not "formal" tools (like prepared cores and bifaces) or "informal" tools (expedient, unstandardized forms) are manufactured locally. When toolstone is locally abundant but of generally poor quality, consumers tend to produce informal tools from local materials and formal implements from exotic stones. In the opposite case, where local toolstone is scarce or sources infrequent but materials are high-quality, efforts at conservation are practiced in which formal implements are produced from local rock and maintained. In still other situations where local stones are abundant and of good quality, a variety of formal and informal tools will be manufactured from these stones. Results from studies by Bamforth (1990) and Gramly (1980) are consistent with these notions, indicating a relationship between raw material availability and tool form that seems independent of settlement organization and mobility.

Added to this are potential influences on flaked stone technology that relate to the sizes and shapes of available raw material packages. Though perhaps the least studied of any factor pertaining to variation in tool form, it is important to realize that toolstone mass and morphology can place limits on the kinds of tools which can be manufactured. Using eastern California obsidians as an example, some sources occur as massive blocks and sheets of volcanic glass, like Casa Diablo, while others

comprise extensive cobble fields, like Coso and Truman-Queen. Still other obsidians, like Pine Grove Hills in western Nevada, are little more than float sources from which only smaller than fist-size nodules can be obtained. All of these obsidians are essentially equal in flaking quality, and most sources offer considerable volumes of glass, yet the sheer volume of available obsidian may be insignificant relative to the potential size of raw material packages present at a given source. Put simply, more sizeable toolstone packages like boulders and large cobbles are capable of generating cores, blanks, and tools of considerable size and variety, while smaller toolstone cobbles are more limited in the kinds of items they can produce. Considerations of raw material selection by aboriginal consumers should be linked not only to degree of residential mobility but also to the desired parameters of tool size and the dimensions of available raw material masses.

Several recent studies at cryptocrystalline quarries in the Mojave Desert (Bamforth 1990, 1992; Bamforth et al. 1996; Giambastiani 1998c, i.p.; Giambastiani and Basgall 2000a; Harry 1992; Lerch et al. 1996) have also demonstrated or implied the existence of a relationship between core form and raw material shape. For instance, at the Wood Canyon quarries near Twentynine Palms, California (Giambastiani 1998c; Giambastiani and Basgall 2000a), landscapes with abundant, good-quality toolstone manifest clear spatial segregation in the distributions of larger and smaller toolstone masses, the two forms generally occurring in different parts of the quarry locality. When present, large cobbles (>15-20 cm in maximum diameter) were manufactured into bifacial cores instead of other core types (unidirectional, bidirectional, and multidirectional forms), regardless of cobble shape. Where cobbles were small (10-15 cm diameter), tabular forms were more often reduced into bifacial cores while rounded or angular shaped cobbles were flaked into other configurations. Exceedingly small cobbles were not even worked into formal cores, being reduced only to generate a few useful flakes and then discarded. In this example, degree of residential mobility probably had little if anything to do with choice of core form, which was determined primarily by cobble size and shape. A situation

like this might preclude consumers from initiating bifacial cores at quarries, instead requiring the production of large flake blanks that could be reduced bifacially at a later time. Depending upon the kinds of tools and weaponry in use by groups coming into contact with toolstone sources of this type, groups may have been forced on occasion to utilize alternative reduction strategies, to forego production of certain kinds of tools, or to ignore certain raw material sources altogether. In the Great Basin this type of scenario might have emerged at the transition from the atlatl-and-dart to the bow-and-arrow, obsidian sources with cobbles too small for dart point manufacture becoming more attractive for the production of smaller, flake-based arrow points.

Finally, the organization and design of flaked stone technology may also be influenced by the particulars of hunter-gatherer subsistence orientation. Degree of mobility aside, some subsistence economies require more or less toolstone than others. For instance, predominantly hunting adaptations may generally use more flaked stone tools and employ a greater specialization in tool design than adaptations emphasizing vegetal use. Different kinds of tools, though fulfilling the same basic function, may also have separate design requirements. A classic example of this from the Great Basin is seen in the conditions for dart-point and arrow-point production. While both types of projectile point can be manufactured via pressure retouch from small flake blanks, it is generally the case that dart-point manufacture proceeded from a large flake blank that was percussion-thinned into a bifacial preform, while arrow-points were initiated from a small flake blank and simply pressure-shaped into finished form. Bifacial cores and preforms thus assume more important roles in technologies using dart-points, while a wide variety of alternative, non-bifacial cores can provide flake blanks for arrow-points. The implications of this distinction for flaked stone technology are profound, in that some systems may need a bifacial orientation while others may not. Such a difference could certainly affect the design of other items in the flaked stone tool-kit, and it might also determine the relative volume of lithic material necessary for tool production.

Patterns of Lithic Acquisition and Use

Lithic procurement strategies are a main component of subsistence-settlement organization among many hunter-gatherer populations throughout the world. In regions where toolstone resources are spatially distributed in a patchy fashion, such as eastern California, prehistoric lithic acquisition is viewed as having been accomplished during settlement shifts made primarily for subsistence purposes. This is what Binford (1977, 1979) has termed the "embeddedness" of raw material procurement, where toolstone is obtained in the context of other food-getting activities rather than by specific, long-distance trips to quarry locations. During residential/subsistence moves, foraging groups often placed themselves in the vicinity of known food and toolstone resources in order to exploit them both at once, or they may have altered their course to pass near a source locality while a small task group made a short diversion to get stone. Groups that were highly mobile, shifting residence often and over longer distances, probably had multiple direct encounters with widely distributed toolstone sources during the course of seasonal or annual foraging rounds. In contrast, groups that moved less often and kept within smaller foraging areas most likely had fewer opportunities to directly acquire stone from a more limited number of source locations.

Viewed in this way, patterns of lithic acquisition have clear implications for understanding trends in human settlement and land-use. Interpretations that derive from lithic source data are based on a number of assumptions, arguments, and facts concerning aboriginal strategies of toolstone procurement. First, it is important to realize some basic tenets of distance-decay models (cf. Metcalfe and Barlow 1992). Generally, the farther away from a given source the less of that material should be present in transported tool-kits and in archaeological assemblages. When moved away from their point of origin, toolstone masses, in whatever form, become smaller as a result of use (damage, reduction, and re-use). Items that are retained for long periods in lithic tool-kits should undergo the most drastic changes in overall size and shape (cf. Shott 1989). Dart-size projectile points from the

Great Basin demonstrate this fact quite well (Basgall and Hall 2000). Points broken and rejected after only limited use are more consistent in morphology, while those curated and maintained will often be smaller and stunted in appearance following repeated episodes of rejuvenation. Bifaces discarded from failed production should also be relatively large and poorly shaped, while others rejected long after completion should be more heavily reduced and refined.

Any understanding of aboriginal lithic acquisition must also rest on assumptions about the kinds of activities normally conducted in the context of toolstone quarrying. Holding all lithic sources equal in terms of material quality and availability, when consumers visited a quarry location it is presumed that any partially reduced or spent cores and broken implements they had been carrying were discarded (cf. Gramly 1980); once upon a lithic source, items such as these require little investment in time or materials to reproduce. Other still serviceable tools may have been retained, particularly hafted items like projectile points which are costly to replace in terms of time and non-lithic raw materials (like sinew or adhesives). Reduction efforts at quarries generally focused on the preparation of cores, preforms, and blanks, items to be removed to other nearby locations for tool manufacturing and completion. Upon departure from the quarry, the replacement of flake-producing masses with new stone but retention of hafted tools creates a temporal disparity within the lithic tool-kit. Many projectile points and other curated items were made at some time in the past, with source materials obtained previously, while cores, preforms, and blanks were fabricated in the present. This is especially true for dart-point technologies, in which points have strong potential for curation. All other things being equal, a collection of points and curated tools within a transported tool-kit is likely to include a variety of source materials, some of these deriving from quite distant locations, while associated cores and waste flakes should primarily represent the most recently visited lithic source.

Finally, it is the use of lithic materials at locations away from quarries which creates observable source patterning in the archaeological record. Generally, flaked stone debris at non-quarry

sites results from the manufacture, repair and/or replacement of stone tools. Following Binford (1979) again, tool repair and finishing activities often dominated stoneworking efforts at special purpose sites, or "locations", with full-scale tool discard (involving broken points, bifaces, and other implements) and manufacturing efforts being accomplished at residential sites where time, food, and facilities are available. Some amount of debitage is generated in both site contexts. In the first scenario, debitage produced strictly from the maintenance of points and curated tools should comprise a variety of source materials. In the second, where items are replaced wholesale with transported stone, debitage from the shaping and reduction of raw blanks or preforms should mainly represent the source material(s) obtained most recently in the procurement cycle. Tools discarded in the context of production at residential sites, however, should include a greater range of sources than debitage. As a result, archaeological assemblages containing both tools and debitage will often portray a source discrepancy, the former having a broader source profile and the latter a narrow one. When source profiles for tools and debitage are different, this signifies both tool discard and tool manufacturing; if they are more or less the same, tool production alone is implied.

MOBILITY, SETTLEMENT PATTERNS, AND LITHIC SOURCE DATA

Contemporary archaeologists have viewed patterns in lithic source distribution as being representative of toolstone acquisition modes and, by extension, of long-term trends in aboriginal mobility and settlement. Goodyear (1979:10) was perhaps the first to formally explore the implications of raw material source patterns for group mobility, arguing that "most of the exotic lithic remains among Paleo-Indian sites represent by-products of mobility." Following Binford's (1979) suggestion that hunter-gatherers procured lithic raw material in the context of settlement shifts, many studies have shown that aboriginal groups often traveled long distances between procurement events (Basgall 1988, 1989; Gould and Saggers 1985; Hughes 1986a; Kelly and Todd 1988; Meltzer 1985;

Roth 2000; Shackley 1990, 1996). Some researchers have advanced socio-cultural explanations for these patterns (Hughes and Bettinger 1984; Gould and Saggers 1985), but it is generally held that the presence of large geographic disparities between lithic sources in an archaeological assemblage reflects long-distance settlement mobility. This belief has been especially prevalent among researchers in eastern California, where many distinct obsidians were transported up and down the east flank of the Sierra Nevada prior to the advent of localized and trans-Sierran exchange networks (Basgall 1989; Bouey and Basgall 1984; Delacorte and McGuire 1993; Ericson 1977, 1981; Gilreath and Hildebrandt 1995; T. Jackson 1984, 1986; Singer and Ericson 1977). Extreme source variation, particularly among debitage, probably signifies a fairly high rate of residential mobility, consumers having visited a variety of sources recently enough to still have materials from those locations in their lithic tool-kits (Basgall 1989; Basgall and McGuire 1988; Delacorte and McGuire 1993). Sources obtained recently in the acquisition cycle should figure prominently in active toolstone supplies, being well-represented among debitage and tools, while sources visited earlier should occur in decreasing amounts with time from procurement and with increasing frequency as finished tools.

Throughout eastern California, a tendency for greater source diversity in more ancient obsidian assemblages, with increasing homogeneity in more recent assemblages, may indicate a long-term shift toward settlement centralization (cf. Basgall 1989; Basgall and Giambastiani 1995; Basgall and McGuire 1988; Delacorte and McGuire 1993; Delacorte et al. 1995). Early/middle Holocene assemblages in Owens Valley often contain obsidians from distant locations to the north, south, and presumably east as well (cf. Basgall 1989). A similar but perhaps more circumscribed north-south pattern is evidenced among Newberry period assemblages (Delacorte and McGuire 1993), where long-distance residential moves were perhaps limited to a few regular settlements (Delacorte 1990). In contrast, post-Newberry assemblages are composed largely of obsidians from nearby sources, irrespective of which locations are most proximal (Basgall and Giambastiani 1995; Basgall and

McGuire 1988; Bettinger 1989b; Delacorte and McGuire 1993). Added to the introduction of labor-intensive subsistence practices and rising aboriginal population levels, both of which placed limits on overall residential mobility, a gradual increase in the use of local obsidians by groups throughout the Inyo-Mono region is suggestive of a widespread decrease in annual foraging area.

Technological outcomes of late-period changes in aboriginal settlement may also help improve the archaeological visibility of centralization in and around Owens Valley. If, as it appears, flaked stone technology shifted from bifacial cores to a more expedient, flake-based economy, partly in response to decreased mobility, a gradual increase in the use of local obsidians should be reflected strongly in source profiles for simple flake tools and debitage. Arrow-size projectile points, if generally made from flake blanks, should also demonstrate this pattern and are expected to contrast sharply with dart-size points (usually made from bifacial preforms). The resonance of this change might carry through to late-period bifacial tools as well, though post-Newberry biface collections will likely have portions of older, scavenged items that could radically skew source profiles.

SOME WORDS ABOUT SITE- AND ARTIFACT-BASED INTERPRETATIONS

Though sort of a sideline issue, it is necessary to realize that a number of different interpretive stances are used in deciphering the large and variable sets of archaeological data generated in this research effort. All of the project assemblages used in this dissertation derive from many sites, and each collection was recovered with the premise that every site represents an accumulation of debris resulting from a behavioral event or series of events that occurred in a single place on the landscape. At a more specific level, it can also be argued that each artifact represents a single event, be it one of use, repair or modification, or simply discard. In this sense, it is possible to consider each artifact from a site to be synonymous with those that are "isolates", items found in solitary locations away from

larger collections of debris. The occupational circumstances may be quite different between sites and isolates, but the specific events that produced them may have been the same.

This point is raised to underscore that some interpretations of obsidian data in the following chapters, specifically those directed to measuring project-wide horizontal and temporal patterning, proceed from an artifact-based approach similar to "nonsite" archaeology (cf. Thomas 1975; Ebert 1992). In certain sourcing and hydration analyses, artifacts are viewed as representing positions on the landscape rather than being considered for their relationships to associated remains at each site. By doing this, the source origin and relative age of each artifact can thus be interpreted primarily by its location within the broader context of the Tableland environment. Relationships between activities carried out at each site are essentially lost, but at the same time it becomes more feasible to examine spatial distributions over wider areas and temporal distributions over longer periods. Not only was the use of an artifact-based strategy critical to generating intra- and inter-regional comparisons of obsidian use, it was logistically necessary given the large number of sites in the overall project database.

Chapter Four

ANALYTICAL AND SAMPLING METHODS

A wide range of analytical and sampling techniques was employed to complete this project. The main purpose of this chapter is to outline the conduct of obsidian studies and examinations of technological variability. Techniques for obsidian sourcing, visual and chemical, are reviewed first. The methods used here are then evaluated and tested in an effort to demonstrate their accuracy and their compatibility with other, more conventional means. A description of project hydration methods follows, succeeded by tests for comparability in rim measurement. Discussions of the many different sampling strategies for sourcing and hydration studies come next, those directed to understanding source and technological variation across space and time. Finally, technological artifact studies are placed into their proper historical and methodological context, this section concluding with the presentation of current classificatory and analytical categories.

VISUAL SOURCING OF EASTERN CALIFORNIA OBSIDIANS

Efforts to trace obsidian artifacts to specific quarry origins have long been of importance to archaeologists working in the Inyo-Mono region. Prior to the coming of age of chemical sourcing methods like X-ray fluorescence or energy-dispersive X-ray fluorescence (XRF or EDXRF) in the mid-1980s, efforts to characterize archaeological obsidians were based largely on the recognition of certain visual traits to distinguish one obsidian from another. Though it was realized early on in California obsidian studies that volcanic glasses were highly variable in color, opacity, texture, and internal properties (Jack and Carmichael 1969; Jack 1971; T. Jackson 1974; Ericson 1977; Ericson et al. 1975, 1976; Hughes 1978), as Inyo-Mono archaeologists grew more familiar with the traits of

different obsidians it became evident that certain types often held consistent visual qualities and could be routinely identified based on sets of phenotypic attributes. This led Bettinger (1982b) to outline visual characteristics of Fish Springs and Casa Diablo obsidians, and to soon thereafter develop rigid methods for visual source analysis and test its reliability (Bettinger et al. 1984b); to date, this particular study has provided the most objective support for the visual sourcing of eastern California obsidians. Implemented between 1980-1983, the experiment involved three separate tests which focused on identifying five obsidians (Casa Diablo, Mount Hicks, Truman-Queen [Truman Meadows], Fish Springs, and Bodie Hills) within samples of projectile points and debitage from surveys in Owens Valley and Long Valley, and within samples of projectile points from excavations at Hidden Cave and Gatecliff Shelter in Nevada. All artifacts had either been subjected to previous source analysis by XRF, as was the case with the Nevada collections (Hughes 1983a, 1983b), or were later examined by XRF following visual assignments. Having selected a set of key traits to be employed in segregating out each obsidian type (which varied only minimally during the course of the tests), two independent operators examined each specimen using a movable high intensity light source and a 10-30x variable power microscope. Throughout the full experiment, operators kept to their objective criteria for each source, attempting to provide an identification for each item and to minimize the number of pieces left unattributed. Hence, if a specimen exhibited traits consistent with a particular source, it was always assigned to that source, whether or not the operator had an intuitive sense to place it into another source category. This procedure permitted consistent, replicable results, and allowed for the comparisons of accuracy between all three tests.

Results of the study by Bettinger et al. (1984b) are presented in Table 4.1, supporting the accuracy of visual sourcing in several ways. Of all artifacts examined during the experiment, 139 of 171 specimens, or 78%, were correctly matched with chemical assignments. More specifically, the Owens Valley test was 87% accurate and the Long Valley test 80% correct, but the Nevada test was

TABLE 4.1. Visual and chemical assignments for obsidian artifacts from Owens Valley, Long Valley, and Nevada (adapted from Bettinger et al. 1984b).

	Chemical (XRF) Assignment								
	Bodie Hills	Casa Diablo	Fish Springs	Mt. Hicks	Truman-Queen	Queen/Hicks*	Majuba Mtn.**	Other	
Visual Source									Total
Bodie Hills	7	-	-	3	-	1	1	-	12
Casa Diablo	2	49	1	-	-	-	3	1	56
Fish Springs	-	1	26	1	-	-	-	-	28
Mount Hicks	1	-	-	20	3	-	-	-	24
Queen	-	-	-	6	15	-	6	-	27
Queen/Hicks*	-	1	-	-	-	10	-	1	12
Other	1	3	-	1	-	-	-	7	12
XRF Total	11	54	27	31	18	11	10	9	171

Note: XRF, x-ray fluorescence. * Truman-Queen/Mt. Hicks combined category used only for Long Valley sample. ** source found only in Nevada sample.

only 63% consistent. In the latter case, the presence of an unexpected source (Majuba Mountain) compromised test results, as ten artifacts from that source were incorrectly attributed to other sources. As for individual source groups, success rates for visual identification are variable. Excluding the Queen/Hicks category, best results were achieved in sourcing Fish Springs (94%), Casa Diablo (91%), and Truman-Queen (83%) obsidians. This has important implications for the present investigation, as all three of these obsidians are common to archaeological sites in the Volcanic Tableland study area. Also, it appears that Truman-Queen obsidian is most often confused with Mount Hicks, and vice-versa, facts that ultimately led Bettinger et al. (1984b) to merge source calls for these glasses into a combined Queen/Hicks category for the Long Valley test. Probably the most important result of this study was its demonstration of how accurate visual sourcing could be for certain obsidians (Fish Springs, Casa Diablo, Truman-Queen). Emphasis was also given to the fact that visual sourcing was

essentially cost-free (in terms of money) and was much less time-consuming than chemical analyses; these factors have played heavily into the current research, which involved thousands of artifacts and could not have been completed with XRF alone (cf. Hughes and Bettinger 1984).

For the next several years, the use of visual methods to source obsidian artifacts was fairly widespread throughout Inyo-Mono archaeological research, and was accomplished with generally favorable results. In 1985, Robert Jackson completed a series of surveys throughout Long Valley that involved limited test excavations for the purpose of recovering obsidian artifacts. Being in close proximity to the Casa Diablo source area, Jackson expected that the majority of artifacts found during the survey would be manufactured of that obsidian. Thus, visual sourcing efforts focused on that obsidian, and were employed to segregate the resulting collection of obsidian tools into two groups, either "Casa Diablo" or "other". Jackson used three separate tests to check the accuracy of visual identifications, examining samples of projectile points, bifaces, formed flake tools, simple flake tools, and cores. The first experiment dealt with projectile points; all items were visually assigned to either the "Casa Diablo" or "other" group and were then subjected to XRF analysis. Fully 86 of 88 specimens were correctly identified as Casa Diablo or non-Casa Diablo by visual means, at an accuracy rate of 95%, within an XRF sample that ultimately included six other obsidians (Bodie Hills, Fish Springs, Mono Craters, Mono Glass Mountain, Mount Hicks, and Truman-Queen). As for the sum of bifaces, formed and simple flake tools, and cores, R. Jackson (1985:110) notes "about a 30% failure [or 70% success] rate in *always* visually distinguishing Casa Diablo obsidian artifacts confidently and correctly". Finally, a random sample of 60 tools and debitage was visually sourced and subjected to XRF. Again, only one item was misidentified as either Casa Diablo or "other", a success rate of over 98%. While of a different sort than the Bettinger et al. (1984b) study, R. Jackson's (1985) work showed that, at least in Long Valley, Casa Diablo obsidian is easily recognized within a varied collection of glasses.

Following these studies, visual source analysis was regularly employed by Inyo-Mono archaeologists but with variable goals, methods, and rates of success. Like R. Jackson (1985), Basgall and Jobson (1986) divided obsidian projectile points acquired during a survey near Mammoth Lakes into "clear" and "opaque" categories, assuming that translucent obsidian probably originated from Mount Hicks or Truman-Queen sources and that black opaque glass was probably from the Casa Diablo area. Working near the Fish Springs obsidian source, Burton (1986) visually sourced over 2500 artifacts, identifying only five items as obsidian other than Fish Springs. A sample of 15 specimens, including two items visually attributed to Casa Diablo, was submitted for XRF analysis; all items had been correctly sourced by visual methods. A few years later, Goldberg et al. (1990) tested archaeological sites in the Casa Diablo vicinity, and selected samples of Casa Diablo obsidian for hydration based on visual criteria. A set of 37 "non-Casa Diablo" (visually indeterminate) artifacts was sourced by XRF; nine specimens returned indeterminate, but of the remaining 26 pieces, fully 18 were ultimately assigned to Casa Diablo. This configures to a quite low success rate in culling out Casa Diablo obsidian from the final XRF sample (31%). The reasons for this problem are not clear, but it may be that small artifact size hindered operator ability in visual analysis. Fortunately, this case is perhaps the only example where efforts at visual sourcing have failed dramatically.

Other recent efforts at visual sourcing have been completed alongside routine XRF checks on visual assignment accuracy. Hall (1990) reports a success rate of 75% in visually identifying obsidian artifacts recovered during surveys between Owens Valley and Walker Basin, Nevada. Also in Owens Valley, Delacorte and McGuire (1993) report a 93% success rate in ascribing items to the Coso Volcanic Field, and a rate of 100% accuracy in assigning artifacts to the Fish Springs source. At Alabama Gates, Delacorte et al. (1995) also present comparable achievements in visually sourcing Casa Diablo, Fish Springs, and Coso obsidians, with 90% or better results in identifying each glass. Excavations by Basgall on the Volcanic Tableland (Basgall and Giambastiani 1995) led to a test of

visual sourcing in the recognition of Truman-Queen obsidian. A sample of 40 artifacts (25 projectile points, 15 unmodified flakes) was assigned to the Truman-Queen source based on visual criteria and was checked by XRF analysis. Of the total, some 33 artifacts were matched to Truman-Queen, an accuracy rate of 83%; projectile points were visually correct 88% of the time, while only 73% of flakes were precisely assigned. The slightly lower success rate with debitage is attributed to the unexpected presence of Mono Glass Mountain at a single site (MNO-2465). Ignoring this, success with debitage jumps to a more comparable figure of 91.7% (Basgall and Giambastiani 1995:44).

Despite the wealth of empirical evidence that visual sourcing provides reliable data for many parts of the eastern Sierra, the technique has not recently been applied on any large scale to help resolve archaeological questions requiring large sets of obsidian source data. As the abilities of chemical source analysts have improved to where intra-source variability is now recognizable and quantifiable (cf. Glascock et al. 1998; Hughes 1988, 1989, 1991), the relative precision of visual sourcing as compared to XRF or neutron activation analysis (NAA) has declined to some degree. There are also several inherent problems with visual sourcing that necessarily limit its potential. First, and perhaps most important, the overall accuracy of the visual method can only be as good as the criteria used to establish source groupings. In order to maintain reliability and replicability, visual source criteria must include only those traits which are strictly unique to certain obsidian types. This is necessary given the known overlap in many of the visual qualities held by Inyo-Mono obsidians (e.g. translucency, opacity, color). For instance, there are many eastern Sierra obsidians that demonstrate moderate-to-high degrees of translucency (Truman-Queen, Mount Hicks, Mono Craters, Fish Springs, Coso, Bodie Hills), and others which often show a strong opacity (Casa Diablo, Pine Grove Hills, Mono Glass Mountain, Coso); it is also possible to find black or red obsidian at most of these sources. Obviously, if just one of these traits was considered a sole criterion for source assignment, no single characteristics would be adequate to confidently identify any obsidian. Indeed,

while Bettinger et al. (1984b) were careful to specify the kinds of visual traits they used to recognize different obsidians, they made clear that "the gross megascopic variability observed in glass from a particular location is reduced to a few key traits which it is assumed to display invariably and which at the same time others are assumed never to display" (Bettinger et al. 1984b:65). For example, their identification of Casa Diablo was based largely on opacity, but on sheen as well, while the distinguishing traits of Truman-Queen were said to be its translucency, a golden brown or gray color, and the occasional presence of straight and parallel flow-banding. In this sense, each obsidian can be identified based on a *set* of specific, unique criteria rather than because of a single attribute. However, as with any polythetic set, the more traits which are required for inclusion in any group, or the more specific each criterion becomes, the more variation is left excluded. In this sense, visual sourcing must work with sets of traits in order to achieve consistency, and its methods work well in finding the more "common" or most "typical" pieces, those which possess *all of the traits* expected for a given glass type. Unfortunately, such methods are less capable of recognizing outliers in whatever range of morphological variability is expressed by each obsidian, meaning those specimens which may lack one or more of the required visual traits but are nonetheless of like origin. In this sense, the accuracy of visual sourcing (its ability to account for all variation) is sacrificed to increase precision (its consistency in controlling the norm). This means that visual source studies may categorically miss or overlook "unknown" glasses not contained in the comparative set used for analysis.

Second, visual sourcing in eastern California produces good results only for obsidians that have received a good deal of archaeological study. To the north, Truman-Queen, Casa Diablo, and Fish Springs are the only obsidians that have been relatively easy to identify (Basgall and Giambastiani 1995; Bettinger et al. 1984b; Burton 1986; Delacorte and McGuire 1993; Delacorte et al. 1995; R. Jackson 1985), while to the south there has been some success with Coso (Delacorte and McGuire 1993). It should also be noted that most successful visual source programs were

implemented in areas relatively near to known obsidian sources, and in each case expectations were high that the preponderance of obsidian in source samples would be of local origin (cf. Burton 1986; Delacorte and McGuire 1993; R. Jackson 1985). In this sense, tests of visual sourcing are more meaningful if completed away from source locales where obsidian profiles are less predictable. The Tableland provides an opportunity for such a test, as it is not in direct proximity to any one source.

Finally, the quality of some visual attributes are in part determined by the size and thickness of an obsidian mass. Opacity and translucency are most obviously affected, as thicker pieces of any obsidian tend to filter the passage of light while thinner pieces allow for more travel. Reports by other researchers (cf. Bettinger et al. 1984b; R. Jackson 1985), as well as flaking tests completed by the author, have shown that thin pieces of Casa Diablo can often be semi-translucent, particularly at their edges, while thicker sections may be totally opaque. Color can also vary considerably with size or mass. Thin flakes of Casa Diablo may appear greenish in hue, with denser pieces being gray; small flakes of Truman-Queen may show next to no color at all, while parent cores can achieve a dark amber-brown hue. Interior checks, bands, phenocrysts, and other inclusions may also hinder visual identification on smaller artifacts, as items of limited diameter can be fully subsumed by a dark band or other such phenomenon. It must be recognized that visual sourcing grows less accurate as artifact size and/or mass decreases. For debitage analysis, difficulties in making source assignments are expected with artifact thickness less than 3.0 mm and artifact diameter less than 15.0 mm or so, depending upon the type of obsidian. These limits are not much different than those of XRF analysis, which are about 1.2-2.5 mm in thickness and 10 mm diameter (Hughes 1986; Davis et al. 1998).

Methods of Visual Sourcing

Visual sourcing methods draw largely from Bettinger et al. (1984b), diverging in only a few but important ways. Most significantly, the goals of source analysis were somewhat different.

Knowing that artifacts not sourced by visual means would be subjected to XRF analysis, a slightly more conservative stance was taken in making assignments for certain obsidians in order to improve the likelihood that each visual assessment was correct. As indicated by Bettinger et al. (1984b:69), this strategy tends to increase the number of specimens deferred to an "indeterminate" category, and does amplify the number of necessary XRF samples, but tests of the methods used here provide over a 90% confidence for assignments to subject obsidians (see below).

All artifacts subjected to visual source analysis were first candled at several angles using a portable, hand-held microscope light equipped for variable intensity. A rotating lens microscope (between 10-40x magnification) was used when necessary, most often serving to help identify pieces of Fish Springs obsidian. All specimens not recognized as Truman-Queen, Casa Diablo, or Fish Springs were labeled "indeterminate" and culled for XRF analysis. Visual criteria were essentially the same as those described by Bettinger et al. (1984b) and by R. Jackson (1985), but are presented here to show where they differ from previous studies. No attempt was made to distinguish between geochemical varieties of Casa Diablo (i.e., Sawmill Ridge and Lookout Mountain).

Truman-Queen

Three main criteria, in combination, were used in recognizing this glass: a) translucency and lack of interior inclusions; b) a golden brown cast, not grey; c) if present, flow banding must be straight, tightly spaced, and parallel. Previous experience with this obsidian indicated that Truman-Queen may sometimes manifest internal, minute gas bubbles; this trait was allowed unless the golden brown cast was absent. Bettinger et al. (1984b:66) and Jackson (1985:108) indicate that Truman-Queen and Mt. Hicks are both translucent and are often difficult to distinguish from one another.

Casa Diablo

While acknowledging that thin pieces of Casa Diablo may permit the passage of light, Bettinger et al. (1984b:66) segregated Casa Diablo based largely on its "near-uniform opacity", also suggesting that some of this obsidian shows "a deep silky sheen that approaches chatoyance." Citing other attributes not reliable for identification, they recognized broad variation in surface texture, color, and the presence of phenocrysts. Much the same characteristics were noted by R. Jackson, but in a bit more detail:

> "Casa Diablo obsidian can also be semi-translucent, such that light can be passed through thin flake edges. Such specimens often exhibit a "muddy" gray or gray-green color. These semi-translucent variants of Casa Diablo may, on occasion, be misidentified as other sources. Total opacity appears to be a characteristic exclusive to Casa Diablo obsidian, at least in this part of central-eastern California" (R. Jackson 1985:109).

Still, it has been claimed that Casa Diablo glass is often confused with Mono Glass Mountain obsidian (cf. Goldberg et al. 1990; Jackson 1985) while Bodie Hills glass may be misattributed to Casa Diablo (Bettinger et al. 1984b), due mainly to variability in opacity, color, and texture. Thus, it was decided that criteria for identifying this glass would be more strict than those used by previous researchers. Prior examinations of Casa Diablo flakes from the Volcanic Tableland had shown that there were two main visual types. One type was the kind described above; semi-translucent, flat gray or gray-green in color, often with a silky sheen, and texture that ranges from smooth to fine-grained. The second type was different in several ways: (a) always completely opaque, even as small flakes; (b) usually jet black in color but sometimes with a brownish tint; (c) often with subtle but tight, straight, and parallel bands. For this analysis it seemed that the first Casa Diablo type would be more problematic while the second was less variable and had the full opacity deemed critical by other researchers. Visual assignments for Casa Diablo obsidian thus focused mainly on opacity, and probably consisted largely

of artifacts of the second visual type. Thicker specimens of the gray/gray-green variety were also easily identified as Casa Diablo, but thinner pieces were usually passed on for XRF analysis.

Samples of Casa Diablo obsidian used in this research as XRF standards were materials of the gray/gray-green type, acquired from source outcrops at Lookout Mountain and Dry Creek. Hughes (1994) has recently identified two, possibly three geochemical types within the Casa Diablo source area: Lookout Mountain, which derives from its namesake location and from Dry Creek; Sawmill Ridge, which occurs mainly in the southwest portion of the Long Valley Caldera; and Prospect Ridge, found exclusively in the southeast part of the caldera. Although Hughes' study does not provide visual descriptions of the different obsidians, if the Lookout Mountain variety is homogenous throughout, being gray or gray-green, then it is possible that the black, fully opaque form of Casa Diablo could originate from either Sawmill Ridge or Prospect Ridge (or both). This remains an empirical question, but it is an interesting one perhaps to be pursued in future visual sourcing studies.

Fish Springs

Visual criteria for recognizing Fish Springs obsidian differ little if at all from those discussed by Bettinger (1982: 115, 118), Bettinger et al. (1984b:66) and R. Jackson (1985:109). All of these studies note Fish Springs obsidian for two attributes: a) an overall green color; b) the presence of feathery, brown or reddish brown inclusions that reflect a blue iridescence when struck with low-angle light. Bettinger (1982b) elaborates the fullest:

> "The pattern of flow banding [inclusions] is usually contorted, but it may occasionally appear as straight, parallel bands. Overall, the material is moderately translucent - the clear to smoky-brown bands more so than the green bands...Black and white phenocrysts of varying size are abundant in the Fish Springs obsidian, giving it a characteristically "dirty" appearance under magnification" (Bettinger 1982b:115, 118).

To identify obsidian from Fish Springs, flow-banding was considered a necessary trait along with green hue so as not to confuse it with thin, semi-translucent, and gray-green pieces of Casa Diablo. Surfaces of Fish Springs artifacts are also generally smooth and reflective, rather than dull and often textured like surfaces of Casa Diablo items.

Test For Accuracy in Visual Source Assignment

Assuming that X-ray fluorescence provides a more accurate method of source determination, a collection of 90 visually sourced artifacts was subjected to XRF analysis in order to assess the relative accuracy of visual sourcing. Selected items comprised 45 flaked stone tools and 45 unmodified flakes, each group including 15 artifacts traced visually to the Truman-Queen source, 15 to Casa Diablo, and 15 to Fish Springs. The tool collection includes five projectile points, 37 bifaces, two formed flake tools, and one core. Using a random numbers table, bifaces visually identified as Truman-Queen and Casa Diablo glasses (15 each) were selected randomly from Enfield materials. Unfortunately, bifaces and other tools visually identified as Fish Springs (n=15) were rare in all study collections; these were chosen for use simply if they met size requirements for XRF analysis. As for debitage, flakes were culled randomly from the entire set of dissertation collections and were retained for analysis if they were of appropriate diameter and thickness for XRF examination. Tools and debitage were employed in this test as a check for differences in the accuracy of visual sourcing between generally larger tools and smaller, thinner flakes. All specimens analyzed by XRF were examined by the author at the University of California, Davis, according to methods presented in a subsequent section of this chapter.

Table 4.2. displays the results of the test for both groups of artifacts. Overall, 69 of 90 (76.7%) visual assignments for Truman-Queen, Casa Diablo, and Fish Springs glasses were matched by XRF, with 13 items (14.4%) unsuccessfully traced by XRF. Ignoring indeterminates, the overall

TABLE 4.2. Visual and XRF assignments for tool and debitage samples.

	XRF Assignments								
	TQ	CD	FS	MO	BH	MH	SV	QI	IN
Visual Tools									
Truman-Queen	13	-	1	-	-	-	-	-	1
Casa Diablo	-	11	-	1	-	-	-	1	2
Fish Springs	-	1	13	-	-	-	-	-	1
Visual Debitage									
Truman-Queen	9	-	-	-	-	1	-	-	5
Casa Diablo	-	8	-	1	1	-	1	-	4
Fish Springs	-	4	10	-	-	-	1	-	-
Total	21	24	24	2	1	1	2	1	13

Note: TQ, Truman-Queen; CD, Casa Diablo; FS, Fish Springs; MO, Mono Glass Mountain/Mono Craters; BH, Bodie Hills; MH, Mount Hicks; SV, Saline Valley; QI, Queen Impostor; IN, failed XRF assignment. Excluding failed XRF classifications, overall accuracy for visual sourcing is 89.6% (90.2% for tools and 75.0% for debitage).

overall proportion of matches increases to 89.6%. In the full sample, Truman-Queen obsidian was identified with the greatest success (91.7%), followed by Fish Springs (82.1%) and Casa Diablo (79.2%). However, visual classifications were generally more accurate for the tool group than for debitage. Of 41 tools given reliable assignments by XRF, 37 (90.2%) were ascribed to like sources by visual analyses. Visual calls for Truman-Queen and Fish Springs tools were matched by XRF slightly more often (92.9% each) than for Casa Diablo (84.6%). As for debitage, some 36 pieces were successfully traced by XRF, 27 (75.0%) of these given like assignments by the visual method. Truman-Queen tools were more often matched in both analyses (90.0%) than either Casa Diablo (72.7%) or Fish Springs (66.7%) items. The lower success rate of visual sourcing for debitage is expected given that small, thin flakes of any obsidian are normally more translucent than larger

pieces. This was mainly a problem in distinguishing Fish Springs from Casa Diablo flakes, as several pieces identified as Fish Springs were ascribed to Casa Diablo by XRF analysis. Classificatory mistakes did not occur in the opposite direction, however, as full or near-total opacity was a visual requirement for Casa Diablo but is not characteristic of Fish Springs; hence, thin, green-gray pieces of Casa Diablo could be mistaken for Fish Springs obsidian but not the other way around.

Following Bettinger et al. (1984b), discrepancies between visual and XRF classifications result from two types of error in visual sourcing. The first is error by *commission*, occasions when pieces are visually identified as one of the three target obsidians (Truman-Queen, Casa Diablo, Fish Springs) but really belong to another source. This is most obvious for Casa Diablo and Fish Springs specimens (especially debitage), where 20.8% of items visually attributed to Casa Diablo and 20.7% of items called Fish Springs were assigned by XRF to other sources. Nonetheless, errors of commission generally occur as expected. Truman-Queen was confused with either Fish Springs or Mt. Hicks (both semi-translucent); Casa Diablo was most often mistaken for pieces of Mono Glass Mountain obsidian; and Fish Springs was wrongly classified primarily to specimens of Casa Diablo glass. The latter example represents the only cross-over between target obsidians, indicating that subject glasses are distinct enough to be reliably segregated most of the time.

The second type of error is by *omission*, in which items not visually assigned to any of the target obsidians actually belong to one of them. Pieces not visually identified as one of the target obsidians ended up in an "indeterminate visual" category and were thus potentially subject to XRF analysis for source assignment. X-ray fluorescence sourcing data presented in Chapter Seven show that of 1846 visually indeterminate pieces which could be reliably placed into specific source categories, only 12.8% traced to Truman-Queen, 20.8% to Casa Diablo, and 4.1% to Fish Springs. These figures reflect errors of omission and are in agreement with errors of commission, implying that Truman-Queen and Fish Springs glasses were more easily recognized by visual means (placing less

often in the indeterminate category) while Casa Diablo was less so. In part this relates to the criteria employed in identifying each of the target obsidians but it also probably testifies to variability in the visual attributes of each glass type, Truman-Queen and Fish Springs being more homogenous and Casa Diablo more diverse.

In review, the overall success rate for visual sourcing achieved in this study (89.6%) is consistent with the results of previous studies on the Volcanic Tableland (Basgall and Giambastiani 1995) and is comparable to if not better than other similar studies in eastern California (Bettinger 1982b; Bettinger et al. 1984b; Burton 1986; Delacorte and McGuire 1993; Delacorte et al. 1995; Goldberg 1990; Hall 1990). This provides strong justification for the use of visual techniques in the current study, and at the same time offers support for the continued practice of visual sourcing in professional archaeology. However, as Bettinger et al. (1984b) so rightly pointed out, geography is an important factor in the success of visual sourcing. It is already known that certain kinds of obsidian are easily confused based on visual attributes (Casa Diablo and Mono Glass Mountain; Truman-Queen and Mt. Hicks), but in locations where similar obsidians are common one may achieve worse results in visual sourcing than in locations where only one glass is abundant. Bettinger et al. (1984b) examine the implications of this in their attempts to identify eastern California obsidians (Truman-Queen, Mt. Hicks, Bodie Hills, Casa Diablo, Fish Springs) in two California locations (Long Valley, Owens Valley) and two Nevada locations (Hidden Cave, Gatecliff Shelter). Their results demonstrate greater success in eastern California, where all subject glasses are prominent, but less accuracy in Nevada due to a strong presence of Majuba Mountain obsidian which can be visually similar to both Truman-Queen and Casa Diablo (Bettinger et al. 1984b:71). In the same way that visual sourcing can be extremely accurate in proximity to quarry locations (assemblages containing mostly one type of obsidian), it can be less accurate where a variety of known obsidians are common or several unknown obsidians exist. The Volcanic Tableland is an area where a high number of obsidians is represented,

but certain glasses are more prevalent than others based simply on their proximity; it is expected that Truman-Queen, Casa Diablo, and Mono Glass Mountain obsidians will be prominent, while Mt. Hicks, Bodie Hills, Fish Springs, and Coso materials will be less so. This given, there should be less confusion between Truman-Queen and Mt. Hicks and fewer errors between Casa Diablo and Bodie Hills, patterns which are clearly reflected in Table 4.2. On the other hand, the infiltration of relatively unknown obsidians like Saline Valley and Queen Impostor has complicated visual assignment in a few cases. While it has been shown that visual sourcing can be fairly accurate, considerations of geographic location and source proximity must be accounted for in order to predict where and what kinds of errors may arise in source assignment.

METHODS AND ANALYTICAL CONDITIONS FOR XRF ANALYSIS

A combination of several procedures was used to conduct trace-element analysis of obsidian artifacts, including the manufacturing of crushed powder pellets, XRF examination, and statistical analysis. Current methods generally follow Bouey (1991), Davis et al. (1998), and Hughes (1986a); where analytical conditions used in the present study depart from those of other research, these differences relate to the mechanical specifications of available equipment and to the practical requirements of analyzing a large artifact sample.

Internal Standards

Prior to implementing XRF analysis, a collection of obsidian standards was compiled to serve as a reference set in generating source assignments. In order to eliminate variations introduced by artifact size, thickness, and surface texture, a group of pressed powder pellets was prepared for use as a control sample. Obsidians from eleven different source locations were obtained for this research,

acquired in either raw cobble or powder pellet form by various means; obsidian cobbles were obtained from nine of the eleven source locations (Table 4.3). In trying to account for at least some chemical variability at these sources, cobbles recovered by the author were acquired from disparate locations at each source; in the case of Bodie Hills, for example, three separate outcrops were sampled (Bodie Hills I, II, and III). When possible in other instances, cobbles were paired with existing pellets or at least two visually divergent cobbles of a particular obsidian were manufactured into pellets. In the end, only four sources were represented by single standards: Coso, Mount Hicks, Queen Impostor and Saline Valley. Of these, only Mount Hicks was expected to occur in ample quantities on the Volcanic Tableland, being fairly proximal relative to the other sources. Both Queen Impostor and Saline Valley sources were known to be geographically localized (L. Johnson, personal communication 1999), and Coso, if at all present, was predicted to occur only in trace amounts. Thus, the need for better control of intrasource variability for these sources was deemed of little significance, and no further efforts were made to bolster pellet samples of obsidians from these locations.

In preparing raw obsidians for powder manufacture, cobbles were first trimmed of all cortex by free-hand percussion using a simple granitic hammerstone. Decorticated interior masses were rinsed in distilled water, and then placed into several nested 4-mil plastic bags. An ordinary metal claw-hammer was used to crush bagged samples into small chunks about 2-3 cm in diameter. Resulting debris was then placed through a 3-mm sieve to remove all tiny glass shards and fragments of plastic bag. Chunks of obsidian were then sectioned with a manual rock-splitter (hand-crank type), enough to generate roughly about 100 grams of obsidian in pieces about 1 cm in size. This material was again rinsed in distilled water and allowed to air dry. Obsidian powders were then manufactured using a tungsten carbide shatterbox. The shatterbox was prepared for use by first crushing 30.0 g of quartz silica in it for ten minutes. This waste was then removed, the unit cleaned with distilled water and methanol, and then 25.0 g of subject obsidian was placed in and agitated for five minutes. Once

TABLE 4.3. Provenience of obsidians used in trace element (XRF) analysis.

Source	Location	Form and Means of Acquisition
Bodie Hills I	Central outcrop	Raw cobbles/collected by author
Bodie Hills II	Northern outcrop	Raw cobbles/collected by author
Bodie Hills III	Southern outcrop	Raw cobbles/collected by author
Casa Diablo I	Lookout Mountain	Raw cobbles/collected by author
Casa Diablo II	Dry Creek (Lookout Mountain)	Raw cobbles/donated by T. Carpenter
Coso		Existing pellet/donated by P. Bouey
Fish Springs I		Raw cobbles/donated by M. Delacorte
Fish Springs II		Raw cobbles/donated by UCD museum
Mono Craters I	Panum Crater (interior dome)	Raw cobbles/collected by author
Mono Craters II	Panum Crater (exterior slope)	Raw cobbles/collected by author
Mono Glass Mountain I		Raw cobbles/donated by UCD museum
Mono Glass Mountain II		Raw cobbles/donated by UCD museum
Mount Hicks		Existing pellet/donated by P. Bouey
Pine Grove Hills I		Raw cobbles/donated by UCD museum
Pine Grove Hills II		Raw cobbles/donated by UCD museum
Queen Impostor		Raw cobbles/donated by L. Johnson
Saline Valley		Raw cobbles/donated by L. Johnson
Truman-Queen I		Existing pellet/donated by P. Bouey
Truman-Queen II		Raw cobbles/collected by author

completed, the unit was cleaned again and the final sample obsidian (30.0 g) was crushed for ten minutes. Resulting powder was removed to a sterile container for storage. Next, pellets were prepared using 2.0 g of obsidian powder mixed with two to three drops of water and backed by 4.0-5.0 g of boric acid. Each pellet was completed by placing it in a hydraulic press at 20,000 kg for two minutes.

Trace element analyses for this research were completed at the Department of Geology, University of California, Davis, with the assistance of Drs. Peter Schiffman, Sarah Roeske, and Paul

Bouey. To examine each artifact, a Kevex 0700 X-ray fluorescence unit was used in conjunction with a Kevex 8000 energy-dispersive analytical spectrometer. The software program IXRF Version 4.11G was linked to the spectrometer and was used to perform all quantitative functions. Like most XRF machines, the sample chamber of the Kevex 0700 unit is equipped with a rotating tray that accommodates up to 16 specimens. Plastic sample holders in the tray are designed to house powder pellets, which fit snugly into position above the X-ray tube and filter bar. Obsidian artifacts were placed atop each sample holder in one of two ways. Smaller items were affixed with clear Scotch tape within plastic rings that have the same diameter as pellets. Larger pieces were placed atop sample holders and affixed with tape, their flattest and smoothest surfaces aligned directly over the x-ray tube. According to Bouey (1991), Hughes (1986a), and Davis et al. (1998), variations in artifact size, shape, texture, and thickness may all reduce the precision of concentration estimates in XRF analysis to some degree. While these factors might not have compromised source determinations (Bouey 1991), attempts were made to orient artifacts so that X-ray loss would be minimized. Each artifact was analyzed once, barring occasions when items accidentally shifted position during tray rotation.

Spectra for Rb, Sr, Zr, Fe (Fe_2O_3), and Mn were acquired for 200 seconds live-time in an air path using a Rh X-ray tube at 27.0 keV and 0.05 mA passed through a 0.05 mm Rh filter. Following removal of background and overlapping spectra peaks, intensities were acquired for analyte peaks. These values were next divided by the Compton peak integral, producing a ratio that represents the concentration of each subject element in the subject specimen. Linear regressions derived from analyte/Compton net peak ratios and concentrations for international rock standards (Govindaraju 1994) were used to transform current ratios into absolute quantities (ppm) for Rb, Sr, Zr, and Mn, and into weight percent for Fe_2O_3. Once all artifacts had been analyzed, concentration data were entered into a Microsoft Access 97 database program and transferred to Dbase IV for use in the SPSS 6.1 for Windows statistical analysis program. This process has been described in detail by Bouey (1986),

Hughes (1986a), and Davis et al. (1998) and the reader is referred to these studies for further explanation of data reduction procedures.

Discriminant Analysis and Source Assignment

Prior to generating source classifications for artifacts, all standards pellets were first subjected to discriminant function analysis to produce a source control sample. Following Bouey (1991), each standards pellet was subjected to XRF examination twelve different times in an attempt to account for variability in pellet surface consistency. Pellets were marked in four opposite locations and rotated so that each position was examined three times. The resulting group of 240 concentration sets was used to represent the eleven distinct obsidians present in the standards sample. As shown in Table 4.4, the discriminant analysis performed adequately enough to sort out almost all of the standards pellets into their actual groups, success rates for the eleven obsidian sources reaching 100.0% in most cases. Errors occurred among only two pairs of sources, Bodie Hills/Pine Grove Hills and Mono Craters/Mono Glass Mountain. There is much precedence in obsidian sourcing research for problems with these source pairs. Using his rapid-scan technique, Jack (1976:191) was unable to distinguish between artifacts of Bodie Hills and Pine Grove Hills or between items of Mono Craters and Mono Glass Mountain, though he insisted that the latter two could be separated using prepared geologic samples (powders). Hughes (1985) later resolved problems in sorting Bodie Hills from Pine Grove Hills; following many sourcing efforts which failed to segregate Mono Craters from Mono Glass Mountain obsidian (e.g., Bouey 1984, 1988; Hughes 1981), Hughes (1989b) was able to solve this dilemma by comparing quantitative values for Fe and Mn rather than Fe/Mn ratios. While the present XRF scheme is generally successful in isolating Bodie Hills from Pine Grove Hills, it was not designed to differentiate between Mono Craters and Mono Glass Mountain. In many cases the analysis did successfully distinguish between the two obsidians, but to correct this problem fully

TABLE 4.4. Discriminant function assignments for standards pellets.

	n	% Correct	BH	CD	CO	FS	MC	MG	MH	PG	QI	SV	TQ
BH	36	91.7	33	-	-	-	-	-	-	3	-	-	-
CD	24	100.0	-	24	-	-	-	-	-	-	-	-	-
CO	24	100.0	-	-	24	-	-	-	-	-	-	-	-
FS	24	100.0	-	-	-	24	-	-	-	-	-	-	-
MC	24	87.5	-	-	-	-	21	3	-	-	-	-	-
MG	24	83.3	-	-	-	-	3	20	1	-	-	-	-
MH	12	100.0	-	-	-	-	-	-	12	-	-	-	-
PG	24	95.8	1	-	-	-	-	-	-	23	-	-	-
QI	12	100.0	-	-	-	-	-	-	-	-	12	-	-
SV	12	100.0	-	-	-	-	-	-	-	-	-	12	-
TQ	24	100.0	-	-	-	-	-	-	-	-	-	-	24
Total	240		34	24	24	24	24	23	13	26	12	12	24

Note: BH, Bodie Hills; CD, Casa Diablo; CO, Coso; FS, Fish Springs; MC, Mono Craters; MG, Mono Glass Mountain; MH, Mount Hicks; PG, Pine Grove Hills; QI, Queen Impostor; SV, Saline Valley; TQ, Truman-Queen. Erroneous classifications restricted to BH/PG samples (n=4) and MC/MGM samples (n=7); all others correct.

would have required a separate run of all possible Mono Craters or Mono Glass Mountain artifacts under a separate set of XRF conditions (see below), a task which was not possible due to fiscal and time constraints on the project. Instead, based on previous evidence (Basgall and Giambastiani 1995) it was decided that Mono Craters obsidian would probably be quite scarce in Tableland assemblages and that the gains from its identification would not outweigh the costs. Statistical analyses imply that most of the indeterminate Mono Craters/Mono Glass Mountain glass is probably Mono Glass

Mountain anyway, but for this study all Mono Craters, Mono Glass Mountain, and indeterminate Mono Craters/Glass Mountain artifacts are combined into an inclusive "Mono" obsidian category.

It is encouraging that discriminant errors among pellet samples are few and are restricted to these two pairs of sources. Admittedly, however, the XRF procedure used in this study yields somewhat less precise concentration values than are normally attained by XRF professionals. Element values in Table 4.5 differ slightly from those in published archaeometry literature (cf. Hughes 1988, 1994; Johnson et al. 1999b), and their calculation is subject to the types of errors usually associated with XRF analysis of artifacts (cf. Bouey 1991; Davis et al. 1998). Standard deviations are sizeable in some cases, particularly for larger Fe and Mn ppm values. In large part, the lowered precision is related to the fact that samples were not run under separate analytical conditions for Fe and Mn, an often standard practice in specialized XRF inquiry which yields higher ppm counts for these elements. Despite the fact that this procedure was not part of the current scheme, a test of present methods against an arguably more precise method shows little difference in the overall classificatory results (see below). Undoubtedly there is greater room for error in source assignment using current methods, but the approach is justified given its obvious success.

Hughes (1986a) has already gone to considerable lengths to identify the drawbacks of discriminant analysis using the SPSS program. He indicates that misclassifications can occur in a variety of ways, particularly when low probability scores for group inclusion are accepted as valid classifications or when high probability scores are accepted blindly. Unfortunately, it is beyond the scope of the present work to recount all of the potential sources of error in discriminant analysis; the reader is referred to Hughes (1986a) and Klecka (1975, 1980) for additional information regarding methods of error detection and the SPSS program itself. It is recognized, particularly with XRF samples of the magnitude used herein, that there are bound to be some misclassifications which result from statistical error. However, given that the accuracy level of present methods appears comparable

TABLE 4.5. Trace element concentration values for obsidian source groups.

	Obsidian Source Group (pellet runs)										
	BH (n=36)	CD (n=24)	CO (n=24)	FS (n=24)	MC (n=24)	MG (n=24)	MH (n=12)	PG (n=24)	QI (n=12)	SV (n=12)	TQ (n=24)
Element											
Rb	183.0 ±14.8	157.1 ±9.8	288.6 ±11.9	224.1 ±11.2	204.6 ±9.5	194.7 ±11.9	171.4 ±9.8	159.1 ±12.3	180.6 ±10.1	145.0 ±12.7	163.0 ±18.4
Sr	82.6 ±11.5	95.0 ±16.7	1.6 ±0.8	1.7 ±0.7	1.5 ±0.6	0.6 ±0.3	12.6 ±4.0	86.1 ±9.9	6.0 ±1.7	73.3 ±8.4	15.6 ±10.2
Zr	95.4 ±7.6	208.7 ±25.0	121.3 ±14.6	76.2 ±8.3	102.9 ±11.7	74.1 ±11.6	60.9 ±8.8	71.6 ±7.9	126.0 ±13.8	143.5 ±6.9	114.1 ±9.6
Fe_2O_3	3336 ±123	8253 ±1542	5812 ±104	3279 ±60	5608 ±261	3643 ±92	3003 ±42	3106 ±73	4651 ±106	4936 ±88	3970 ±185
Mn	228.5 ±21.8	160.8 ±23.4	116.7 ±20.0	495.5 ±28.3	203.9 ±27.3	142.2 ±28.1	217.1 ±20.0	250.8 ±25.2	320.9 ±18.6	258.1 ±23.3	375.2 ±54.6
Fe/Mn Ratio	14.6	51.3	49.8	6.6	27.5	25.6	13.8	12.4	14.5	19.1	10.6

Note: BH, Bodie Hills; CD, Casa Diablo; CO, Coso; FS, Fish Springs; MC, Mono Craters; MG, Mono Glass Mountain; MH, Mount Hicks; PG, Pine Grove Hills; QI, Queen Impostor; SV, Saline Valley; TQ, Truman-Queen. All values are means in parts per million (ppm) except for Fe/Mn ratio. ± represents sample standard deviation (one sigma).

to more rigorous analytical schemes (see below), any classificatory errors are probably restricted in number and limited to a few specific obsidians.

Test of XRF Methods

As compared to the techniques employed by contemporary XRF specialists (Davis et al. 1998; Hughes 1994; Skinner 2000), the XRF analysis methods used in the present research are a bit less sophisticated. Limitations of available XRF machinery, along with severe fiscal and time restrictions,

necessitated the use of analytical conditions that are less stringent and yielded results that are less precise than those demanded by contemporary archaeometrists. Potential sources of error in the current XRF scheme have already been discussed; what remains is to test the methods used against those of professional analysts to see how they match up in terms of accuracy in source assignment.

A simple test of current XRF methods was devised using materials previously sourced via XRF by Dr. Richard Hughes (in Richman and Basgall 1998). A collection of 135 artifacts recovered during the Transportation Enhancement Activities survey, conducted by the Archaeological Research Center in Mono and Inyo counties, were subjected to XRF analysis using current techniques. Items from this group of materials were selected for two main reasons: 1) they derive from locations all across the Inyo-Mono region and were thus likely to include all of the major sources dealt with in this research; 2) they include a variety of both tools and debitage. As done for the test of visual sourcing, artifacts were selected to represent the major obsidian sources measured in this study: Bodie Hills, Casa Diablo, Coso, Fish Springs, Mono Craters, Mono Glass Mountain, Mount Hicks, Queen Impostor, Saline Valley, Truman-Queen. An attempt was made to choose 15 specimens for each obsidian; this was accomplished for all glasses except Queen Impostor and Saline Valley, the former which was only represented by 14 items and the latter accounted for by just one piece. Unfortunately, sourced archaeological samples of Saline Valley obsidian are difficult to find at present, as this source has only recently been identified and studied by XRF analysis (Johnson et al. 1999a). Where possible, artifact samples included tools and debitage, all items selected in accordance with size parameters necessary for XRF source assignment.

Tables 4.6 and 4.7 present results of the XRF tests. Raw data in the first table show that current methods produced 115 of 135 source assignments, or 85.2%, which correctly match Hughes' classifications. However, the present XRF scheme failed to classify 12 specimens within the accepted probability range (>90%); excluding these, some 93.5% of Hughes' characterizations were correctly

TABLE 4.6. Source assignments by current methods and by R. Hughes.

		Giambastiani XRF Assignments										
		BH	CD	CO	FS	MC	MH	MG	QI	SV	TQ	IND
Hughes XRF												
BH	(15)	15	-	-	-	-	-	-	-	-	-	-
CD	(15)	-	14	-	-	-	-	-	-	-	-	1
CO	(15)	-	-	15	-	-	-	-	-	-	-	-
FS	(15)	-	-	-	15	-	-	-	-	-	-	-
MC	(15)	-	-	-	-	3	-	5	-	-	-	*7
MH	(15)	1	-	-	-	-	14	-	-	-	-	-
MG	(15)	-	-	-	-	-	-	13	-	-	-	*2
QI	(14)	-	-	-	-	1	-	-	11	-	-	2
SV	(1)	-	-	-	-	-	-	-	-	1	-	-
TQ	(15)	-	-	-	-	-	-	-	1	-	14	-

Note: BH, Bodie Hills; CD, Casa Diablo; CO, Coso; FS, Fish Springs; MC, Mono Craters; MH, Mount Hicks; MG, Mono Glass Mountain; QI, Queen Impostor; SV, Saline Valley; TQ, Truman-Queen. *All sourced as either MC/MGM or MGM/MC and were eventually consolidated into a single "Mono" category.

matched. Though problems in source assignment were relatively rare, difficulty was encountered in classifying artifacts of Mono Craters obsidian (a success rate of only 20.0%). Five specimens of Mono Craters glass were instead attributed to Mono Glass Mountain, and seven were indeterminately sourced, the latter identified by statistical analyses as either Mono Craters/Mono Glass Mountain (first /second group probability) or Mono Glass Mountain/Mono Craters. This problem did not emerge for pieces of Mono Glass Mountain obsidian (86.7% success), though two indeterminates were classified the same as were indeterminate items of Mono Craters glass. As discussed earlier, current analytical procedures were not designed to distinguish Mono Craters from Mono Glass Mountain, and it was anticipated that statistical routines would fail to reliably differentiate between them. The fact that Mono Craters was problematic but Mono Glass Mountain was not is unexpected, however, and in this case at least may relate partly to the relatively small size of Mono Craters artifacts. This is pronounced

TABLE 4.7. Source assignments for tools and debitage by current methods and by R. Hughes.

		Giambastiani XRF Assignments										
		BH	CD	CO	FS	MC	MH	MG	QI	SV	TQ	IND
Hughes XRF												
Tools												
BH	(6)	6	-	-	-	-	-	-	-	-	-	-
CD	(8)	-	7	-	-	-	-	-	-	-	-	1
CO	(8)	-	-	8	-	-	-	-	-	-	-	-
FS	(7)	-	-	-	7	-	-	-	-	-	-	-
MC	(4)	-	-	-	-	2	-	1	-	-	-	1
MH	(5)	-	-	-	-	-	5	-	-	-	-	-
MG	(4)	-	-	-	-	-	-	3	-	-	-	1
QI	(8)	-	-	-	-	-	-	-	7	-	-	1
SV	(1)	-	-	-	-	-	-	-	-	1	-	-
TQ	(7)	-	-	-	-	-	-	-	-	-	7	-
Debitage												
BH	(9)	9	-	-	-	-	-	-	-	-	-	-
CD	(7)	-	7	-	-	-	-	-	-	-	-	-
CO	(7)	-	-	7	-	-	-	-	-	-	-	-
FS	(8)	-	-	-	8	-	-	-	-	-	-	-
MC	(11)	-	-	-	-	1	-	4	-	-	-	6
MH	(10)	1	-	-	-	-	9	-	-	-	-	-
MG	(11)	-	-	-	-	-	-	10	-	-	-	1
QI	(6)	-	-	-	-	1	-	-	5	-	-	-
TQ	(8)	-	-	-	-	-	-	-	-	-	8	-

Note: BH, Bodie Hills; CD, Casa Diablo; CO, Coso; FS, Fish Springs; MC, Mono Craters; MH, Mount Hicks; MG, Mono Glass Mountain; QI, Queen Impostor; SV, Saline Valley; TQ, Truman-Queen.

pronounced in the sample of Mono Craters debitage (Table 4.6), where 10 of 12 classificatory errors exist. Unbdoubtedly, other factors have strengthened this dichotomy but they are irrelevant to the current study which has generally treated Mono Craters and Mono Glass Mountain obsidian as a single, combined source category.

A few other minor errors deserve quick mention. In Table 4.7, one artifact attributed to Mt. Hicks by Hughes was classified in this analysis as Bodie Hills. This piece has a relatively high Sr

value (95.4 ppm) as compared to other Mt. Hicks items (see Appendix A) and may be rightly attributed to Bodie Hills. Another item supposedly of Queen Impostor obsidian was attributed to Mono Craters; this artifact has a high Fe/Mn ratio (29.2) which does make it more closely resemble the latter obsidian. Last, one piece of Truman-Queen was called out as Queen Impostor glass. Early XRF work with obsidians from INY-30 met with difficulty in differentiating between Truman-Queen and source "Unknown 1" (cf. Basgall and McGuire 1988; Basgall 1989), now identified as Queen Impostor. Bouey (1988) suggests that ppm values for Rb, Sr, and Zr in "Unknown 1" specimens are within ranges documented for Truman/Queen, hence the name Queen Impostor. This same phenomenon can be seen in ppm values for current standards pellets (Table 4.4) and appears to be the reason behind the failed Truman/Queen classification.

It is noteworthy that relatively few errors were committed in the analysis of larger tool forms as opposed to smaller pieces of debitage. Davis et al. (1998) provide evidence that artifact thickness and size have minimal limits beyond which XRF analysis may be adversely affected. Though flakes tend to be flatter in shape and often provide smoother surfaces for examination (cf. Bouey 1991), their small size appears to contribute a few additional errors while also adding to the number of items relegated to the "indeterminate"source category. Overall, however, errors in XRF source assignment occur in predictable fashion, involving obsidians which are difficult to separate without separate analytical runs or are exceedingly similar in trace element quantities. The above test confirms that the amount of precision sacrificed by current methods used is not great and is not highly significant to the outcome and use of XRF source data.

METHODS FOR OBSIDIAN HYDRATION ANALYSIS

Hydration analysis for this study was completed by analysts at three separate laboratories: Craig Skinner, Northwest Research Obsidian Studies Laboratory (NWR), Tom Origer, Anthropological Studies Center at Sonoma State University (T. Origer), and myself at California State University, Sacramento (CSUS) hydration facility. Samples of 125 specimens each were submitted to the other laboratories for analysis, while the remainder were examined by the author at CSUS. Methods employed at the CSUS hydration laboratory are presented below.

Slide Preparation

An obsidian artifact was first scrutinized to locate an appropriate location for thin section removal. Two parallel cuts were then made into the edge of the piece using a Beuhler ISOMET low-speed saw equipped with two 4-inch diameter, diamond impregnated .004-inch thick blades. The blades are separated with a thin plastic spacer; resulting wedges from artifacts are approximately 1 mm thick. One plane of the wedge was then ground on the tip of the forefinger in a figure-eight motion (to distribute pressure evenly) on a glass plate, within a slurry mixture of water and 600-size silicon carbide grit. Once its thickness has been decreased by about a third, the wedge is cleaned and its ground side mounted to a petrographic microscope slide using Lakeside brand thermoplastic cement. Four or five specimens were mounted in this fashion, all with the same orientation, and then the entire slide was ground in silicon slurry until all samples achieved a final thickness of about 30-50 microns. Thickness was determined by the "touch test" in which a finger is rubbed over a specimen to gauge its thickness relative to its condition prior to mounting, and by a "translucency test" in which a specimen is held up to bright light to determine the amount of light passing through it. More often than not the second factor is more important, as clearer obsidians can be thicker for analysis while

opaque obsidians must be thinner for ample light penetration. Specimens were topped with water (to improve refractive index) and temporarily capped with a glass slide cover for rim measurement.

Rim Measurement

Specimens on the prepared slide were measured using a Leitz Dialux Pol-D petrographic microscope fitted with a 360° rotating mechanical stage and a 10X filar screw micrometer. A Leitz Wetzlar 63X lens and a 1.25X eyepiece was used in conjunction with the micrometer; resulting magnification from all components of the microscope is approximately 800 times normal. For measurement, a Sanyo color video camera (model VCC-3912) with a Navitar 0.3 m lens was mounted atop the filar eyepiece, which transferred the microscope image to a 600 DPI computer screen where the measurement was taken. Hydration layers were first identified under polarized light with a Gypsum (first-order red) waveplate in place, producing a blue hue in hydrated zones and a pinkish color in unhydrated zones. Once a hydration layer was recognized it was scanned under normal light for suitable measurement locations, and rim measurements were taken from the computer image with the subject section in the center of the viewing area. Five rim measurements were taken on each artifact, both surfaces measured at least twice in order to verify comparability in rim thickness; where multiple bands were noted, each was measured five times. Hydration band thickness was calculated to the nearest 0.1 μm, measurements reported as mean values which represent all five readings. Due to normal limitations of the equipment, hydration readings have an error range of $\pm$ 0.2 microns.

Tests of Obsidian Hydration Methods

Recalling earlier cautions about errors in obsidian hydration rim measurement, a test was completed to determine if current methods produced rim readings which were comparable to those provided by other hydration laboratories. This was accomplished in two ways. First, a set of mounted

thin sections was borrowed from the University of California, Davis, which had been measured by R. Jackson in 1992 (Lithichron Obsidian Hydration). Obsidian specimens in this collection derive from sites MNO-458 and MNO-630 in Mono County. Ten slides were drawn at random from each site and read blindly without knowing the micron reading calculated by the previous analyst. Second, a set of ten artifacts examined by T. Origer (Sonoma State) and C. Skinner (Northwest Research) for the purposes of this study were re-cut in adjacent locations and measured by the author; again, the resulting slides were read without knowledge of the previous operator's measurements. Items that presented diffuse hydration or non-measurable bands were rejected. Results of the test are presented in Table 4.8, with source assignments provided where available. Clearly, measurements by current methods are in close agreement with those of other analysts. Differences range from 0.1-0.5 microns, with seven pairs varying by more than 0.2 microns. These results are comparable to those obtained from inter-laboratory tests by R. Jackson (1984a) and Stevenson et al. (1989). Moreover, there seems to be no pattern to the directionality of error differences; the same number of new readings is either smaller or larger than previous measurements (eight each), with the average differences being 0.28 for larger readings and 0.24 for smaller ones.

Another way to evaluate the accuracy and consistency of current methods is to compare sets of measurements on diagnostic projectile points between laboratories. In Table 4.9, hydration rim readings for select projectile point classes are presented by obsidian source and by hydration facility. Casa Diablo and Mt. Hicks obsidians were chosen because they are the only obsidians examined by all three laboratories in any quantity; all Truman-Queen specimens were analyzed at CSUS. Despite small samples in a few cases, overall means for Desert Series, Rosegate, and Elko points are not all that different between laboratories. Calculations of standard deviation and coefficient of variance are also quite comparable, indicating a high degree of consistency in rim measurements. The only notable variation occurs in the sample of Pinto points, a difference of 2.2 microns between CSUS and ASC

TABLE 4.8. Results of hydration test by sample type, source, and operator.

	Initial Operator	Item	Source	Initial Reading	Re-cut
1.	R. Jackson	Flake (4902-B16A)	Casa Diablo	3.8	3.5
2.	R. Jackson	Flake (4903-B16B)	Casa Diablo	5.5	5.2
3.	R. Jackson	Flake (4910-B26B)	Casa Diablo	5.7	6.0
4.	R. Jackson	Biface (4925-S47)	Casa Diablo	2.4	2.3
5.	R. Jackson	Biface (4929-S53)	Truman-Queen	1.8	1.5
6.	R. Jackson	Flake (4932-T112A)	Casa Diablo	2.6	2.6
7.	R. Jackson	Flake (4939-A320)	Casa Diablo	4.4	4.9
8.	R. Jackson	Flake (4941-A364)	Casa Diablo	1.5	1.7
9.	R. Jackson	Flake (4953-S62B)	Casa Diablo	3.9	4.1
10.	R. Jackson	Flake (4958-S62C)	Casa Diablo	10.9	10.4
11.	T. Origer	Point (ENF-5W8-1)	Casa Diablo	4.4	4.4
12.	T. Origer	Point (ENF-5U8A-1)	Mono Glass Mountain	8.8	9.0
13.	T. Origer	Point (474-16)	Casa Diablo	7.9	8.0
14.	T. Origer	Point (474-23)	Casa Diablo	6.6	6.9
15.	C. Skinner	Point (455-335)	Mono Glass Mountain	4.5	4.4
16.	C. Skinner	Point (ENF-5S6-3)	Saline Valley	3.6	3.6
17.	C. Skinner	Point (467-2502)	Saline Valley	7.6	8.0
18.	C. Skinner	Point (ENF-5S9-2)	Casa Diablo	1.0	1.0
19.	C. Skinner	Point (392-2915)	Bodie Hills	2.2	2.1
20.	C. Skinner	Point (392-8091)	Mono*	3.4	3.2

means. Limited samples are at least partly to blame for this discrepancy, though large micron ranges and standard deviations are expected in samples of Pinto points given the broad time span they represent (Basgall and Hall 2000). It is interesting, though, that standard deviations are near-equal in both samples, reflecting consistency in rim measurement at each laboratory.

In any hydration program it is necessary to run checks on measurement accuracy in order to demonstrate comparability in methodology and expose any unanticipated degree of error. Studies that rely on obsidian hydration to develop chronological sequences are even more obligated to perform self-tests, as serious discrepancies in rim measurement (on the order of one micron or more) can translate into errors in age estimation of several hundred years (cf. R. Jackson 1984a). For instance,

TABLE 4.9. Hydration statistics for Desert Series and Elko Eared projectile points.

		n =	Mean	Std	CV
DESERT SERIES					
Casa Diablo	CSUS	7	1.9	0.36	.189
	NWR	5	2.2	0.88	.400
Mt. Hicks	CSUS	7	1.9	0.51	.268
	NWR	5	2.2	0.60	.272
ROSEGATE					
Casa Diablo	CSUS	13	3.6	0.74	.205
	NWR	4	3.5	0.39	.111
ELKO EARED					
Casa Diablo	CSUS	9 [b]	5.5	0.79	.143
	ASC	3 [a]	5.0	0.60	.120
PINTO					
Casa Diablo	CSUS	4	10.4	1.70	.006
	ASC	3	8.2	1.65	.201

Note: Std, standard deviation (one sigma); CV, coefficient of variation; CSUS, California State University, Sacramento; NWR, Northwest Research; ASC, Anthropological Studies Center. [a] excludes one statistical outlier, [b] excludes two outliers.

this would not be an acceptable error range when attempting to resolve specific chrono-stratigraphic problems at one or a group of sites, or in trying to segregate diagnostic artifact types into discrete temporal periods. For purposes of the present research, it is important to note that hydration data are being used primarily to determine broad time frames in which different obsidians were brought onto the Tableland and during which significant technological changes occurred. It is also the case that many hydrated specimens are of obsidians for which we currently do not have working rate formulae (e.g., Mono Craters, Mono Glass Mountain, Mt. Hicks). This is not to say that error ranges in the current study are any more drastic than other programs, but only that the requirements on resolution in hydration measurement are not as stringent given the goals of this analysis. It is simply the case

that, were there any exceptional error ranges pertaining to current methods, the design of this program would tolerate such variation better than others.

SAMPLING STRATEGIES FOR OBSIDIAN STUDIES

Given the many different artifact collections used in this research and the massive size of the combined project assemblage, a variety of sampling regimes was employed to choose artifacts for obsidian sourcing and hydration programs. The goals of these studies were often divergent as well, demanding separate types of data and increasing the need for separate processes of artifact selection. As a result, sampling strategies are fairly complicated and require explanation so that the ways in which research aims are met with obsidian data can be made clear.

Visual Source Sampling

With some 4057 obsidian tools and 120,863 obsidian flakes to choose from in the full project collection (see Chapter Seven), initial attempts at sourcing obviously required some type of sampling strategy. By the time this project was undertaken, a sample of 8194 artifacts (plus another 11 added later) had already been subjected to megascopic examination (Basgall and Giambastiani 1995:40-41). The sum includes 1451 tools (258 projectile points, 509 bifaces, 30 point blanks, 25 drills, 518 simple and 76 formed flake tools, 35 cores) and 6754 unmodified flakes. These items were taken from six different sites (MNO-1992, MNO-2189, MNO-2190, MNO-2464, MNO-2465, and INY-399), selected mainly from well-substantiated component areas with reasonable temporal indices.

Except for items found in ambiguous temporal contexts during the 1987-89 project, all of the remaining tools were visually sourced during the course of the present study, bringing the full sum of tools so examined to 3631. Of the huge quantity of debitage still to deal with (114,109), some 43,597

pieces derived from either mixed or temporally unattributed contexts at the six sites excavated in 1987-89. These were formally excluded from further consideration, leaving 70,512 with which to contend. The vast majority of this collection, some 63,824 pieces (91%), was recovered during the 1993-1996 excavation program at Fish Slough. However, more than 80% of this sample derives from only three locations, MNO-1992 (which had been previously excavated and sampled for debitage sourcing), site FS10B-2, a multi-locus complex at the northwest spring head, and FS14D-1, a multi-component deposit on the east side of the slough. Each of these sites was complicated in its own right and would require substantial analytical time just to develop accurate site-specific technological flake profiles. Also, because so little debitage was recovered from the other 14 locations, it was obvious that any overarching sampling strategy requiring large totals would be restricted to the three main contributors. This was added to the fact that much of the debitage from the 14 other slough sites and the 1997 survey sites came from the surface contexts (a recovery situation which tends to bias flake types to larger, more complete specimens) and that excavated debitage samples from the 1997 sites were too small to be representative of even the grossest source and technological patterns.

Taking all this together, it was decided that a thorough visual source examination of obsidian debitage would have to wait. Instead, debitage samples were selected in anticipation of an hydration analysis which would investigate the relative antiquity of reduction stages. Beginning with each Enfield site collection, technologically diagnostic percussion flakes were sorted into reduction groups (decortication, interior, biface thinning) and a maximum of 12 pieces was removed at random, four from each group. Flakes were retained if they met size and condition criteria (greater than 1.0 cm diameter, essentially whole), with no favoritism paid to one type of obsidian. Each of these flakes was visually scrutinized and the indeterminates set aside for XRF scans. The same procedure was carried out with all of the 1993-1996 and 1997 sites, with two exceptions. Excavated debitage lots were used where possible, but in most cases selection was restricted to surface materials due to the limited size

and number of flakes in excavated samples. Sites that had multiple loci which were investigated during surface collection/excavation programs contributed a sample of debitage each. In a few cases, sites along Fish Slough ended up having slightly more visually sourced samples because additional pieces had been sourced during previous studies of obsidian hydration (Giambastiani 1995, 1996). Ultimately, a total of 1300 flakes was examined by visual sourcing in addition to the 6754 items sourced previously, for a grand total of 8054 visual attempts on unmodified flakes. In all, some 11685 artifacts were visually inspected to determine obsidian source origin (Table 4.10).

XRF Sampling

As mentioned earlier, XRF examinations focused primarily on pieces that could not be sourced by visual means. Following megascopic assessments a total of 2198 pieces was submitted to chemical analysis, some 2112 items (1366 tools and 746 flakes) having been visually indeterminate. Beyond the indeterminates, another 86 artifacts were added to the XRF list, items visually classified as Truman-Queen (54), Casa Diablo (16), and Fish Springs (16). Fully 69 of these pieces are tools, some 29 projectile points, 36 bifaces, three formed flake tools, and a single core, and all others are unmodified flakes. Most of the extra projectile points were included to bolster hydration samples, though a few along with the remaining tools were examined by XRF to test the accuracy of the visual sourcing program. As for the 17 flakes, 15 sourced as Truman-Queen had been used to test visual accuracy during the 1987-89 program, while the other two identified as Fish Springs were employed to do the same in the current endeavor. In all, the XRF program examined 18% of all items subjected to visual sourcing and took more than two years to finish.

Table 4.10. Artifacts subjected to visual and XRF sourcing programs by artifact class.

	PRJ	BIF	PTB	FLK	FRM	DRL	COR	DEB	Total
Visual Attempts	640	1129	71	1534	173	42	42	8054	11685
Indeterminates	256	411	36	663	61	19	16	3825	5287
XRF Attempts	244	436	36	633	64	5	17	763	2198
Indeterminates	16	48	3	61	9	-	2	42	181
Source Attempts	884	1565	107	2167	237	47	59	8817	13883
Artifacts Attempted	640	1137	71	1534	173	42	42	8239	11876
Assigned Sources	583	1084	68	1443	164	28	40	4933	8343

Note: PRJ, projectile point; BIF, biface; PTB, point blank; FLK, simple flake tool; FRM, formed flake tool; DRL, drill; COR, core; DEB, debitage.

Obsidian Hydration Sampling

Artifacts were selected for obsidian hydration to track changes in obsidian source use through time and to investigate long-term changes in flaked stone technology. In order to meet these goals, different sampling methods had to be used for each artifact class. At the outset it was hoped that all tools and a large quantity of debitage would be cut, an ideal total reaching somewhere around 5000 artifacts. Delays in obtaining the necessary hydration equipment, setting up the laboratory, learning the process of hydration analysis and becoming proficient, made it obvious that desired sample totals could not be achieved. In the end, it was decided that two artifact classes would yield relatively little information, simple flake tools and drills. Assuming that blanks for most simple flake tools would have been culled from on-site debitage, they would probably track waste flakes by source and time. Drills were excluded because there were so few available (only 42 obsidian) and there was no reason to think they would have any discrete temporal affinity. In retrospect, it would have been nice to cut

a sample of simple flake tools if only to compare these with bifaces in pinpointing the timing of and effects from the introduction of the bow-and-arrow.

A collection of 73 projectile points and 136 flakes had been cut during the 1987-89 excavations on the Tableland (Basgall and Giambastiani 1995:43). All of these were taken from good temporal components in order to develop site chronologies, but some good diagnostic points from mixed or temporally unattributed contexts remained uncut. In deciding which points to examine, I assembled the 640 projectile points from all project collections and sorted them into stylistic groups. As it turned out, over half (57%) represented Elko and more recent variants, though a good portion was untypable (22%) or temporally undiagnostic (Table 4.11). Because evaluating the Truman-Queen hydration rate for the Tableland required larger samples of pre-Elko points, I first chose all of the uncut Leaf-shaped, Little Lake, Fish Slough Side-notched, Pinto, Great Basin Stemmed, and Great Basin Concave-Base points of certain type. Not all of the remaining items could be analyzed, so I next assembled samples of about 50 points of the Elko series and between 20-30 points from the Cottonwood, Desert Side-notched, Rose Spring, Eastgate, and Humboldt series. Of these, 87 specimens were sent off to professional laboratories for examination, 40 to Northwest Research (Craig Skinner) and 37 to Sonoma State (Tom Origer), and I analyzed the rest. Ultimately some 382 projectile points were subjected to hydration analysis, with measurable rims obtained on 361 artifacts (Table 4.11).

Bifaces were sampled in an entirely different manner. The main purpose of measuring hydration on bifaces was to detect temporal differences in biface reduction stages. Given indications that Newberry-age occupations involved substantial biface manufacturing, while earlier and later habitations did not, it was assumed that there might be temporal variation in early-, middle-, and late-stage forms. Long-term changes in source use might also be reflected in hydration profiles of bifaces and other tools. Given a total of 1319 obsidian specimens to choose from, biface selection was only

TABLE 4.11. Projectile points for obsidian hydration by typological class.

	Total Obsidian	Total Examined	Total with Rims
Cottonwood	37	32	32
Desert Side-notched	15	32	31
Rose Spring	79	50	49
Eastgate	22	20	18
Elko Corner-notched	41	30	23
Elko Eared	98	71	66
Elko Contracting Stem	15	13	13
Elko Side-notched	3	2	2
Elko Series	28	6	6
Humboldt Basal-notched	28	17	17
Humboldt Concave-Base	3	-	-
Large Side-notched	2	2	2
Leaf-shaped	6	5	5
Little Lake	14	13	11
Fish Slough Side-notched	41	37	35
Pinto	22	22	21
Great Basin Stemmed	14	11	11
Great Basin Concave-Base	3	3	3
Untypable Arrow	24	4	4
Untypable Dart	108	12	12
Untypable	10	-	-
Total	640	382	361

Note: Diagnostic point classes in bold.

a matter of how many in each reduction group were available; as it turned out, there were ample numbers in each, 251 early-stage (Stage 1-2), 401 middle-stage (Stage 3), and 499 late-stage (Stage 4-5) bifaces. Rather than examine the lot, however, I figured that about 75 pieces in each group would be enough to demonstrate temporal patterning. First, all potential bifaces were assembled and examined to see if they had adequate margins or other unweathered surfaces for examination. A surprising portion of early-stage forms was too badly damaged to provide surfaces that would reliably indicate their initial manufacture. Most middle- and late-stage forms were more or less intact. Lists

of items in good condition within each reduction group were printed out and specimens selected using a random numbers table. A total of 232 bifaces was examined, but only 70 early-stage, 77 middle-stage, and 75 late-stage forms ultimately provided rim measurements. As for other tools, all 173 formed flake tools, 77 obsidian point blanks, and 42 obsidian cores were also selected for hydration.

Finally, the hydration program also included a sample of 821 unmodified flakes. Added to the 136 items cut during the 1987-89 project, another 685 pieces were subsequently examined. Of these, 512 flakes constitute a sample of percussion debitage (cortical and biface thinning flakes) from Enfield, Slough, and Plateau survey sites that had been previously sourced. The remaining 173 were pressure flakes from excavated components at Fish Slough sites (n=88) and plateau sites (n=85). These flakes were too small for reliable sourcing, either visual or chemical, and were sent off to professional analysts for hydration only; items from Fish Slough went to Sonoma State, those from the plateau to Northwest Research. In all, the full obsidian hydration sample includes 1727 artifacts, of which 1658 provided measurable rims (Table 4.12). Two different hydration rims were evident on 75 specimens, twelve of these having diffuse, unreadable bands. It is notable that point blanks show by far the greatest share of double rims (27%); as discussed later in Chapter Seven, this indicates a high frequency of scavenging from older lithic deposits by arrow-point manufacturers.

METHODS FOR FLAKED STONE ANALYSIS

Building on an extensive history of archaeological research in the Sierra Nevada and Great Basin, the present artifact analysis program draws primarily from methods developed over the last 10-15 years in eastern California (Basgall and McGuire 1988; Basgall and Giambastiani 1995) and the southern high deserts (Basgall 1991, 1993; Basgall and Giambastiani 2000). These methods originate from a materialist perspective and are thus designed to reveal behaviors associated with artifact use

TABLE 4.12. Obsidian items for hydration by artifact class.

	All Obsidian	All Measurable	All Examined	All w/Rims	Double Rims
Projectile Point	640	429[a]	382	361	24
Point Blank	77	77	77	70	19
Biface	1319	1012	232	222	10
Formed Flake Tool	173	173	173	166	11
Core	42	42	42	40	2
Debitage	120999[b]	8343[c]	821	799	9
Total	122978	10076	1727	1658	75

Note: [a], includes good diagnostic items only; [b], does not include flake already hydrated during 1987-89 program; [c], total flakes available for hydration is estimated as those which had been successfully sourced.

through the examination of form and function. However, all classificatory terminology and procedures are intended to minimize functional implications prior to analysis so as to avoid bias in interpretations of use and discard behaviors. As demonstrated below, in some cases this is easier than others, a few terms having retaining functional associations for the sake of efficiency in description and analysis. To this effect, all materials were initially divided into four broad groupings: *Formed Artifacts* include all flaked and ground stone tools and other intentionally shaped artifacts of stone, bone, or other materials; *Debitage* includes all waste flaking from the production of flaked stone implements; *Ecofactual Remains* comprise vertebrate and invertebrate faunal detritus, seeds, nutshell fragments, and any wood or charcoal; and *Miscellaneous Stone* accounts for all other unmodified stone items that are presumed to have anthropogenic origin (e.g., ochre, pebble or cobble manuports). Formed artifacts were next divided into separate classes based on their method of production. *Flaked Stone* artifacts, those created by intentional chipping and reduction of stone masses, were classified based largely on their morphological attributes and were sorted into ten possible categories: *projectile points*, *point*

blanks, *bifaces*, *simple flake tools*, *formed flake tools*, *drills*, *cores*, *core tools*, *assayed nodules*, and *debitage*. All of these classes are represented in archaeological collections from the Volcanic Tableland but the vast majority of items fall into only a few of these categories. Similarly, *Ground Stone* artifacts, those produced by the grinding and/or battering of raw stone, were assigned to six possible categories: *millingstone*, *mortar*, *handstone*, *pestle*, *cobble tool*, and *miscellaneous ground stone*. A few other categories were also used to classify other utilitarian artifacts: stone items like discs, polished pebbles, abraders, or shaft straighteners were placed in a *modified stone* class; fragments of bone awls or flakers were put into a *modified bone* class; *pottery sherds* remained in their own grouping. Other non-utilitarian items placed into ornament classes (*beads* or *pendants*). To complement basic artifact descriptions, all stone items were assigned to standard material classes (obsidian, cryptocrystalline silicate [chert], basalt and vesicular basalt, quartz, quartzite, rhyolite, sandstone, and unclassified igneous), other artifacts given material types as necessary (e.g., limonite, glass). Formed artifacts of any kind were assigned a condition type (whole or near-complete, proximal, margin, distal, medial, or indeterminate end). Normally, all implements would receive standard measurements (maximum length, maximum width, maximum thickness, and weight), but given the present goals and the massive size of project collections, metric dimensions were recorded for only a few classes (projectile points, bifaces, and formed flake tools). All artifacts, along with unit/level-provenienced lots of debitage, bone, and shell, were weighed in grams.

Analytical procedures were also attenuated in keeping with research goals, and as a result each flaked stone artifact class received specific, limited attention while ground stone and other classes did not. In some cases, as with debitage, only samples of artifacts could receive analytical scrutiny given the huge volume of debris present in all collections. All flaked stone materials used in this study were classified following methods used to treat the 1987-89 Far Western collections (Basgall and Giambastiani 1995); still, it is useful to provide descriptions of each flaked stone class, with references

to specific attributes selected for analysis in this program. For descriptions of other, non-flaked stone artifact classes (e.g., ground stone, beads, sherds, abraders, etc.), the reader is referred to Basgall and Giambastiani (1995) or Giambastiani (1998b).

Projectile Points

Bifacially modified tools with diagnostic hafting elements like shoulders, shaped basal ends, notches, and tangs were classified as projectile points. Basic attributes were measured following Thomas (1981), enough to place points in accepted typological/chronological categories, but full metrical treatment was not given the goals of this study. Examinations did scrutinize points to find evidence of impact fracture, use-wear (including base/stem grinding), weathering, and rejuvenation.

Point Blanks

Small, flake-based artifacts which are basically triangular in outline, have steep edge chipping around much or all of their perimeters, demonstrate few or no flaking scars across the body, and/or manifest rudimentary notches or basal indentations were classified as point blanks. These pieces are assumed to represent preforms for projectile points that were discarded prior to pressure thinning and shaping. In general, point blanks have arrow-point dimensions (e.g., <30 mm in length and <4 mm in thickness) though some are a bit larger, evidently having been reworked from fragments of dart points or bifaces. Point blanks were not formally measured but were sorted into one of two relative size categories (dart-size or arrow-size) based on visual assessment of their overall length and width.

Bifaces

Artifacts classified as bifaces are bi-pointed, teardrop- or oval-shaped items which appear lenticular in cross-section due to the consecutive detachment of flakes from opposing surfaces along

two continuous lateral margins. In addition to weight, all bifaces were measured for length, width, and thickness; these attributes were essential to placing each item into a general size class based assumptions about the average dimensions of bifacial processing tools and projectile points (core/knife-size, dart-point size, or arrow-point size). Following Crabtree (1972), Collins (1975), Callahan (1979), and Muto (1971), each biface was assigned to one of five sequential reduction stages based on a combination of technological and morphological traits that included width/thickness ratio and number of arrises per centimeter, among others. *Stage 1* bifaces are thick in cross section, have a limited degree of planar symmetry, and manifest irregular, sinuous margins whose outer edges are shaped solely by percussion flaking; *Stage 2* bifaces are also strictly percussion-flaked, but have increased edge symmetry, straighter margins, and narrower cross-sections to indicate further shaping and thinning; *Stage 3* bifaces are well-thinned preforms with good planar symmetry, regular margins, and extensive percussion removals which generally extend across the mid-section of the artifact. Such artifacts are generally thicker than bifacial point preforms but may demonstrate some pressure flaking; *Stage 4* bifaces are well-shaped, thin preforms that are wholly or nearly symmetrical; straight margins and uniform cross-sections are developed through moderate to heavy amounts of invasive pressure flaking; and finally, *Stage 5* bifaces are refined, finished tool forms (frequently undiagnostic point fragments) that are extensively pressure flaked, with opposing surfaces showing total or near-complete coverage by closely spaced, parallel flake scars. Stage 1 and Stage 2 bifaces are considered to represent the earliest, post-raw blank phase of percussion biface reduction (Early Stage). Stage 3 bifaces (Middle Stage) represent fully shaped blanks in the process of final percussion thinning. Stage 4 and Stage 5 bifaces (Late Stage) are fully thinned preforms in the final phase of pressure completion. These stages comprise an overall reduction sequence for the manufacture of dart-size projectile points. However, it is also possible that early stage bifaces are cores for the production of small flakes or are roughed-out tools themselves. Middle stage and Late stage bifaces may also have been used as

processing implements. Stage classifications are intended only to identify the phase of reduction at which bifaces were discarded.

Simple Flake Tools

These are flake-based implements that display one or more modified edges which conform closely to the shape of original flake outlines, i.e., do not significantly alter the original outline. Thus, edge damage is generally limited and in some instances may be wholly circumstantial, restricted solely to use-wear. Simple flake tools are light-duty processing implements, flakes used as small cutting and scraping tools that were employed only briefly without intentional shaping. As data concerning edge characteristics were not relevant to the current study, items in this artifact class were examined only to determine the flake type they represent (see Debitage) in order to indicate of the kinds of flakes normally selected for use as expedient tools.

Formed Flake Tools

These are flakes with margins that have been intentionally shaped by intrusive percussion and/or pressure flake removal to produce continuous, uniform, and sturdy working edges. Used margins generally have fairly obtuse angles and are heavily modified. Substantial edge shaping and use distinguishes formed flake tools from simple flake tools. These distinctions are important, as the formality of a tool edge is taken to signify greater edge strength and durability but may also reflect a specialized function or greater curation. As with simple flake tools, flake type was documented for formed flake tools. In addition, each tool was also measured (length, width, thickness) and sorted by morphological category based on overall plan and cross-section shape. *Amorphous* tools remain more or less true to original flake outlines. *Domed* tools are circular in outline and steeply semi-circular in profile. *Endscrapers* bear an extensively modified, convex distal end and a narrower, unmodified

proximal end, resembling "classic" endscrapers in early Holocene contexts throughout the western Great Basin. *Spokeshaves* have one or more deep notches modified for use with little other perimeter shaping. *Keeled* tools are plano-convex in cross-section, with broad and rounded proximal ends and narrow, elongate blades having straight, parallel lateral edges. A pronounced shoulder on keeled tools separates base from blade, this presumably created by resharpening along the blade while the tool base remained in some type of haft. Keeled formed flake tools, though not yet recognized in regional archaeological literature, may be a fairly ancient tool form, having been identified with some frequency in association with Fish Slough Side-notched points at MNO-1992 (Basgall and Giambastiani 1995) and returning hydration readings that imply at least 7000 years antiquity at other locations (Giambastiani 1998b; Giambastiani et al. 2001).

Drills

Several artifacts were recognized as drills or perforators, both flakes and formally shaped items that have bit-like protrusions that show directed, repeated pressure removals or simply damage from use. Two subtypes were identified, *flake drills* fashioned from otherwise unmodified flakes and *bifacial drills* made from fragments of bifaces or projectile points. Bifacial drills were assigned to the reduction stage categories used for bifaces. Most of these are considered to have been used in light-duty drilling or puncturing involving softer materials (shell, hide, cane, or soft wood) and were probably not durable enough to have processed stronger materials like stone or hardwood.

Cores and Core Tools

A core was defined as any amorphous piece of stone shaped wholly by the removal of flakes large enough to have served as tools or as blanks for other tools (e.g., flake tools, drills, or small arrow-points). Artifacts in this class were also required to demonstrate two or more flake initiations

(not just removal scars) from the same platform margin. By estimates of original form, as made by noting the location and extent of natural cortex or original flake surfaces, and by considering the number and orientations of used platform margins present, each core was assigned to a general type category based on its overall reduction orientation. *Unidirectional* cores manifest one or more flaked platform margins, initiated and reduced in a single direction. *Bidirectional* cores have at least two separate platform margins reduced in two directions. *Multidirectional* cores have at least three separate platform margins reduced in three or more directions. *Bifacial* cores are similar in design to early stage bifaces but larger, having at least one margin that is flaked bifacially. *Bipolar* cores are generally small items showing evidence of reduction using an anvil. These cores may have one platform margin, the flaking of which drove other flakes from the anvil end of the core back along the same face opposite the intended direction. Alternatively, they may have two platform margins reduced in opposite directions on the same face.

Core tools differ from cores in that they demonstrate edge damage resulting from use as processing tools, in the form of end battering, edge flaking or chipping, or edge grinding. They are otherwise comparable in overall morphology to cores and were classified in the same way. No attempts were made to characterize use wear on these implements.

Debitage

Unmodified flakes and shatter produced by the manufacture, use, and rejuvenation of flaked stone tools were classified as debitage. Debitage was sorted by material type, counted, and weighed by its provenience within a recovery unit (surface collection grid/cell or excavation unit/level). Samples of obsidian debitage were drawn from various site collections for more specific kinds of analysis (see Chapter Seven). Selected flakes were sorted into five general size classes by maximum flake diameter: <1.0 cm, 1.0-2.0 cm, 2.0-3.0 cm, 3.0-5.0 cm, >5.0 cm. Size-sorted flakes were

weighed individually and categorized into 15 technological classes that represent a reduction trajectory from early percussion shaping to pressure finishing. *Primary decortication* flakes display more than 70% dorsal cortex, exclusive of the platform. *Secondary decortication* flakes have less than 70% dorsal cortex or only a cortical platform. *Cortical shatter* includes any angular or blocky fragment of debitage with cortex. *Simple interior percussion* refers to non-cortical (interior) flakes that are relatively straight in cross-section, generally with broad platforms and one principal dorsal arris. *Complex interior percussion* refers to interior flakes with two or more principal dorsal arrises, usually displaying more refined platforms and somewhat more uniform dorsal topography than the simple interior flake. *Linear interior percussion* flakes have straight cross-sections, are at least twice as long as they are wide, and have a single major longitudinal arris. *Early bifacial thinning* flakes have curved cross-sections, narrow and/or lipped and faceted platforms, and one or two major dorsal arrises. *Late bifacial thinning* flakes have curved cross-sections, narrow/lipped and faceted platforms, three or more dorsal arrises, and often more intensively prepared platforms than the earlier thinning flakes. *Interior shatter* comprises chunky or angular fragments without cortex or other diagnostic attributes. *Percussion fragment* includes all unrecognizable fragments of interior percussion or biface thinning flakes. *Edge-preparation pressure* refers to small pressure flakes that are broader than long, that retain fragments of the original tool or core margin on the platform or adjacent flake edges, and that exhibit complex dorsal topography. *Linear pressure* includes small flakes twice as long as wide that have one major dorsal arris and a well-defined, focal platform. *Rounded pressure* refers to small flakes with a well-defined focal platform which are round or amorphous in outline, usually with a simple dorsal topography; notching flakes are included in this type. *Indeterminate percussion* includes whole interior flakes that cannot be otherwise categorized because of weathering or some other hindrance. *Indeterminate pressure* refers to fragments of pressure flakes or complete pressure flakes that could not be assigned to a specific pressure flake type.

For certain technological comparisons the above flake types can be merged into seven inclusive reduction groups. The first five are technologically "diagnostic", representing the progressive stages of unifacial (core/flake) and bifacial (bifacing) reduction strategies. The *decortication* group combines all cortical flakes (primary, secondary, and shatter) and represents material from the initial or primary reduction of raw toolstone masses and/or the production of large, cortical flake blanks. The *interior percussion* group includes the three interior flake types (simple, complex, and linear), comprising debris from the secondary core reduction stage which involves the shaping and thinning of non-bifacial and bifacial cores. The *biface thinning* group accounts for all biface thinning flakes, indicating the percussion-thinning of already shaped bifacial cores and bifacial tool preforms. This stage is not represented in the reduction of non-bifacial cores. The fourth group, *pressure*, includes the three types of diagnostic pressure flakes (edge-removal, linear, and rounded), and constitutes the final, or tertiary stage of tool production, shaping, and maintenance. The last group, *indeterminate*, includes four nondiagnostic flake types (interior shatter, percussion fragments, indeterminate percussion and pressure) and is normally omitted from technological analyses.

Chapter Five

THE SURFACE SURVEYS

This chapter details three different surface surveys on the Volcanic Tableland. The first was a series of "weekend" surveys completed by the Enfields between 1960-1993. The last two were implemented more recently by the author, at Fish Slough in 1993 and across the larger Tableland plateau in 1997. Enfield surveys were of a slightly different order than mine, their main goals being to locate sites and recover interesting artifacts while mine were to locate sites, record them in detail, and collect samples of obsidian artifacts. During my dissertation program, cursory Enfield site records were useful in developing initial impressions about land-use patterns in the study area, and their collections have been an invaluable part of my obsidian studies. Details of the Enfield work will be summarized first, followed by discussions of the present surveys.

ENFIELD SURVEYS 1960-1993

Bishop residents Rollin and Grace Enfield began archaeological surveys on the Tableland nearly 40 years ago. Active as avocationalists, the Enfields had already worked with E. L. Davis on many projects by the mid-1960's, most notably excavations at Mammoth Creek Cave (Enfield and Enfield 1964). Starting out as weekend jaunts on the Tableland, the Enfield surveys turned into years of work throughout southern Mono and northern Inyo counties. With the aid of friend Norm Weller, the Enfields utlimately recorded over 1000 archaeological sites around Bishop and on the Tableland, around Mammoth Lakes, Casa Diablo, and in the Benton Ranges, at Truman Meadows, and in Round Valley. On the Tableland the Enfields identified over 150 archaeological sites, from isolate milling loci to large residential camps. Judging by Enfield notes, and by the setting of most sites, surveys

were normally restricted to existing jeep trails, major drainages, and canyons, wherever access and orientation were easy. This methodology allowed the Enfields to examine a vast amount of territory, but it unfortunately resulted in less than systematic coverage.

At each site, the Enfields recorded a range of information on "Unisort" cards, data that were later transferred to state site record forms. In the end, each site record included: USGS township, range, and section listings; UTM coordinates; a brief description of the site, its landform context and constituents; classifications and drawings of projectile points and other artifacts; vegetation lists; quick renderings of any petroglyphs; and a broad-scale sketch map with directions from local roads and landmarks. Sketch maps were not so detailed as to capture intrasite relationships between artifacts and features, but nearly always provided some sense of the layout of each site and rough distances between rock constructions, natural bedrock outcrops, and the like. All in all, the Enfields were quite thorough in recording the sites they encountered relative to other "avocationalists" of the time. Indeed, much of this information was useful to the Enfields as well, as they eventually returned again and again to many sites on the Tableland.

To keep track of the sites they recorded, the Enfields established a numbering system based on photographs taken at each location. Each site received a number that corresponded to a specific roll of film and to the first frame shot at that site. For example, site 3A-5 was so named because film roll 3A, frame 5 was the first photo taken there. Gaps in the numbering system occurred, however, if several frames were exposed at one location or for personal photographs. So while there is a site 3A-5, the next site in the sequence is 3A-9, as frames 6, 7, and 8 were taken either at site 3A-5 or a non-site context. Though it is still unclear what the film roll numbering system was, frame references appear to be relatively straightforward. Unfortunately, inconsistencies arose when the Enfields revisited sites for additional collecting. In some cases, artifact samples recovered during subsequent visits to a site were simply given an alphabetical suffix (e.g, 3A-5a, 5T-19b, etc.). However, often

during the course of returning to a specific location the Enfields would find a new site nearby, or decide to extend a previous site to encompass another patch of deposit. The new deposit would be given the original site prefix, but also assigned a letter suffix. As a result, in some cases single sites have multiple letter suffixes, while in others multiple sites have like prefixes but consecutive suffixes. For instance, site CA-MNO-7 at the mouth of Chidago Canyon is listed as E-17a and E-17b in the Enfield system (interpreted as two loci of the same site), but sites E-17c (no trinomial) and E-17e (MNO-945) are entirely separate locations, each more than 2.0 km away from site MNO-7. Similarly, sites 5U-4A to 5U-4G all appear to be separate locations despite the common prefix. While it has been possible to sort out nearly all of these discrepancies, this example underscores the fact that the Enfield site numbers often have little spatial or chronological relevance.

Irrespective of problems with this numbering system, Enfield records from 151 sites contained sufficient information for use in this study; characteristics of those sites used in this study are provided in Appendix B. Enfield records show that archaeological sites on the Tableland are highly variable, ranging from small flake scatters to large residential complexes with formal rock constructions, bedrock milling facilities, and developed middens, but that some attributes are quite common at all locations. Table 5.1 lists presence/absence data compiled from 143 Enfield records, excluding records for six sites excavated by Far Western (Basgall and Giambastiani 1995) and two locations that were re-recorded during the plateau survey. Columns contain the numbers of sites in each group that were positive for a certain attribute (flaked stone artifacts, ground stone artifacts, pottery, and so on). Sites are combined into two categories, "Fish Slough" or "Plateau", those in the former class located within the valley that hosts Fish Slough (see below) and all others located on plateau surfaces elsewhere on the Tableland. Flaked stone artifacts were found at 93% of all sites, ground stone items at 78.3%, bedrock milling surfaces at 75.5%, and rock rings at 54.5% of all sites. This suggests that differences in site composition are of degree rather than kind, sites varying within a common range of attributes.

Table 5.1. Select characteristics of Enfield site records.

	Sites	FL	GS	SD	RS	RR	TF	BE	PT
Slough	10	10	8	5	2	3	4	8	2
Plateau	133	123	104	30	8	75	51	100	23
Total	143	133	112	35	10	78	55	108	25

Note: FL, flaked stone; GS, ground stone; SD, sherd; RS, rockshelter; RR, rock ring; TF, threshing floor; BE, bedrock milling; PT, petroglyph.

As noted earlier, there is an obvious landscape bias to Enfield surveys. Most Enfield sites are situated on or around bedrock outcrops, canyons, and drainages, where useable bedrock materials exist. This explains why rock constructions and bedrock milling facilities are so prevalent at Enfield sites. It is also evident that Enfield surveys were more likely to discover larger, more easily identified sites (again, those with obvious rock constructions, bedrock milling facilities, or middens), as ephemeral flaked stone deposits are poorly represented in the Enfield inventory. Because of these biases, the Enfield work does not fully reflect the range of site types that exists on the Tableland. In comparing Enfield records for sites at Fish Slough and elsewhere on the Tableland there appear to be few real differences in the relative frequencies of various site attributes. Rockshelters and sherds are slightly more common at Fish Slough, and rock rings are more prevalent at other Tableland sites, but all other site attributes look to be about equally common in the two areas.

In retrospect, the Enfield bias makes sites at Fish Slough and on the Plateau look more similar than they really are. As demonstrated in the following sections, there are some key discrepancies between Fish Slough and plateau sites that were only be revealed through careful study of the Enfield records in conjunction with intensive, systematic surveys.

SYSTEMATIC SURVEYS: 1993 AND 1997

Two intensive surface survey programs were completed in the study area in an effort to gain some measure of site distributions and densities across space and to develop a simple site typology that could be used in identifying prehistoric land-use patterns. The first survey was conducted at Fish Slough in 1993 (referred to hereafter as "Slough" survey) with students from the University of California, Davis, and the second was undertaken on the Tableland plateau in 1997 (referred to as "Plateau" survey) with help from students at the California State University, Sacramento. Field methodologies were largely comparable in both cases, but overall project objectives were different enough that it is easier to describe the surveys separately. Unless otherwise specified, methods used during the Plateau survey are the same as those used at the Slough.

Slough Survey

The Slough survey took place from July 1-August 4, 1993 in an effort to locate and record archaeological sites in the area. The Enfields had evidently visited Fish Slough on a number of occasions, but their attention had clearly focused on the Tableland plateau. There was substantial variety among the dozen or so sites they did record at the slough, and several appeared to be substantial lithic scatters without rock constructions, middens, or large quantities of formed artifacts. Judging from their descriptions, such flaked stone deposits were rare on the plateau. With this in mind, it seemed important to document the kinds and densities of sites at Fish Slough carefully to facilitate comparisons with sites on the plateau.

For purposes of the Slough survey a site was defined as an accumulation of 10 or more artifacts (formed items or debitage) within a 25 x 25 m or smaller area. In a few cases up to 15 isolates were found within the requisite 25 m^2, but all other examples consisted of just one to five

artifacts. Using these criteria, very small scatters of flaking debris were considered isolates, but sparse, extensive scatters could be classified as sites. As for historic refuse and constructions, a few examples were noted around Fish Slough (e.g., the Riley Ranch property) but were wholly ignored during the survey.

The original survey universe was designed as a north-south trending block of 26 parallel and contiguous east-west transects, placed so as to cover the entire Fish Slough valley (Figure 5.1). Transects were numbered consecutively from north to south (1-26), set along Universal Transverse Mercator (UTM) lines of two United States Geological Survey (USGS) 7.5 minute series maps, Chidago Canyon (1987) and Fish Slough (1984) quadrangles. The north edge of the survey block was aligned with the 4157000m N line, well beyond the northern reach of the Fish Slough valley. The southern end of the block terminated at the 4144000 m N line, less than 500 meters above the McNally Canal. Transects were 500 meters wide (north-south), beginning and ending on east-west UTM lines. Transects were further divided into 1000 x 500 m units, with west and east ends delineated by longitudinal UTM lines. Within each transect, these units were labeled A, B, C, and D if appropriate, from west to east. Of the original 26 transects, 20 were 3000 meters long (east-west) between the 374000 m E and the 377000 m E lines; six transects at the center of the survey block were expanded to 4000 meters (between the 373000-377000 m E lines) to cover a broader, middle section of the valley. In this way, all transects directly crossing the Fish Slough drainage (n=18) stretched from the west edge of the valley (the Tableland plateau) to just beyond the high eastern fault scarp that parallels the slough. In full, the survey block measured 13 km from north to south and either three or four km east-west, encompassing a total area of 42 sq km.

Because there were excavations to be completed during the 1993 field school as well, it was uncertain at the outset of the project how many field days would be available for survey. I expected that survey progress would be slowed by student inexperience and by steep terrain along the west and

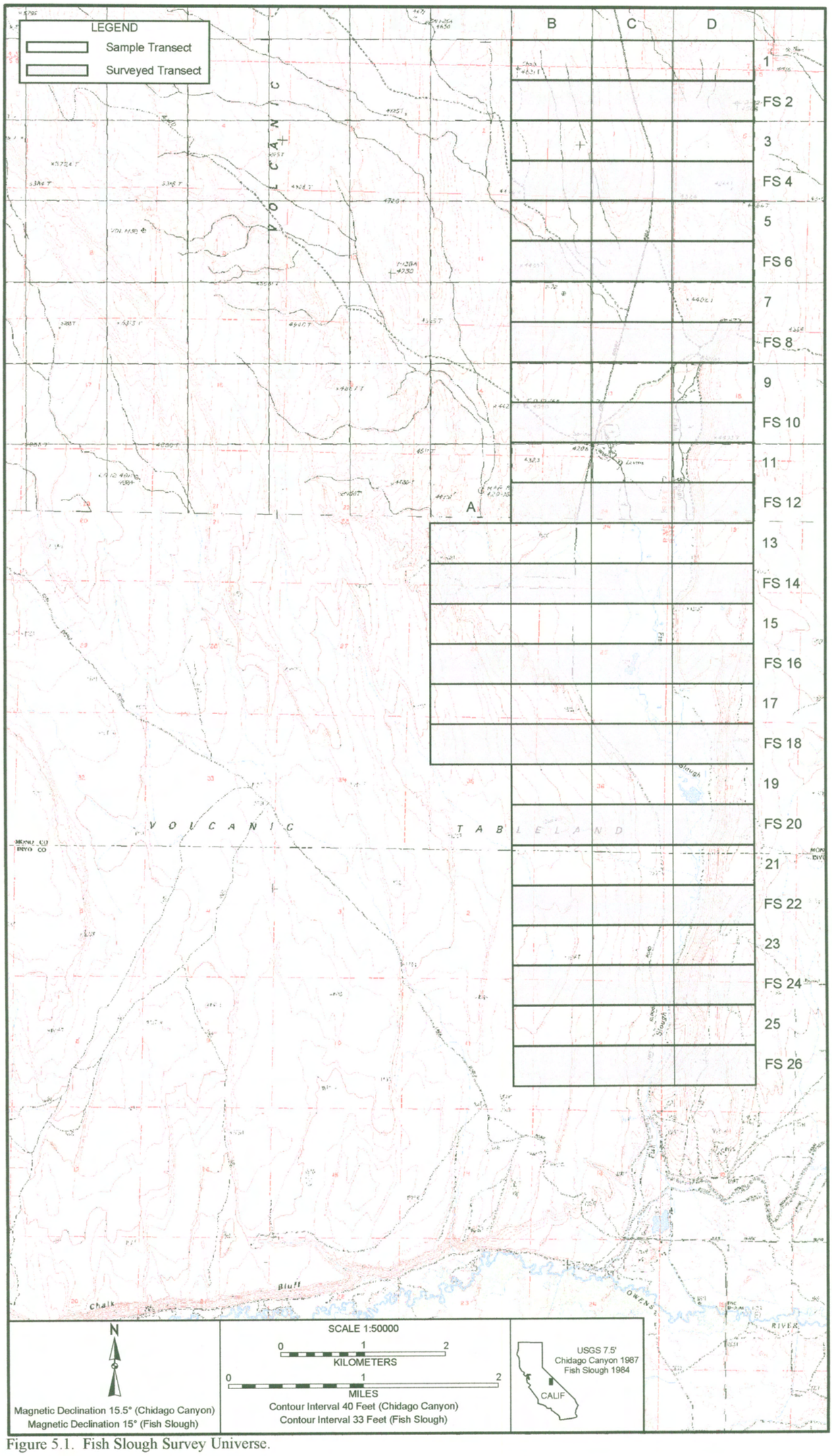

Figure 5.1. Fish Slough Survey Universe.

east edges of the survey block. With the toss of a coin it was decided, as a precaution against running out of time, that all even-numbered transects would be walked prior to any odd-numbered ones. If time allowed, surveyors were to traverse as many odd-numbered transects as possible. It was hoped that all transects would be completed, but this strategy helped maintain an unbiased and systematic approach to the selection of initial transects while still achieving maximum spatial coverage.

Each transect was surveyed by a team of five individuals comprising a field director (me) and four students who rotated in and out on a daily basis. Surveyors were spaced 50 m apart, slightly more distant than is the norm for contemporary "intensive" survey projects (25-30 m). The rationale for this was twofold: (a) available information suggested that sites were sizeable but fairly rare; (b) five surveyors should cover a transect in two sweeps, increasing the number of transects that could be covered. In retrospect, the extended spacing between surveyors probably delayed progress rather than hastened it, as I spent much of my time literally running back and forth fielding questions from students and examining would-be artifacts.

During traverses, orientation was maintained by the director through triangulation with a Brunton field compass and USGS maps. Surveyors moved in a single line parallel to one another, pausing momentarily at each 100 m increment to realign. Pace counts were used to track distance across each transect and roughly plot locations of isolates and sites, which were also field-checked using project maps and triangulation. Changes in surface vegetation, geology, landform type, and slope were also recorded across each transect. Other kinds of landmarks (obvious boulders, fences, roads, etc.) were also plotted to aid in relocating sites for future excavations. Artifact collection was restricted to time-sensitive items (projectile points, pottery, and beads) found at sites and as isolates.

Sites were assigned field designations based on their location within 1000 x 500 m units in each transect and on their order of discovery; thus, sites found consecutively within survey transect FS-14, unit C, were listed as FS14C-1, FS14C-2, and so on. Temporary provenience datums (wooden

stakes) were placed at all sites encountered, and extra datum stakes were set to identify artifact concentrations (loci). Site recording followed standard guidelines and always included: (a) completion of Department of Parks and Recreation (DPR) site record forms; (b) production of a site sketch map, with plotted locations of cultural features (rock constructions, milling slicks, and the like) and notations of distance/degrees to natural landmarks, fences, and roads; © site overview photographs; (d) plot of site datum locations on USGS maps. Cursory lists of formed artifacts attended site record production, though items were not regularly plotted on site sketch maps. Isolate finds were plotted on project maps with notations made as to frequency and type, and whether the find was an artifact (debitage, biface, etc.), feature (milling slick, bedrock mortar), or rock construction (house ring, threshing floor, wall).

Slough Survey Results

As it turned out, progress was slower than expected and only the 13 even-numbered transects were completed. Overall transect area totaled 21 sq km but the central portions of transects 10-22 were not passable due to the slough waterway or were completely covered in marsh vegetation. Factoring out unsurveyed areas within each transect, total coverage is 19.3 sq km (Table 5.2). Within this area, survey teams identified a total of 34 sites, six of which had been previously recorded (MNO-6, MNO-1992, MNO-2317, MNO-2328, INY-3387, INY-3386). According to Enfield records, four additional sites lay within transect boundaries (MNO-2302, "2D-7", "5R-13B", and "6D-8" [no trinomials available]), but these none of these was found during the survey. Site density is then 1.8/sq km, or 2.0 per sq km if the four unlocated Enfield sites are counted. Isolates were only slightly more common, 161 examples occurring at an average rate of 8.3 per sq km (Table 5.2). These produced a total of 296 artifacts; unmodified flakes comprise the vast majority (266 pieces, 89.9%), followed by bifaces (15 items, 5.0%), projectile points and handstones (five each, both 1.7%), flake tools and

Table 5.2. Size, location, and content of Slough survey transects.

Transect	Size (NSxEW)	Sq Km	UTM, SW Corner	Sites*	Isolates
FS-2	500x3000 m	1.5	4156000 m N/374000 m E	-	4
FS-4	500x3000 m	1.5	4155000 m N/374000 m E	1	6
FS-6	500x3000 m	1.5	4154000 m N/374000 m E	-	4
FS-8	500x3000 m	1.5	4153000 m N/374000 m E	2	18
FS-10	500x2500 m	1.25	4152000 m N/374000 m E	4	8
FS-12	500x2200 m	1.1	4151000 m N/374000 m E	5	6
FS-14	500x3300 m	1.65	4150000 m N/373000 m E	3	15
FS-16	500x3700 m	1.85	4149000 m N/373000 m E	3	21
FS-18	500x3600 m	1.8	4148000 m N/373000 m E	4	17
FS-20	500x2600 m	1.3	4147000 m N/374000 m E	5	22
FS-22	500x2700 m	1.35	4146000 m N/374000 m E	3	15
FS-24	500x3000 m	1.5	4145000 m N/374000 m E	2	8
FS-26	500x3000 m	1.5	4144000 m N/374000 m E	2	17
Total 13		19.3		34	161

millingstones (two each, both 0.7%), and a single hammerstone (0.3%). Rock constructions were fairly abundant along the rims of the Fish Slough valley, nine examples found include four definite and one possible threshing floor, one definite and and three possible house rings; four isolated bedrock surfaces hosted solitary milling slicks. Collections amassed 18 artifacts from surveyed transects, these including 14 projectile points, one point blank, two glass beads, and a single Owens Valley Brownware potsherd (Table 5.3).

Plateau Survey

Survey on the Plateau was implemented between June 16-July 15, 1997. Field methods, though basically the same as those used at Fish Slough, were designed to meet different research goals. A major goal was to get an idea of site densities and distributions on the plateau to supplement

Table 5.3. Collection totals for Slough survey by transect unit.

	PRJ	PTB	BED	SHE	Total
TRANSECT					
FS-2	-	-	-	-	-
FS-4	-	-	-	-	-
FS-6	-	-	-	-	-
FS-8	1	-	-	-	1
FS-10	-	-	-	-	-
FS-12	2	1	-	-	3
FS-14	4	-	2	-	6
FS-16	1	-	-	-	1
FS-18	3	-	-	-	3
FS-20	-	-	-	-	-
FS-22	1	-	-	-	1
FS-24	1	-	-	1	2
FS-26	-	-	-	-	-
NON	1	-	-	-	1
TOTAL	14	1	2	1	18

Note: PRJ, projectile point; PTB, point blank; BED, glass bead; SHE, pottery sherd.

results of the Enfield surveys and provide a comparison to the Slough survey. It was also imperative to acquire samples of obsidian for sourcing and hydration and for this reason survey methods were modified to include standardized surface collections and some excavation (see below).

Criteria for site definition were slightly different from the Slough survey. Results from that survey and others nearby (Basgall and Richman 1998) indicated that even small scatters of obsidian would be useful for sourcing and hydration, so the minimal site artifact total was dropped to 10 items in a 10 x 10 m area. No sites of this size were actually found, but one small flaking concentration (site "T10-B", with 19 flakes) would have been ignored using the slough site criteria. Isolated rock alignments were treated as "features" but not assigned formal site designations. Finally, historic refuse was recorded only where it was intermixed with prehistoric debris. The remnants of Riley Ranch west of Fish Slough (approximate UTM: 4150250 m N/373900 m E) were again ignored, but a small camp

at the southeast margin of the Tableland (site "T30-A") was fully recorded because it overlapped a substantial prehistoric deposit.

The Plateau survey universe comprised the broad, contiguous outline of the Tableland (Figure 5.2). This area was bounded by the Owens River on west and south, by gradual slopes and cliffs to the east at the edge of Chalfant and Hammil Valleys, and by Chidago Canyon Road (west from U.S. 6 at Hammil) to the north. Despite limited time for survey a total of 30 transects was slated for study. Each of these measured 150 m wide and 2000 m long, but not subdivided as at Fish Slough. All transects ran west-east and were set along UTM lines, spaced at fairly even intervals to provide systematic coverage. With each transect marking out 0.3 sq km in area, full coverage would have reached a total of 9.0 sq km. To facilitate on-the-ground location of survey tracts, and to minimize time spent traveling to and from unit corners, all transects were set to begin at various roads that criss-cross the plateau. This strategy required that transects be quite long in order to get well away from accessible areas (thus avoiding the Enfield survey bias), but it allowed crews access to project vehicles in case of an emergency (no more than 2000 meters distant at any time). In areas where few sites had been previously recorded, transects were set up on opposite sides of the road to fill out survey coverage. In general, this strategy worked quite well, though minor compass adjustments were required along the western north-south road (origin of transects T-4, T-6, T-11, T-13, T-16, T-20, T-25, T-28) where power lines paralleled the edge of the roadway.

Spacing for this survey was narrowed to 25 m in order to locate small sites, as artifacts from these locations would be useful in planned obsidian studies. Transects were traversed and orientation maintained as described previously, though more detailed information was collected concerning landscape variation. Site designations were applied as before, but with letters simply reflecting the order in which sites were located. For example, sites found consecutively in Transect 24 were labeled T24-A, T24-B, T24-C. Isolates were plotted on project maps and listed with pace counts, and along

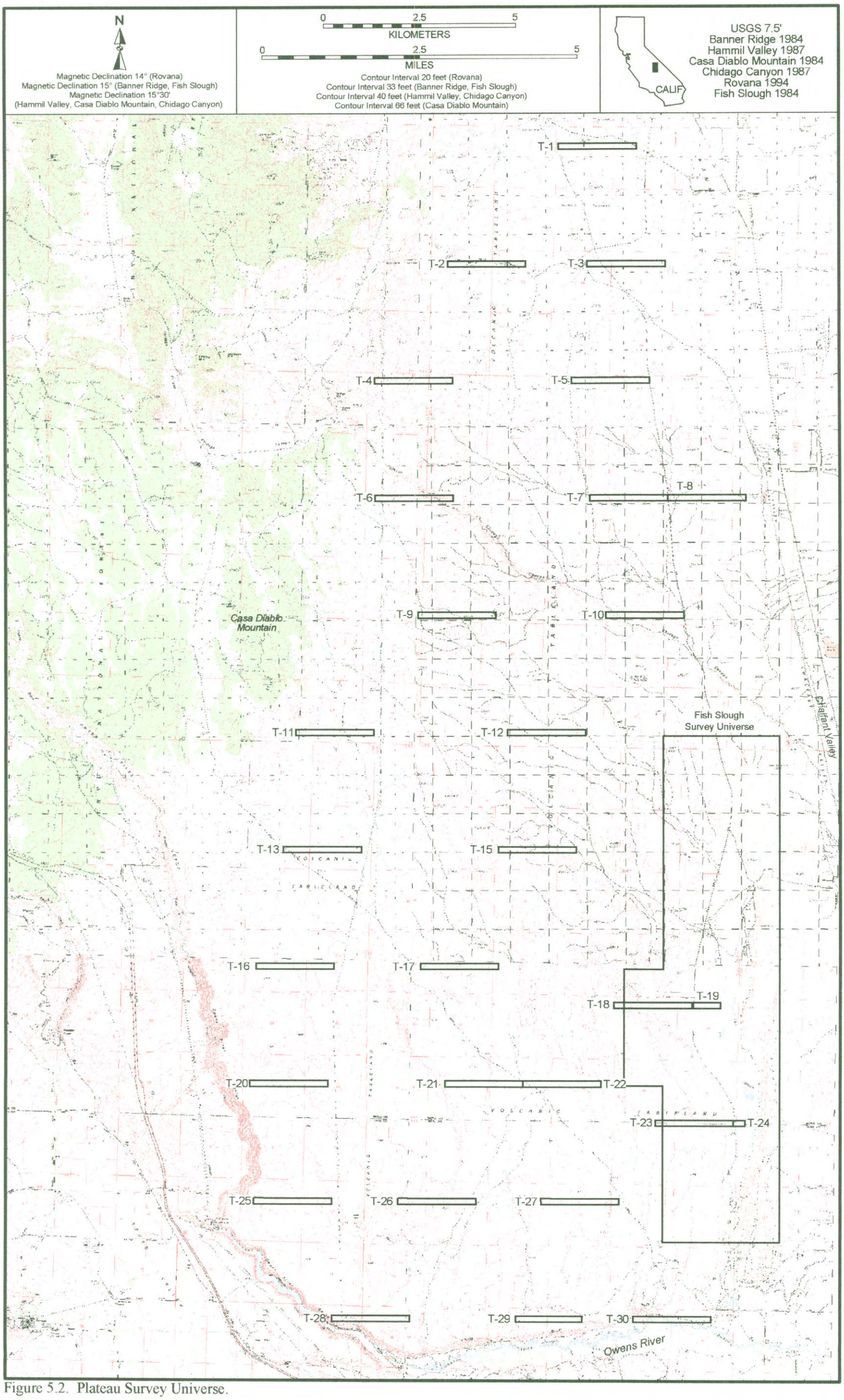

Figure 5.2. Plateau Survey Universe.

with notations as to type all isolates were counted and segregated into material classes. As at Fish Slough, all diagnostic artifacts were collected.

Site recording also differed slightly from the Slough survey. Standard site record forms were again completed, but more detail was included in surface artifact lists and on attending sketch maps. Inventories of formed artifacts were maintained on cardstock templates, one each kept for flaked and ground stone artifacts that noted provenience (distance and degrees from site datum), artifact type, material, condition, tool modification and other unique attributes. Inventoried items were plotted on site sketch maps along with other cultural features such as rock constructions, midden deposits, hearths, and artifact concentrations (loci). For surface features, such as house rings and milling areas, additional notes were taken to document spatial dimensions and other attributes including: (a) the number of boulders/cobbles used in construction of walls; (b) the number of courses in height; © overall shape and diameter; (d) number and type of grinding surfaces (slick or mortar); (e) constituency of interior matrix (sandy, midden, bedrock); (f) associated artifacts and rock art. In addition to recovering time-sensitive materials from survey sites, other collections were made to acquire samples of obsidian debitage for later technological, sourcing, and hydration studies. Debitage samples were also collected from site surfaces. In general, samples were taken from around site and locus datum stakes, collectors bagging obsidian flakes at random within a 10 x 10 m radius until roughly 50 pieces had been amassed. In some cases, collection areas were expanded to achieve the desired sample total, while in others entire site surfaces simply did not contain 50 flakes. In the former, collection areas normally reached a 20 m radius; in the latter all visible flakes were collected. Though it is well known that surface collections are normally biased to the recovery of larger over smaller flakes, pieces less than 2.0 cm in diameter become difficult to trace with either visual or chemical sourcing methods; for this reason, small flakes were left out of subsequent obsidian analyses entirely (see Chapter Eight).

To provide debitage samples for technological analyses that would include small flakes missing in surface collections, buried deposits were sampled at nearly all survey sites. Following methods used by R. Jackson (1985), limited excavations were made by digging a single test unit near each site and locus datum. Matrix was removed with short-handled spades and was sifted through small screens about 60x30 cm in size and fitted with 3-mm mesh hardware cloth, both carried by surveyors atop backpacks. Given the often shallow nature of Tableland deposits (Basgall and Giambastiani 1995), excavations were restricted to 10 cm with unit area expanded horizontally from 1x1 m to 1x2 m depending upon recovery totals. The aim of excavations was to collect between 30-50 flakes from each unit without spending inordinate amounts of time, this goal met at all but three sites where the absence of a buried deposit negated excavation. To preserve assemblage composite all artifacts from excavated units, regardless of type or material, were retained.

Plateau Survey Results

It was not possible to finish all 30 transects initially slated for study. In the end, a total of 27 full and three partial transects was completed. Transect 14 was deleted, only the western portions of Transects 19 and 24 were surveyed, and a section of Transect 29 was partially overlapped by a private landholding not shown on USGS maps; hence, the total area surveyed amounts to 8.20 sq km or about 2032 acres (Table 5.4). It should be noted that the four transects placed across Fish Slough (T-18, -19, -23, and -24) were intended to serve as a check against the precision of the 1993 survey program. Because of differences in the spacing of survey lines between the two projects (50 m at the Slough, 25 m on the Plateau), it was desirable to re-examine the Slough to determine if differences in survey spacing would affect the frequency of site identification. For this purpose Transects T-18 and T-19 were placed on a parallel that lay within the southern third of Slough Transect FS-14, and Transects T-23 and T-24 were placed across the south third of Slough Transect FS-20 (see Figure 5.2). Surveys

Table 5.4. Size, location, and content of Plateau survey transects.

Transect	Size (NSxEW)	Sq Km	UTM, SW Corner	Sites	Isolates
T-1	150x2000 m	0.3	4172000 m N/371380 m E	-	4
T-2	150x2000 m	0.3	4169000 m N/368540 m E	2*	24
T-3	150x2000 m	0.3	4169000 m N/372110 m E	-	4
T-4	150x2000 m	0.3	4166000 m N/366700 m E	2	24
T-5	150x2000 m	0.3	4166000 m N/371700 m E	-	1
T-6	150x2000 m	0.3	4163000 m N/366700 m E	1	11
T-7	150x2000 m	0.3	4163000 m N/372150 m E	-	4
T-8	150x2000 m	0.3	4163000 m N/374150 m E	1	4
T-9	150x2000 m	0.3	4160000 m N/367750 m E	1	1
T-10	150x2000 m	0.3	4160000 m N/372560 m E	1	2
T-11	150x2000 m	0.3	4157000 m N/364620 m E	-	25
T-12	150x2000 m	0.3	4157000 m N/370040 m E	-	1
T-13	150x2000 m	0.3	4154000 m N/364280 m E	-	1
T-15	150x2000 m	0.3	4154000 m N/369800 m E	-	3
T-16	150x2000 m	0.3	4151000 m N/363600 m E	1	6
T-17	150x2000 m	0.3	4151000 m N/367810 m E	-	6
T-18	150x2000 m	0.3	4150000 m N/372760 m E	-	10
T-19	150x700 m	0.1	4150000 m N/374770 m E	1**	4
T-20	150x2000 m	0.3	4148000 m N/363440 m E	1	10
T-21	150x2000 m	0.3	4148000 m N/368420 m E	-	1
T-22	150x2000 m	0.3	4148000 m N/370420 m E	-	10
T-23	150x2000 m	0.3	4147000 m N/373820 m E	1	10
T-24	150x300 m	.05	4147000 m N/375820 m E	3	5
T-25	150x2000 m	0.3	4145000 m N/363550 m E	-	6
T-26	150x2000 m	0.3	4145000 m N/367240 m E	-	2
T-27	150x2000 m	0.3	4145000 m N/370900 m E	-	1
T-28	150x2000 m	0.3	4142000 m N/365550 m E	1*	7
T-29	150x1700 m	0.25	4142000 m N/370260 m E	-	11
T-30	150x2000 m	0.3	4142000 m N/373260 m E	2	14
Total 29		8.20		18	212

* Includes Enfield sites and ** 1993 Fish Slough sites identified within survey transects.

of T-18 and T-19 revealed no new sites but did locate one previously noted site that lay within their boundaries (FS14C-1), while T-23 and T-24 discovered four additional sites, one up on the plateau west of Fish Slough (T23-A) and three on alkali flats adjacent to it (T24-A, T24-B, and T24-C). It is unfortunate that the eastern portions of T-19 and T-24 were not completed. However, it had been

decided early on that, of all the units slated for survey, these transects were the most expendable. If additional sites lay undiscovered along Fish Slough, they would most likely have been found in the western portions of T-19 and T-24. In retrospect, this estimate appears to have been correct. Even the attenuated T-24 transect showed that there *are* other sites at Fish Slough that were missed during the earlier project. It is not known if this is due to survey error or to fluctuations in the amount of seasonal alkali buildup, but other undiscovered sites likely exist in the southern part of Fish Slough.

Surveys on the Plateau identified a total of 18 archaeological sites, three isolated rock alignments, and 212 isolates. Only two sites, T2-A and T28-A, had been recorded by the Enfields (5A-12A [MNO-2588] and 5C-16 [no trinomial]) and just one had been found during the slough survey (FS14C-1). Overall, sites were encountered at an average of 2.2/sq km in Plateau transects. Isolates were encountered at a much higher rate, averaging 25.8/sq km. The isolate artifact sample totaled 271 items, dominated by unmodified flakes (216 pieces, 79.7%). Other artifact types were comparatively rare, consisting of 23 bifaces (8.5% of all isolates), 17 projectile points (6.3%), seven simple (2.6%) and three formed flake tools (1.1%), four millingstones (1.5%), and a ceramic sherd (0.3%). Six separate bedrock milling features were also identified, including one boulder bearing well over a dozen mortar depressions. Some 18 artifacts were recovered from isolate contexts, including 17 projectile points and one Owens Valley Brownware sherd. At least one point was found in each transect save T-14 (which yielded the lone sherd), Transects T-11, T-16, and T-23 produced two points apiece and Transect T-20 produced three.

SURVEY SITE DESCRIPTIONS

To provide a background for site classifications presented later in this chapter, brief descriptions of all new sites identified on the Tableland are provided here. Surface collections and

excavations at Fish Slough in 1993 and in 1995-96, and on the Plateau in 1997, are reported later in Chapter Six. Sites are described in numeric order by their Slough and Plateau temporary numbers.

Slough Survey

533

So named for a number of unknown meaning scribbled onto an old BLM map, site 533 is an elongate, moderately dense scatter of flaked and ground stone spread across a sandy terrace that overlooks alkali flats to the east and beyond that the Fish Slough drainage. The site is bordered on the west by Fish Slough Road and is about 200 meters north of the former location of a sign that marked the Inyo-Mono county line. Another small two-track road defines the north boundary of the site, cutting east from Fish Slough Road until it reaches the edge of Fish Slough Lake. Site 533 also displays a fairly rich midden deposit containing faunal bone, freshwater mussel shell, and other organic materials. Its surface not very dark because whitish aeolian sands have intermixed with midden matrix. There are no features on the surface. The site's proximity to Fish Slough Road made it accessible to archaeological investigation and, unfortunately, to illicit collecting. Given this, and considering its assemblage and buried deposits, site 533 was selected for testing in 1993.

FS4C-1

The northernmost site found during the survey, FS4C-1 lies at a small outcrop of tuff bedrock on the west flank of a broad basin about one kilometer north of the Fish Slough valley. The exposed bedrock is flat and elliptical, and is modified by four separate milling slick depressions and a single threshing floor feature. A narrow zone of darkened sediment borders the exposure immediately on the west, and two separate bedrock milling areas lie to the north. The threshing floor is enclosed by a semi-circle of tuff cobbles and lacks a visible milling surface (eroded away). A schist handstone was

found in association with one of the slicks, other artifacts including two millingstone fragments, one handstone, a quartzite cobble tool, an obsidian biface, one obsidian flake tool, and eight pieces of obsidian debitage. All obsidian artifacts were collected in 1995 but the site was never excavated.

FS10A-2

This site is located at an isolated knoll of tuff bedrock some 200 meters beyond the west end of Transect 10, its artifact deposit extending to within 100 meters of the transect boundary. The location of FS10A-2 is shown on Enfield maps of sites "5U-4" and "5U-4A", but Enfield descriptions of these sites do not correspond with the site's attributes. The bedrock knoll, which is easily seen from a distance, stands about 20 m high and measures 50 m north-south by 30 m east-west. Vertical faces on the east and north display five separate petroglyph panels, each bearing curvilinear and rectilinear elements. On the east side of the knoll, sandy surfaces contain a wide array of artifacts. Formed tools are dominated by ground and battered stone, including at least 11 millingstone fragments, five handstones, one piece of miscellaneous ground stone, and two cobble tools (probably hammerstones). Flaked stone artifacts are largely obsidian, formed tools represented by three bifaces, two projectile points, and one basalt core. Controlled surface collections were conducted in 1995.

FS10B-1

This is a small flake scatter atop a low dune, situated a bit northeast of the northwest springhead and the associated FS10B-2 site complex. The lithic deposit is roughly 50 x 50 m in size, with a small concentration of *Anodonta* shell on its southwest perimeter. Artifacts are mostly obsidian flakes, with some cryptocrystalline and quartzite flakes, two simple flake tools, and a possible millingstone also identified. This site is much like the low dune loci at site FS10B-2 (Locus A-C, E) which are situated about 125 meters away.

FS10B-2

One of the most interesting sites encountered during the Slough survey, site FS10B-2 is an extensive complex of artifact-bearing dunes and flats distributed along the eastern margin of the northwest springhead. Spanning an area of about 450 x 300 m, the site contains six occupational loci, four situated on low dunes (Locus A, B, C, and E), one on an alkali flat (Locus D), and one on a sandy flat (Locus F). Of the four dune deposits, Locus A demonstrates the darkest, richest midden which is full of *Anodonta* shell but contains little vertebrate fauna or artifactual debris. The other dune middens are smaller and less well developed but similar in character. In contrast, the interdune deposits are heavily dominated by lithic debris and contain only limited amounts of shellfish remains. The densest lithic scatter, Locus D, sits directly on alkali-covered sands against the marsh vegetation of the spring pond. Dozens of projectile point fragments were observed in this area, mostly Elko Eared, along with a wide array of bifaces, flake tools, millingstones, battered cobbles, and debitage of all sorts. Locus F lies farther back from the springhead but is also fairly rich in artifactual debris, its sediments containing a light midden deposit as well. Three loci at this site (A, D, F) were tested in 1996 and yielded evidence of Newberry and Haiwee period occupation (see Chapter Six).

FS12A-1

Site FS12A-1 is a dense scatter of *Anodonta* shell and a handful of artifacts on a low dune just north of an elongate alkali flat and about 80 m east of Fish Slough Road. Approximately 40 x 40 m in size, the shell deposit yielded only four handstones, one millingstone, and about a dozen unmodified flakes of various materials (obsidian, cryptocrystalline, granitic, quartzite, and schist). This site is over 500 m from the slough waterway, but seasonal flooding clearly reaches at least its eastern edge.

FS12A-2

Situated on the same alkali flat as FS12A-1 but at the opposite end, site FS12A-2 is another small scatter of *Anodonta* shell refuse and milling implements on a low dune, lying about 125 m east of Fish Slough Road. Though slightly larger (50 x 40 m) than its counterpart, site FS12-A manifests a comparable array of surface artifacts including just four handstones, two millingstones, and a dozen pieces of debitage (obsidian, igneous, granitics, and tuff). One of the handstones was located atop an intact millingstone. Again, the northern and eastern edges of the site are seasonally flooded by the slough despite its location some 600 meters from the dry season waterline.

FS12B-1

Site FS12B-1 is located near the west end of Transect FS-12, Unit B, comprising a cluster of obsidian flakes atop a low dune. The deposit is about 125 m west of the slough and encompasses a 30 x 30 m area, containing roughly 70 obsidian flakes and a single cryptocrystalline arrow point blank (collected). No mussel shell was observed at this location.

FS12C-1

This site lies at the eastern end of Transect FS-12, well beyond the fault scarp of Fish Slough valley on the east rim of the Tableland. Contained within a 30 x 20 m area are six circular rock constructions, two resting on decomposed tuff and four on exposed bedrock. All of these are probably threshing floors of some kind, as all but one contain milling slicks within their walls. Only three artifacts were observed, a handstone and cryptocrystalline Cottonwood projectile point (collected) found inside a feature and a lone millingstone fragment not associated with any structure. It is possible that the two rock rings on tuff sands are living facilities, but the absence of debitage, faunal remains, and midden deposits from this site argue against even a short-term residential occupation.

FS12C-2

One of many archaeological deposits fronting the base of the eastern fault scarp, site FS12C-2 lies on the east side of the two-track road that parallels the east margin of Fish Slough. The cultural deposit here is perched atop grayish tuff sediments and consists primarily of a large (135 x 80 m), diffuse scatter of *Anodonta* shell and obsidian artifacts. There are light midden deposits in the southwest portion of the site (designated Locus B), and three large tuff boulders at the north end of the site display several milling slicks and mortar depressions (Locus A). The few formed artifacts observed include five handstones, two millingstone fragments and two pieces of miscellaneous ground, two cobble tools, two bifaces, one Elko Series and one Rose Spring Series projectile point. Unmodified flakes probably number well into the hundreds, distributed fairly evenly across the site. Surface collections were made at both loci in 1995 but the site was not excavated.

FS14C-1

Set atop a low, sandy terrace less than 100 m west of Fish Slough (UTM: 4150085 m N/376300 m E), site FS14C-1 is a complex deposit of flaked and ground stone with pockets of light, *Anodonta*-rich midden. The entire deposit is roughly 60 x 55 m in size, its east half dominated by lithic artifacts and its southwest quarter by intact midden. Flaked stone tools include two Elko Corner-notched points, several bifaces, drills, and flake tools, while ground stone tools include millingstone and handstone fragments, cobble tools, and miscellaneous ground stone. Midden and non-midden zones excavated in 1996 produced very different artifact assemblages.

FS14C-2

Lying about 120 m north of site FS14C-1 and about 150 m west of the slough channel, this deposit is a fairly dense accumulation of flaking debris spread across several very low dunes.

Interdune surfaces expose thin alkali deposits, artifacts in these areas often manifesting a thick alkali encrustation. Obsidian flakes and a few tools are evenly distributed throughout a 50 x 50 m area. This site was tested in 1996, resulting a shallow but relatively rich subsurface deposit.

FS14D-1

This rich midden deposit is situated along the base of the eastern Fish Slough fault scarp on a raised terrace just above the slough margin. Two massive, opposing boulders center the site, each showing use as an aboriginal shelter. The smaller, five meters in diameter and six meters high, lies upslope at the base of the fault scarp talus field. Its resting position has created a small, natural cave-like opening that is now fronted by a well-developed, semi-circular apron of midden deposit. The downslope boulder is much larger, about 10 m in diameter and tall, and has near-vertical faces on all sides; at least two of these faces served as shades or windbreaks for prehistoric occupants of this site.

The cultural deposit at FS14D-1 covers an area of approximately 150 x 65 m, spread mainly along the east side of the two-track road that parallels the slough on its eastern side. Midden soils are rich in *Anodonta* shell, which is densest in between the two boulders. Artifacts are most common in this area, consisting of flaked and ground stone tools, debitage, pottery, and glass beads. Overall, some 11 obsidian bifaces, three projectile points (2 Elko and 1 Cottonwood), four flake tools, one handstone, one millingstone, two cobble tools, two glass beads, and several pieces of Owens Valley Brownware pottery were found during the survey. Excavations in 1996 sampled both the shelter apron and central midden deposits to 80 and 90 cm below surface, respectively, yielding additional beads and ceramics, two shaped pieces of turquoise, a wide variety of flaked and ground stone tools, large volumes of chipping waste, and faunal remains.

FS16B-1

Lying about 150 m west of Fish Slough Road near the base of the western tuff cliffs of the valley, FS16B-1 is a small scatter of flaking debris on a sandy alluvial bench. The surface deposit consists of just three obsidian bifaces and about 20 flakes (about half obsidian and half basalt) spread over a 50 x 25 m area.

FS16B-2

Farther north along the same cliffs from the previous location, FS16B-2 is a small (30 x 35 m) scatter of milling implements. Six millingstones (all tuff) and five handstones (four igneous, one tuff) were identified on the surface, these items accompanied by just one obsidian flake. Slabs for the milling implements were no doubt acquired from the adjacent plateau or talus slope, as the site itself rests on alluvial sediments lacking in suitable stone.

FS16C-1

Site FS16C-1 is an extensive (175 x 100 m) but sparse chipped stone scatter found along the southern margin of Transect FS-16 about 200 m east of Fish Slough Road. Artifacts are mainly flaked stone debitage (obsidian, with some cryptocrystalline, felsite, quartzite, and basalt), but a few formed items were also present (five millingstone fragments, one obsidian biface, one basalt core). A mix of tuff and grantitic sediments covers the site, and there is no evidence of *Anodonta* shell or midden soils.

FS18C-1

This is the northernmost of several sites found on a dunefield terrace that parallels the west side of Fish Slough near its midpoint. It is a moderately dense scatter of flaking debris spanning a circular area roughly 100 m in diameter. Ground surfaces are loose and sandy. The assemblage

consists of over 100 obsidian flakes, a much smaller quantity of other debitage (cryptocrystalline, basalt, rhyolite, quartz, and miscellaneous igneous), and a few formed tools including two projectile points (a Fish Slough Side-notched, an Elko Eared [both collected]), and three obsidian bifaces. Bits of fire-affected rock are also thinly scattered across the site.

FS18C-2

Located right along the western edge of Fish Slough, this is a thin scatter of flaking waste spread across a deflated alkali flat. Artifacts cover an area of 120 x 135 m, distributed atop silty sediments capped by a thin veneer of white alkali. As observed in the early spring of 1995, this site floods completely during the winter; as a result, many artifacts are partially embedded in the ground and are alkali encrusted to some degree. The site assemblage is mainly obsidian debitage (about 150+ pieces) though some cryptocrystalline and basalt flakes were also noted. Shaped tools include six obsidian bifaces, one formed flake tool, and a core. Excavations in 1996 located a dense pocket of flaking debris in an otherwise sparse buried component.

FS18C-3

Nearly 400 m west of FS18C-2 is site FS18C-3, an extensive but sparse scatter of flaked and ground stone artifacts covering part of the dune terrace that lies west of Fish Slough. Artifacts are spread across an expanse of about 500 x 140 m in three distinct concentrations. Debitage is densest in a 100 x 60 m zone near the site center and two separate accumulations of milling implements occur in the southeast and northeast portions of the site. The southeast milling area is the largest (about 120 x 40 m), containing at its southern end a small pocket of midden that displays darkened sediment and *Anodonta* shell. As expected, the artifact assemblage at FS18C-3 is quite varied. We noted more than 100 pieces of debitage (mostly obsidian but also cryptocrystalline, basalt, and quartzite) and several

flaked stone tools including one Elko Corner-notched projectile point (collected), four obsidian and one cryptocrystalline formed flake tool, and one simple flake tool. Ground stone tools are also numerous, particularly within the milling concentrations. These include 12 millingstones, seven handstones, one piece of miscellaneous ground stone, and two cobble tools. A few pieces of fire-cracked rock are strewn about the site, being most abundant within the milling concentrations. Surface collections in 1995 retrieved several dozen obsidian flakes and a few obsidian tools but the site was not selected for further testing.

FS18D-1

FS18D-1 is located on the east side of the slough directly opposite FS18C-2, oriented north-south along the narrow bench at the foot of the east fault scarp in Fish Slough valley. More than 100 obsidian flakes were recorded in an area spanning 100 x 35 m, along with an obsidian formed flake tool and an obsidian simple flake tool. The site is situated adjacent to but slightly above alkali flats to the west. It appeared to have some depth and was selected for testing in 1996. Surface survey delineated two loci of flaking debris (Locus A and B); excavations at the latter revealed a moderately deep (50 cm) and dense deposit of flaking waste that resembled materials observed on the surface.

FS20A-1

Situated more than a kilometer west of Fish Slough valley, within a broad basin out on the plateau and adjacent to a small drainage, site FS20A-1 is a small but dense scatter of obsidian flaking debris. Artifacts cover an area 35 x 20 m in size, including about 75-100 obsidian flakes and a single obsidian biface. Visual inspection of the artifact assemblage indicated that almost all pieces were of Truman/Queen obsidian. Unfortunately, attempts to relocate this site in 1995 and 1996 were unsuccessful, and it is presumed the site has been buried under loose, shifting surface sediments.

FS20C-1

This site is similar in depositional context to FS18C-2 but lies a kilometer downstream. Also like FS18C-2, it is a sparse accumulation of obsidian flaking debris, though slightly larger in overall size (135 x 80 m). The assemblage is mainly debitage (100+ pieces) with two formed flake tools. As seen in 1995, winter expansion of the slough inundates this location entirely, as evidenced by the alkali crust present on all debris. Test excavations conducted in 1996 revealed a buried deposit similar in structure and content to those found in other alkali sites at Fish Slough.

FS20C-2

Within Transect FS-20 two sites, FS20C-2 and FS20C-3, were located well to the east above Fish Slough along a bedrock terrace near the southeast edge of the Tableland. FS20C-2 is the larger of the two (115 x 135 m) and is situated on an east-facing bedrock terrace and sandy slope near the east end of the transect. Most obvious at the site are nine circular rock constructions. Four are probably houses and five are likely threshing floors. The structures are distributed along the margin of the bedrock terrace and are accompanied by five isolated bedrock milling slicks. Downslope and off the terrace from the structures is a substantial midden zone covering an area roughly 45 m in diameter with another two milling loci present on exposed bedrock. There are just two obsidian tools (one biface and one formed flake tool), but groundstone tools include five handstones and one millingstone fragment. Debitage is notably absent; not a single flake was found anywhere on the site. Two Owens Valley Brownware sherds were found near the structures but were not collected.

FS20C-3

FS20C-3 is just over 200 m southeast of FS20C-2. It is a small (60 x 30 m) cluster of rock constructions and isolate milling slicks atop an east-facing bedrock cliff. Two circular rock rings lie

on sandy sediments and another, more ephemeral construction, sits on bedrock. Two milling slicks occur to the southwest, in separate locations along the edge of the cliff. The site shows no evidence of midden. Only two artifacts were observed, a burnt handstone and an Owens Valley Brownware sherd (not collected).

FS22B-1

Near the southern end of the dunefield that borders Fish Slough to the west, FS22B-1 lies on an elevated dune terrace about 75 m east of Fish Slough Road. A fairly thin accumulation of flaked stone artifacts covers an area of 80 x 40 m. Artifacts include an obsidian fluted point base, one formed flake tool and one simple flake tool, about 40-50 pieces of obsidian debitage, and one millingstone fragment. Test excavations in 1996 disclosed two areas of deposit, one a buried component overlain by about 30 cm of aeolian sand.

FS22C-1

This site lies about 75 m southwest of FS22B-1 at a contact between dunes and deflated alkali flats. A sparse artifact scatter covers an area of about 75 x 50 m, mostly obsidian debitage (75-100 pieces) but with some non-obsidian flakes (cryptocrystalline, basalt, and igneous). Formed artifacts are few, including a cryptocrystalline formed flake tool, two millingstone fragments, and one piece of miscellaneous ground stone. Surface collections in 1995 recovered three points (one Pinto, one unclassified stemmed point, one Elko eared), one biface, four flake tools, and over 75 flakes.

FS24A-1

Site FS24A-1 lies out on the plateau on a west-facing bedrock terrace that borders the east side of a small playa basin. Cultural deposits cover an area of about 115 x 70 m hosting deep aeolian

sands, a depositional context quite rare in this part of the Tableland. Formed artifacts include both flaked and ground stone but are dominated by the latter. Some 21 handstones, five millingstones, and a cobble tool were identified, flaked stone tools including one Elko series projectile point (collected) and an obsidian biface. Obsidian flakes, however, were relatively common (about 75 pieces), many evidently derived from the bipolar flaking of small nodules. The only other artifacts found at the site were a lone quartz crystal and one sherd of Owens Valley Brownware pottery (collected). At the edge of the terrace above a steep talus slope there is a single tuff boulder with three milling slicks.

FS24C-1

Found in a context similar to FS20C-2 and FS20C-3, site FS24C-1 lies a considerable distance east of Fish Slough on an east-facing bedrock terrace. A single threshing floor is bounded by a low, semi-circular rock wall, three solitary milling slicks present within a surrounding 65 x 35 m area. Only a single millingstone fragment was found, this lack of artifactual debris being consistent with patterns at sites FS20C-2 and FS20C-3 farther north along the same terrace.

FS26B-1

FS26B-1 is the southernmost site found during the survey. It is an elongate deposit of flaked and ground stone artifacts bounded by Fish Slough Road on the west and the slough drainage on the east. The site matrix is a thin layer of decomposed tuff, discontinuously draped over bedrock exposed along the slough margin. Cultural materials are spread across a 160 x 50 m area, often in fairly dense concentrations. Flaked stone is the most abundant, including one obsidian biface, two flake tools, and well over 500 pieces of debitage (obsidian, cryptocrystalline, felsite, basalt). Ground stone tools include two handstones and a single millingstone fragment. This site was tested in 1996. Four projectile points were collected from the surface (one definite and one possible Pinto, one Humboldt

Basal-notched, and one Eastgate), and excavations disclosed a moderately dense but shallow cultural deposit (less than 30 cm depth) overlying tuff bedrock.

Plateau Survey

T2-A (CA-MNO-2588)

This site measures 50 x 30 m and lies near the western end of Transect T-2 on a high, sandy rise overlooking Red Rock Canyon. There were approximately 75-100 pieces of obsidian debitage on the site surface, other artifacts including one formed flake tool, three simple flake tools, two handstone fragments, one unusual piece of ground and perforated tuff, and two historic cans. Surface collections around the site datum produced 28 obsidian flakes, and a 1x2 m excavation nearby produced another 31 pieces of debitage. The location and contents of T-2A suggest it is CA-MNO-2588, or Enfield site 5A-12A.

T2-B

Located about 500 meters east of T2-A, this site is a fairly large (100 x 40 m) complex of flaked and ground stone covering the crest and east slope of a long, sandy ridge. The site assemblage is dominated by several hundred pieces of debitage, mainly obsidian but also cryptocrystalline and grey quartzite. Debitage occurs in two main concentrations at the site (Locus 1 and Locus 2). Formed artifacts are common at each locus. The site as a whole produced one biface, four simple flake tools, five handstones and five millingstones, four pieces of miscellaneous ground stone and two battered cobble tools. At Locus 1, surface collections yielded 50 obsidian flakes, while a 1x2 m excavation nearby produced 164 obsidian flakes. No collections were made at Locus 2 where surface artifact densities were much lower. A large exposed boulder of grey quartzite was found perched atop a small tuff knob some 100 meters beyond the north site boundary. Quartzite flaking debris surrounding the

boulder attests to its *in situ* reduction; this boulder may have provided some of the quartzite material found at site T2-B.

T4-A

Site T4-A comprises an extensive (120 x 100 m) and varied deposit of flaked and ground stone debris surrounding a large outcrop of granitic boulders at the western margin of the Tableland. There are two artifact concentrations, one upslope and west of the boulder outcrop (Locus 1) and one at the base of the outcrop to the east (Locus 2). Surface sediments at Locus 1 are granitic sands lacking organic content. Artifacts are mostly unmodified flakes, mainly obsidian but some cryptocrystalline, rhyolite, and quartzite as well. Formed artifacts include seven bifaces, one formed flake tool and three simple flake tools, one handstone, seven millingstone fragments, and one piece of miscellaneous ground stone. Three features were identified at the south end of the locus, a collection of fire-affected rock (Feature 1) and two concentrations of boulder milling slicks (Features 2 and 3). Locus 2 contains a midden with a smattering of surface debitage and several formed tools. Ground stone is abundant (five handstones, seven millingstone fragments, and five battered cobbles), but two Rose Spring projectile points (collected) and three bifaces were also noted. A large boulder at Locus 2 contained several milling slicks (Feature 4), two with handstones *in situ*. Surface collections at both loci focused on pockets of denser flaking debris. Some 51 obsidian flakes and two obsidian flake tools were recovered from Locus 1, and 45 obsidian flakes were retrieved from Locus 2. Excavations in these same concentrations produced 89 (Locus 1) and 32 (Locus 2) obsidian flakes.

T4-B

This site consists of 40 flakes and one simple flake tool, all obsidian, located on a sloping, sandy tuff terrace above an ephemeral drainage. Flaking debris was thinly scattered across a 10 x 10

meter area. All surface artifacts were collected, but the sparse nature of the site deposit warranted no excavations.

T6-A

Site T6-A is a moderate-density artifact scatter found on an east-sloping terrace near the western border of the plateau. Unfortunately, the western edge of the site is bisected by a major dirt road, and the north half of the site was graded years ago for the construction of a large electrical tower just beyond the site. Cultural debris remains visible across a 70 x 30 m area, comprising a few obsidian flaked stone tools (three bifaces and an Eastgate projectile point [collected]), roughly 100 obsidian flakes, one battered cobble, and several dozen fire-affected rocks. A large remnant patch of midden containing charcoal and other burnt materials (faunal, rock and sediment) is visible in the bed and banks of the dirt road near the midpoint of the site. Elsewhere, grading has created a linear berm of at least 100 tuff boulders and cobbles, nearly 50 meters long, that runs in a northeast/southwest aspect across the site. Given the lack of such boulders elsewhere on the site terrace, and that the size of these boulders is comparable to those seen in residential structures at other sites, it is possible that several rock house rings once existed here, now totally destroyed. There is no indication as to where these might have been, but grading was confined mainly to the northwestern part of the site and they may have been located there. Both surface collection and excavation targeted the more intact central-eastern part of the site. Surface collection produced 52 obsidian flakes from a 25 x 25 m area. A 1x2 m exposure placed northeast of the site datum yielded 25 obsidian flakes.

T8-A

One of the more interesting sites found during the survey, T8-A lies east of Fish Slough Road on the east side of a tall tuff outcrop. A sparse surface assemblage spanned a 60 x 20 m area and

included only a few obsidian artifacts (three Rose Spring projectile points [collected], one formed flake tool, and roughly 30 flakes) but a wide array of ground stone items. Milling tools totaled six handstones, two millingstones, three battered cobbles, and two pieces of miscellaneous groundstone. In addition, 14 bedrock milling slicks were discovered atop the bedrock knoll. Two separate concentrations held four and five slicks apiece; the other five slicks were isolates. In front of the knoll, near a bedrock finger that extends eastward, a half-circle of 12 tuff boulders may be the remains of an aboriginal house. Measuring about four meters across, this feature had both darkened sediment and a few obsidian flakes within its confines. A possible petroglyph panel was observed on a vertical boulder surface near the southeastern portion of the site, near two other boulders that displayed odd grinding facets on vertical faces. The site was intensively collected for obsidian flakes, which yielded only 33 pieces. A 1x2 m excavation unit was placed near the center of the site where one Rose Spring point and the formed flake tool were discovered, this unit finding a shallow deposit and producing just three obsidian flakes.

T9-A

Found near the midpoint of Transect T-9, this site is a construction of tuff boulders and cobbles built on a sandy terrace against a west-facing bedrock cliff. The structure has five courses of small cobbles stacked 1.2 meters high, forming a nearly closed semi-circle about three meters in diameter with an entrance that opens southward against the cliff. Bedrock forms a small alcove at the rear interior of the structure. Sediments inside the structure are not culturally modified, though some recent charcoal and modern rodent bones are present in trace quantities. Two aboriginal artifacts were found, however, one handstone inside the structure and another outside it roughly twelve meters away. Despite the presence of the handstones, it is difficult to discern the origin of this construction. It is quite unlike other prehistoric house rings on the Tableland, being higher than most and made of much

smaller cobbles. The structure actually resembles a wall more than a foundation, with rocks of varying size carefully stacked to minimize vacancies in its form. Perhaps built as a temporary windbreak or shade, the feature is probably aboriginal but recently rebuilt.

T10-B

Lying about 600 m west of Fish Slough Road in the central part of the Tableland, site T10-B is a scatter of 19 obsidian flakes in a small, narrow saddle. Artifacts were well-dispersed over a 10 x 10 m area. All flakes were collected but the site was not tested further.

T16-A

This is a small scatter of obsidian artifacts including one Pinto projectile point, two formed flake tools, and a few dozen flakes. It is situated on a sandy, east-facing bench roughly two kilometers east of the Owens River gorge. A low cliff of tuff bedrock (about 15 m high) overlooks the site from the west, and a ground-level rim of tuff bedrock slopes down away to the east. Formed artifacts and debitage were dispersed over a 60 x 50 m portion of the terrace. The entire site was surface collected, yielding just 30 obsidian flakes and the three tools. Near the center of the site, a 1x2 m excavation produced just 11 obsidian flakes.

T20-A

Site T20-A is a large residential complex set less than one kilometer east of the Owens River Gorge. Cultural deposits are spread over a 180 x 100 m area that spans a small, shallow basin formed by two low, opposing ridges. Two large bedrock exposures exist, one in the upper northern part of the site and one in the lower, central site area. These surfaces have been exposed by water draining through a narrow wash that starts at the north end of the site and runs beyond the artifact deposits.

There are four main components to this site. First, there are five circular house constructions in a small embayment along the rim of the northern bedrock exposure. These rings are between 3-5 meters in maximum diameter and show dark, culturally-modified sediments inside and out. Three of the structures have upright, serviceable millingstones incorporated as foundation stones, and four structures have boulders with either pecked cupules or ground grooves associated with them. None of the structures appears to have been vandalized. The second component consists of various milling features present on both upper and lower bedrock exposures. Upper bedrock displays at least four clusters, and several other isolated, milling slicks and mortar depressions. Many of these are associated with houses but others are clearly not. In contrast, the lower bedrock exposure demonstrates six distinct threshing floors, each bounded by a thin, circular line of boulders/cobbles which probably served as a foundation for a brush windbreak or shade. The bedrock in this area is less intact than to the north, but each threshing floor still displays one central milling slick and many probably had two or more. Three of the threshing floors have associated milling implements. The third component is a a large (35 x 15 m) mound of dark, grass-covered midden southeast of the house cluster near the center of the site. This deposit is rich in charcoal, faunal material, and artifactual debris, and it appears to have been disturbed only by rodents. The character of this midden remains unknown, but it is probably 50 cm deep and perched on tuff bedrock. The fourth component is an extensive concentration of obsidian debitage located at the south end of the site. This spreads out over a flat expanse, covering an area of about 70 x 50 m, with artifact densities averaging 8-10 flakes per square meter. Ground stone is rare within this zone.

Both flaked and ground stone are well-represented at this site. Piece-plotting identified 16 flaked stone tools including five projectile points (three Elko Series, one Humboldt Basal-notched one Rose Spring), six bifaces, and five formed flake tools. There were 15 ground and battered stone tools, five handstones, six millingstones, three pieces of miscellaneous ground stone, and one battered

cobble. Counts of flaked stone debitage number well over one thousand, mainly obsidian but quartzite and cryptocrystalline are also represented. Other artifacts include seven pieces of Owens Valley Brownware pottery and two ground tuff discs. Surface collections recovered all five projectile points, five sherds, and both tuff artifacts. Controlled area collections were made in two locations, one near the midden (Area 1) and the other within the debitage concentration (Area 2). Each yielded 52 obsidian flakes, the Area 2 collection also yielding one simple flake tool. Excavation of a 1x1 m unit produced 76 obsidian flakes from Area 1 and 41 flakes and a simple flake tool from Area 2.

T23-A

This site was found near the southeastern margin of the Tableland about 800 meters west of Fish Slough Road. It is situated on sandy sediments within a rocky, undulating section of the plateau, tucked up against a low, elongate cliff to the east and bordering a small drainage to the west. The cultural deposit here covers an area of only about 15x15 m and includes one chert Cottonwood projectile point (collected) and scattered obsidian flakes. Surface collection of the entire site yielded the Cottonwood point and 28 obsidian flakes, and the excavation of a 1x1 m unit produced another 34 flakes. The deposit may be half a meter deep in some areas, but for the most part is shallow judging from the exposed bedrock observed in the drainage bordering the site.

T24-A

One of three sites discovered in Transect T-24, this is a small lithic scatter fronting the western margin of Fish Slough near its southern end. Situated on an alkali mudflat, T24-A is bordered to the east by marsh (reeds, cattails, and grasses) and to the west by the extensive, sandy terrace that runs north-south between the slough channel and Fish Slough Road. Surface artifacts are sparsely distributed over an area of about 60 x 30 m, the assemblage comprising mostly obsidian flakes, a few

cryptocrystalline flakes, two Elko Series projectile points (collected) and one obsidian biface. Surface collection of the entire site produced 45 obsidian flakes, and a 1x2 m excavation unit placed near the site center contributed 60 obsidian flakes.

T24-B

Site T24-B lies about 125 meters southeast of T24-A and is also situated on an alkali mudflat. Of moderate size (80 x 60 m), this artifact scatter is set a bit farther back from the marsh and is bordered both east and west by a number of low dunes a half meter in height. Accordingly, alkali buildup is a bit less developed than at site T24-A, occurring only on lower surfaces around the site. The majority of artifacts occurs within these areas, the full surface assemblage consisting mainly of obsidian flakes (and a few cryptocrystalline) with a few obsidian tools (two bifaces and one simple flake tool). Surface collection of a roughly 20 x 20 m area produced 49 obsidian flakes and two simple flake tools, and a 1x2 m excavation unit near the site center yielded one cryptocrystalline and 124 obsidian flakes.

T24-C

This is another lithic scatter on alkali mudlfats, located about 75 meters northeast of T24-B. It is bordered on the west by an old two-track road and on the south by two ephemeral drainages which run southeast from slightly higher dunes to the slough. Artifacts are distributed in a 30 x 20 m area and include mostly obsidian and a few cryptocrystalline flakes, one Elko Series projectile point (collected) and a simple flake tool, both of obsidian. Surface collections around the central datum produced 46 obsidian flakes, and excavation of a 1x1 m unit east of datum produced 23 obsidian flakes and a piece of ungulate tooth enamel.

T28-A (Enfield 5C-16)

At the far southwestern edge of the Tableland, T28-A is an extensive residential camp situated atop a narrow, north-south trending bench that is bounded on the west and east by tuff bedrock outcroppings. The western bedrock is fairly low (10-15 m) but steep cliff and talus slope; the eastern outcrop is a relatively flat but elongate exposure that slopes downward to the east. Cultural materials are spread across an area of about 120 x 50 m, artifacts relegated mainly to sandy sediments in between the bedrock exposures. The location and description of this site appear to correspond with Enfield site 5C-16, "RR Ledge Site" (no state trinomial).

Much like site T20-A, this location also contains a number of residential and milling features. At the north end of the site, three circular house rings are aligned roughly 10 meters apart. The southernmost house is adjacent to the bedrock talus slope, the others farther out toward the center of the bench. These constructions range between 3-5 meters in maximum diameter, each displaying carbon-stained interior sediments and associated lithic debris. Only the largest structure, the southernmost, has milling implements incorporated within its boulder ring. No cupules or grooves were observed on any of these features. Farther south, a semi-circular rock wall at the base of the talus slope may represent another house, but the remains of packrat nests and vegetation completely obscure the ground surface within its interior. Numerous milling features are present along the eastern bedrock exposure and among talus boulders on the west. Seven threshing floors were identified on the eastern bedrock, spread out along the entire perimeter of the site. All but one floor has at least one central slick and some kind of remnant rock foundation, the lone exception having lost its interior milling slick to exfoliation. Two of these features have milling implements associated with them. In contrast, milling features on the western bedrock, where there are no extensive flat surfaces, occur as mortars or slicks in clusters or as isolates. Three such features were recorded, one occurring mid-slope and overlooking the southernmost house structure.

The main artifact deposit is in the center of the site in between the houses on the north and the threshing floors on the east. Both flaked and ground stone implements are present. Flaked stone includes eight bifaces, two formed flake tools, and three simple flake tools (all obsidian). Ground stone consists of four handstones, three millingstones, and two battered cobbles. Debitage is mainly obsidian but cryptocrystalline, basalt, quartz, and quartzite are also present. Surface flakes probably total several hundred pieces in all, being concentrated in a 20 x 20 m zone between the site center (datum) and the southernmost house ring. Surface collections yielded 48 obsidian flakes, one biface and two simple flake tools (both obsidian), and a 1x1 m excavation produced 140 obsidian flakes.

T30-A

There is substantial prehistoric and historic debris at site T30-A, which is situated at the extreme southeast edge of the Tableland on a low, broad terrace overlooking Chalk Bluff Road. An exposure of granitic cobbles borders the site on the west, and a gradual slope continues downward to the intersection of Casa Diablo and Chalk Bluff Roads on the east. Three well-used dirt tracks cross the site, all intersecting at various locations. The least-used route courses north-south through the site and directly bisects the historic deposit. Prehistoric materials cover an area 180 x 150 m, much larger than that encompassed by historic debris (180 x 90 m). Concentrations of prehistoric debris occur in the southern and eastern parts of the site, while historic refuse is found mainly to the west. These distributions and other indicators together imply that the two deposits are temporally distinct and do not reflect a single, protohistoric occupation.

Historic use of the site appears to have been residential. Two collapsed wooden shacks lie west of the north-south road through the site, milled wood planks covering rectangular areas of 10 x 10 m and 10 x 20 m, respectively. There is no evidence of any structure east of the road. Both downed shacks are surrounded by house debris (stove parts, cans, glass, crockery, bed or couch

springs) and some less common objects were found east of the road (an alarm clock body, glass and shell buttons, light bulb base, Levi-Strauss button, shoe, metal baking pan). Glass shards represent a wide variety of colors (amethyst, deep purple, red, brown, amber, forest green, olive green, aqua, cobalt blue, white opaque, clear), and there is an array of metal containers (oil, milk, tobacco, spice, sardine, coffee, maple syrup, baking powder). Ceramics include white porcelain, white china with blue designs, white china with gold paint, earthenware, and crockery. Other objects include small and large metal pails, bowls, plates, tubs, and pots, window screen, galvanized sheet metal, metal hoops and bands, hinges, barbed wire, battery cores, and various bits of rubber and wire.

Prehistoric use of the site may have involved two separate occupations. There is a light midden surrounding the site datum, east of the road and near the center of the larger prehistoric deposit. The tool assemblage in this area is evenly divided between flaked and ground stone (10 and 11 tools each). Flaked stone tools are all obsidian, including three Elko Series projectile points (two possibly Elko Side-notched), five bifaces, and three formed flake tools. Milling tools include four handstones, five millingstones, and two pieces of miscellaneous ground stone. A second concentration of prehistoric debris occurs outside the midden in the southeast quarter of the site. Flaked stone artifacts are dominant here, consisting of two projectile points (one Great Basin Concave-base and one Humboldt Concave-base [collected]), seven bifaces, and three simple flake tools (all obsidian). Three other formed artifacts were found in this area, one millingstone, one piece of miscellaneous ground stone, and a small clay sphere. Flaked stone debitage around the site is exclusively obsidian and mostly quite small (2-3 cm diameter).

Two separate areas were surface collected for debitage, one in the midden and one in the southeast concentration. Some 39 flakes were obtained from the former and 50 flakes from the latter. A 1x1 m excavation in the midden produced only 13 obsidian flakes, but a 1x1 m unit in the southeast concentration yielded 66 obsidian flakes.

T30-B

This is an extensive, elongate deposit of flaked and ground stone artifacts that begins approximately 250 meters west of T30-A and runs along the southernmost edge of the Tableland high above Chalk Bluff Road. Artifact deposits at T30-A were found to span a length of nearly 600 meters but varied considerably in surface density. The densest part of the site measures roughly 250 x 90 m and contains projectile points, bifaces, formed and simple flake tools, drills, debitage, handstones, millingstones, and battered cobbles. These materials are spread thinly across this area but do occur in two distinct concentrations (Loci 1 and 2). Locus 1 covers a 15 x 15 m area in the northeastern part of the denser deposit and consists mainly of obsidian debitage. To the south, Locus 2 is much larger (150 x 45 m) and more diverse including debitage, a range of milling implements, substantial quantities of burnt rock, and two rock features. One rock feature is a cluster of milling tools containing eight tuff millingstone fragments and a granitic handstone. The other feature is a low mound of about 40 burnt rocks, charcoal, and burnt soil about 1x1 m in diameter. Given it is much more intact than other surface debris at the site, this feature may be of historic or modern origin. Surfaces between the two loci showed a light but continuous scatters of artifacts that included one obsidian biface, one simple flake tool, and a millingstone.

Formed artifacts at Locus 1 include just three pieces of flaked stone, one biface and two simple flake tools. Unmodified debitage is exclusively obsidian, of which surface collection efforts produced 48 pieces. A 1x1m excavation unit near the Locus 1 datum (site datum prime) produced 54 obsidian flakes. At Locus 2, both flaked and ground stone tools are represented. An incomplete count showed eight projectile points, nine bifaces, one each formed and simple flake tool, one drill, two handstones, 14 millingstones, and one battered cobble. All projectile points were collected, these including one Great Basin Concave-base, one Great Basin Stemmed, two Elko, one possible Humboldt Basal-notched, one large side-notched, and two untypable dart points. Surface debitage was

collected from the center of Locus 2 (51 obsidian flakes), and a 1x1 m excavation unit near the locus datum produced one of the Elko points and 85 obsidian flakes.

OVERALL SURVEY RESULTS AND COMPARISONS

Intensive surface surveys at the Slough (19.3 sq km) and on the Plateau (8.2 sq km) identified a combined total of 51 sites and 373 isolates. Site densities averaged 1.8 per sq km at the Slough and 2.2/sq km on the Plateau, with isolate frequencies averaging 8.3 per sq km at the Slough and 25.9 per sq km in Plateau transects. Both surveys found an abundance of sites along the margins of Fish Slough, densities dropping with distance from it. In contrast, isolates appear more concentrated in parts of the Plateau, being three times as abundant there than at the Slough. These figures, though not drastically opposed, are somewhat curious. The consistency in site densities may not be that surprising, given that some of the Fish Slough survey traversed sections of plateau terrain. On the other hand, land surfaces within the Fish Slough valley are radically different than anywhere else on the Tableland, not only in terms of their depositional history but in the abundance and variety of subsistence resources they support. For this reason we might expect site density figures to vary substantially, many more sites being present at the Slough. From this perspective, isolate frequency should actually be higher at the Slough if it really was an important resource base for prehistoric occupation. Clearly we need to examine differences between the Slough and Plateau more carefully if we are to recognize any landscape-specific trends in human use of the Tableland.

Site Densities on the Volcanic Tableland

To more effectively estimate site densities at Fish Slough, a distinction must be made between portions of Slough transects that occupy "valley floor" surfaces and those that cover "plateau" terrain.

Some Slough transects did fall entirely on plateau terrain (Transect FS-2, FS-4), while nearly all others covered portions of the plateau on both west and east sides of the valley. Along these same lines, it is also important to ignore landscapes that cannot realistically support archaeological deposits (assuming continuity throughout occupational history). This is of particular concern at Fish Slough, where large sections of several transects crossed marshy areas that are submerged in water during all or much of the year and could not be traversed. It is also pertinent to the Plateau, however, where many rough, rocky expanses cannot support aboriginal use beyond petroglyph production and milling activity. In this sense, it is useful to estimate the total useable land surface within survey transects at the slough and on the plateau, if only to arrive at site density estimates that better depict relative levels of prehistoric use.

Using project transect maps, USGS quad maps, and aerial photographs, it was possible to factor out portions of Slough transects that either covered plateau margins or crossed over "non-useable " land surfaces where archaeological sites cannot realistically exist. Estimates of "useable" land surface are thus configured for the 11 transects that cross the valley floor (Table 5.5). As shown, in most cases actual surface area within the valley (not on plateau edges or in submerged areas) is quite low, save for the central portion of the slough corridor crossed by transects FS-12 through FS-16. Exceptions are transects FS-6 and FS-8, which are unaffected by the slough drainage, and transects FS-24 and FS-26 which cross Fish Slough at a point where the drainage is so narrow (only about 25 m across) as not to affect area estimates. A conservative estimate shows that the total area of Fish Slough valley that could be expected to reveal archaeological sites is extremely limited (6.55 sq km) in contrast to the total area covered by full valley transects (16.3 sq km). With these exclusions, the site total for useable area at the Slough drops from 33 to 25.

To be fair, not all surfaces on the Plateau are suitable for habitation either. Many places are extremely rocky, consisting purely of boulder talus or cobble fields, while others are sandy and steep.

Table 5.5. Estimates of useable land surface within the Fish Slough valley.

Transect	Total Area (sq km)	Area in Valley	Area in Slough	Useable Area	Sites in Valley
FS-6	1.50	0.50	-	0.50	-
FS-8	1.50	0.75	-	0.75	1
FS-10	1.50	0.75	0.25	0.50	3
FS-12	1.50	0.75	0.40	0.35	4
FS-14	2.00	1.75	0.35	1.40	3
FS-16	2.00	1.00	0.15	0.85	4
FS-18	2.00	0.75	0.20	0.55	4
FS-20	1.50	0.50	0.20	0.30	2
FS-22	1.50	0.50	0.15	0.35	2
FS-24	1.50	0.50	-*	0.50	-
FS-26	1.50	0.50	-*	0.50	2
Total	18.0	8.25	1.7	6.55	25

Note: * indicates transects where the drainage is too narrow to affect area estimates.

Unfortunately, there is no easy way to estimate total useable surface area within plateau transects, as most units were highly variable in surface topography. A first adjustment can be made by ignoring plateau transects placed at Fish Slough to compare the effects of variation in survey spacing. This drops out the east halves of Transects T-18 and T-23 and all of Transects T-19 and T-24 (0.45 sq km total), cutting overall survey coverage to 7.75 sq km actually on Plateau surfaces. Next, there are innumerable rock outcroppings and cobble fields on the Plateau but particular areas contain very extensive rocky surfaces. Areas of extremely rocky composition were crossed by Transects T-6 and T-10 in the Chidago Canyon area, and T-21, T-22, T-23, T-26, and T-27 in the southern part of the Plateau. Exposed bedrock is prevalent in Transects T-6 and T-10 in the form of cliffs, talus slopes, and broad, undulating terraces, while extensive fields of tightly packed cobbles are common to more southern reaches. Rocky surfaces and cobbles were obviously important to native occupants for a

variety of uses, particularly in vegetal processing, but one could argue that expanses of bedrock, cliffs, talus slopes, and dense cobble fields constitute essentially "non-useable" space for aboriginal occupation, just as do water-covered areas at Fish Slough. From this standpoint, the total area encompassed by these surfaces should be ignored in developing site and isolate density estimates for the Plateau. Transect maps, which contain information about changes in land surfaces and slope, indicate that the total non-useable surface in plateau transects amounts to about 2-3 full transect lengths, or around 0.6-0.9 sq km. Splitting the difference, this equates to 0.75 sq km, which if deducted from the total Plateau survey area (7.75 sq m) produces a round estimate of 7.0 sq km in total useable surface area. A total of 14 survey sites exists within the revised Plateau area.

Armed with these figures, site densities for the Slough and Plateau can be recalculated. At the Slough (within the actual Fish Slough valley) some 25 sites were identified within an area of 6.55 sq km of useable land surface, occurring at an average of 3.8 per sq km. This basic figure is nearly double the unadjusted average (1.8/sq km), presenting a much different picture than the one offered earlier. On the Plateau, a total of 14 sites was identified in a useable area of 7.0 sq km, the average dropping slightly to 2.0 sites/sq km from the previous unadjusted figure of 2.2/sq km. These computations show that sites are nearly twice as abundant at the Slough than on the Plateau. However, we can also add three sites to the Slough total, new sites found at Fish Slough during the Plateau survey (T24-A, T24-B, T24-C). This brings the total number of sites in useable area at the Slough up to 28 and the site average to 4.3 per sq km. Conversely, we may also add all "plateau" terrain covered during the Slough survey (12.75 sq km) to the Plateau area figure and add the 8 sites found to the Plateau site total. This raises the total Plateau area surveyed to 19.75 sq km and the site total to 22, an average of 1.1 sites per sq km. These revised figures clearly reflect the on-the-ground differences in the density of sites at the Slough and Plateau.

Comparisons with Meighan and Enfield Surveys

The above density calculations correspond fairly well with figures provided by Meighan (1955) and those generated from Enfield records. At Chidago Canyon, Meighan claims to have identified 36 sites within an area estimated to be about 7.0 sq miles, at an average of 5.0 sites per sq mile (Meighan 1955:7). However, plots of Meighan's sites on available BLM maps indicate that five sites (within a 1.0 sq km area) are actually in Chalfant Valley and not on the Tableland at all (MNO-48, -49, -50, -51, and -52). Adjusting Meighan's figures accordingly (31 sites within 11.3 sq km), the average drops to 2.7 sites per sq km, comparing favorably with the average of 1.11 sites per sq km for all Plateau terrain surveyed. As for the Enfields, they recorded well over 150 sites on the Tableland, of which 149 had sufficient provenience and constituent information for these comparisons (see Table 5.1, above). Across the entire province (32 x 20 km), Enfield sites occur at an average of 4.3 per sq km, a figure higher than Meighan's for Chidago Canyon but exactly equal to the present results from Fish Slough. However, only ten Enfield sites lie within the Fish Slough valley. Using the area total for the Slough devised earlier (6.55 sq km), this works out to only 1.5 sites per sq km. This discrepancy exposes the Enfield bias toward large sites at rock outcrops or with obvious rock constructions, and highlights the fact that most Fish Slough sites are small, less visible artifact scatters. The same can probably be said for Meighan's surveys, as he notes that the "...stone construction of house circles and blinds" was an abundant trait at Chidago Canyon sites (Meighan 1955:14). Added to the fact that many of my transects on the plateau lay across broad, sandy stretches lacking any rock formations, it would seem that differences in site frequencies resulting from the various Tableland surveys probably relate more to the kinds of sites being targeted and the landforms investigated than to any real variations in site densities across sections of the plateau. Fish Slough still provides a strong contrast, containing many more prehistoric sites on average than any part of the Tableland.

Site Typology for the Volcanic Tableland

Considering the traits and constituents of Tableland sites, it is possible to develop a simple site typology for the project region. The goal here is to generate a classification scheme than can serve to differentiate between sites of varying size, general structure, and content, without employing strict metric parameters, extensive trait lists, or relying strictly on assumptions about site function. There are, however, a few assumptions kept here that pertain to the use of different rock constructions on the Volcanic Tableland, as these features must figure into the proposed site typology. As described earlier in Chapter Two, and as Delacorte (1995a) has pointed out, stacked rock constructions on the Tableland consist essentially of three kinds: (a) "house structures" are large, semi-circular to complete rings of high, carefully stacked boulders on sandy sediments; (b) "threshing floors" are smaller, semi-circular alignments of low, loosely arranged cobbles on exposed bedrock, almost always enclosing bedrock milling surfaces (slicks or mortars); (c) "walls" or "windbreaks" are linear arrangements of boulders or cobbles, either freestanding or extending outward from bedrock outcrops.

Sites displaying these constructions have obvious functional connotations. Those with house structures are considered to be residential locations where a variety of resource processing and equipment maintenance activities were pursued. The presence of threshing floors reflects the bulk-processing of vegetal matter, either of extended duration or on repeated occasions, that mandated some investment in the construction of a sun/wind shelter. Bedrock milling slicks and mortars without rock constructions are viewed in much the same light, though some of these may represent less intensive processing. Walls and windbreaks are more difficult to interpret, but these are perceived as related to domestic activities other than seed or nut milling. Even though the proposed typology deals with these rock constructions qualitatively, their functional implications are important in considering the distributions of different site types across the project area.

Any site typology should be based on a set of attribute criteria developed from sites that have been formally investigated. This ensures that each site used to create the classification has been thoroughly examined to determine the presence or absence of each selected attribute. For the present, it is possible to consider all 23 Tableland sites that have been systematically examined, and to use Enfield and my survey records as background data. Upon review, there appear to be five different kinds of sites in the study area:

Type 1: Low- to moderate-density scatters of flaked stone debris with few or no ground stone artifacts.

Type 2: Moderate to heavy accumulations of flaked and ground stone debris, often with bedrock milling slicks or mortars, but lacking both middens and stacked rock constructions (e.g., house rings or threshing floors).

Type 3: Moderate to heavy concentrations of flaked and ground stone debris with middens, rock constructions, or both.

Type 4: Isolated milling loci, with portable or bedrock facilities and ground stone debris, containing few or no flaked stone artifacts.

Type 5: Isolated, non-milling rock constructions (house rings, blinds, walls) with or without low-density scatters of flaked stone debris.

Table 5.6 presents artifact inventories and attributes for the 23 investigated sites. Only Type 5 sites are not represented in this group, the existence of this type ascertained solely from survey records. As expected, there are some important differences between the four site type categories represented. Class richness increases dramatically from Type 1 to Type 3 sites, being at least partly a function of burgeoning sample size. However, in some cases assemblage richness increases from Type 1 to Type 3 sites while sample size remains consistent (e.g., FS22B-1 versus MNO-2381 or FS18D-1 versus INY-399). This implies that the addition of artifact types and/or other attributes is not strictly a function of sample size. Without calculating diversity indexes or chi-square residuals, several patterns

in artifact/attribute distributions are immediately obvious. Of all artifact types, debitage is of greatest significance to all site categories. Excluding this class, flaked stone tools assume relatively more importance at Type 1 sites and ground stone tools have greater significance to Type 2 sites, though flaked stone generally dominates at all sites. Drills, cores, beads, and ceramics are limited primarily to Type 3 sites, while middens, rock structures, and bedrock facilities occur exclusively at Type 3 locations. The basic implications of these distinctions are threefold: 1) that Tableland sites can be easily segregated into distinct groups based on attribute data; 2) that the addition of artifact types and attributes may reflect increased complexity and functional variability, not merely sample size increase; and 3) that specific artifact forms and features are more characteristic of Type 3 sites than of Type 1 or Type 2 sites.

This classification can be compared with functional settlement taxonomies developed by Bettinger (1982) for the Owens Valley and and Delacorte (1990) for Deep Springs Valley. According to published descriptions, current Type 1 sites appear to correspond with "desert scrub temporary camps" (Bettinger 1982) or "lowland temporary camps" (Delacorte 1990), sites which are normally restricted to Desert Scrub or lakeshore vegetation communities. On the Tableland these sites reflect brief encampments occupied by a few to several individuals which provide evidence that flaked stone tools were maintained and occasionally replaced. Type 2 sites are temporary camps as well, perhaps akin to Bettinger's (1982:52) "riparian temporary camps" or the "seed camps" described by Delacorte (1990:224), though occurring in slightly different environments. These appear less task-specific than Type 1 sites, perhaps representing brief stopovers by complete family groups for tool refitting and vegetal procurement. Clearly, though, Type 2 sites are not restricted to marshy or riverine environments as implied by Bettinger (see below). Type 3 sites are essentially akin to "lowland occupation sites". The presence of middens and/or structures, along with a large number and wide range of artifacts, imply some duration of occupation and a variety of domestic tasks. Sites of this type

TABLE 5.6. Artifact assemblages and select attributes by site type for all formally investigated locations in the study area.

	PRJ	BIF	FKT	DRL	COR	DEB	MIL	HND	COB	BED	SHE	MID	RSH	RRG	THR	Size	Rich
Type 1 (6)																	
FS18C-1	2	2	-	-	-	42	-	-	-	-	-	-	-	-	-	44	3
FS18C-2	1	3	2	-	-	214	-	-	-	-	-	-	-	-	-	220	4
FS18D-1	-	4	9	-	1	1121	-	-	-	-	-	-	-	-	-	1135	4
FS20C-1	-	2	6	-	-	292	-	-	-	-	-	-	-	-	-	300	3
FS22B-1	1	1	8	-	-	156	-	-	-	-	-	-	-	-	-	166	4
FS22C-1	3	1	4	-	-	76	-	-	-	-	-	-	-	-	-	84	4
Total	7	13	29	-	1	1901	-	-	-	-	-	-	-	-	-	na	na
Type 2 (5)																	
MNO-2464	12	28	34	-	2	2282	11	10	2	-	-	-	-	-	-	2381	8
FS10A-2	2	-	3	-	-	82	4	1	-	-	-	-	-	-	-	92	5
FS14C-2	6	11	17	-	-	1111	1	4	2	2	-	-	-	-	-	1154	8
FS18C-3	2	2	3	-	-	36	12*	7*	2*	-	-	-	-	-	-	64	7
FS26B-1	5	3	5	1	-	1713	4	1	-	-	-	-	-	-	-	1732	7
Total	27	44	62	1	2	5224	32	23	6	2	-	-	-	-	-	na	na
Type 3 (11)																	
INY-399	2	10	7	-	-	1050	11	4	7	-	-	+	+	-	-	1091	9
MNO-1992	72	181	200	10	9	29451	14	51	10	8	12	+	-	+	+	30018	14
MNO-2189	33	97	103	5	13	15288	13	19	22	8	37	+	-	+	-	15638	13
MNO-2190	116	354	281	10	25	17227	75	202	185	8	78	+	-	+	+	18561	14
MNO-2381	10	10	24	-	-	124	1	2	1	2	6	+	+	-	-	180	11
MNO-2465	48	113	264	7	1	8895	82	43	36	7	7	+	-	+	+	9503	14
"533"	6	31	10	-	-	4106	7	7	-	1	-	+	-	-	-	4168	8
FS10B-2	56	84	85	-	-	17053	8	12	2	7	-	+	-	-	-	17307	9
FS12C-2	4	2	7	1	-	49	2*	5*	2*	-	5	+	-	-	+	77	11
FS14C-1	20	43	32	2	-	3111	2	8	1	4	-	+	-	-	-	3223	10
FS14D-1	29	58	46	2	2	16060	-	4	2	9	2	+	+	-	-	16214	12
Total	396	983	1059	37	450	112414	213	352	266	54	147	11	3	4	4	na	na
Type 4 (1)																	
FS4C-1	-	1	1	-	-	8	2*	2*	1*	-	-	-	-	-	+	15	7

Note: PRJ, projectile point; BIF, biface; FKT, formed or simple flake tool; DRL, drill; COR, core or core tool; DEB, debitage; MIL, millingstone; HND, handstone; COB, cobble tool; BED, bead; SHE, sherd; MID, midden; RSH, rockshelter; RRG, rock ring; THR, threshing floor; Size, sample size; Rich, class richness; +, attribute present. * Denotes items observed but not collected.

were probably inhabited for one to a few weeks' time and may have supported one or two small family groups. Type 4 and Type 5 sites probably fit within the broader rubric of "special use sites" (Bettinger 1982:53) but do not find direct correlates in the Owens Valley or Deep Springs taxonomies.

The current site categories also compare favorably with site types outlined in Binford's (1980) forager-collector scheme. Type 1 sites are similar to *forager residential bases*. These are true temporary camps where few artifacts were left behind, perhaps only a few broken tools and some debitage. Shackley (1990:23) likens these sites to modern backpacker camps that may be occupied only once and very briefly. Type 2 sites, and perhaps Type 4 sites as well, are similar to Binford's *collector field camps*. These are places where collectors established temporary camps beyond the daily foraging radius for task-specific purposes (hunting, processing plant foods, etc.). Shackley (1990:24) suggests that such sites are usually smaller than collector *residential bases* (see below), have less developed middens, and are situated near "unique or specialized resource locations" (like Fish Slough). He notes that field camps are often reoccupied and may eventually resemble residential bases, but that they still tend to have more limited activity sets. Type 3 sites are comparable to *collector residential bases*, having well-developed middens, high artifact densities, and showing evidence of intensive milling activity and tool manufacturing. Other behaviors often carried out at seasonal collector residences, such as food storage or human burial, do not seem to have occurred at Type 3 sites on the Tableland. This presumably relates to the lack of a resident population on the Tableland, a fact that may have related directly to the overall paucity of the area's resource base. In fact, Type 3 sites sites do not appear to have been long-term seasonal villages occupied by semi-sedentary groups; instead, they were established for shorter intervals to take advantage of food resources that became available for brief periods during certain seasons. On the Tableland, grass seeds were probably targeted from residential bases during the spring and early summer, while slough resources may have been the focus during the fall and winter. Finally, Type 5 sites can be viewed as

a variant of Binford's (1980:9) *stations*. Isolated rock walls may have served as hunting blinds, while solitary house rings may have been occupied during forays to monitor game movements.

Other kinds of sites identified by Binford (1980) have not been identified on the Tableland. Conspicuously absent are forager and collector *locations*, sites where resource extraction tasks were carried out (e.g., isolated roasting pits, lithic procurement sites, and pinyon gathering areas). Locations related to the presence of specific natural resources, like toolstone or pinyon pine, are unlikely to be found on the Tableland because such resources do not exist there. Sites like isolate roasting pits, though not identified during my surveys, were probably ignored during Enfield and Meighan surveys and probably do occur on the Tableland. As Shackley (1990:23) notes, locations can also be represented by isolate tools and may be "essentially invisible", even indistinguishable from episodes of artifact loss. Many isolates found during my surveys could represent locations, especially those found at Fish Slough where there was a variety of resources to be had.

The next task is to apply the site taxonomy to the current data set. As it turns out, all 196 known sites on the Tableland place easily into the five site categories (Table 5.7). Most are Type 3 sites (n=103), with Type 1 and Type 4 sites being common (31 and 32 apiece), Type 2 sites a bit less so (28), and Type 5 sites represented by just two examples. Differences in frequencies of site types, however, may be a result of variability in site visibility. Certainly, the prevalence of Type 3 sites relates in part to their greater visibility, having obvious middens and/or rock structures. The scarcity of Type 5 sites, in contrast, may be a true phenomenon, given that they are conspicuous and easily spotted by surveyors. We might also expect that Type 1 and Type 2 sites should be less common because they are less visible than other sites, but this is not really the case. Type 1 and 2 sites are just as abundant as more obvious Type 4 sites. It would appear, then, that frequencies of site types are not overwhelmingly biased by site visibility.

TABLE 5.7. All study sites by project and type.

	Type 1	Type 2	Type 3	Type 4	Type 5	Total
Enfield	12	19	85	26	1	143
1987-89 Excavations*	-	1	6	-	-	7
1993 UCD (Slough)	11	6	6	6	-	29
1997 CSUS (Plateau)	8	2	6	-	1	17
TOTAL	31	28	103	32	2	196

Note: UCD, University of California, Davis; CSUS, California State University, Sacramento. * Includes sites discussed by Basgall and Giambastiani (1995) and site MNO-2381 (Nelson 1999).

Looking at individual survey projects, however, some biases do emerge that relate to methodology. For instance, Enfield surveys found a lot of Type 3 locations (nearly 60% of all sites) while other surveys found relatively few, this class accounting for only 21% and 35% of sites on slough and plateau surveys, respectively (see Table 5.7). The Enfield bias is also demonstrated by a scarcity of Type 1 sites (8%), whereas both current surveys found these sites rather abundant (38% and 47% each). As Enfield survey biases have been discussed earlier in this chapter and in other contexts (see Giambastiani 1996), suffice it to say that more recent surveys are truer barometers of site type frequencies than the Enfield work. In the case of the 1993 survey, however, this conclusion is tempered a bit by locational bias; this work was essentially restricted to the Fish Slough valley while Enfield surveys were not (see below).

Site Types and Distributions on the Volcanic Tableland

Ignoring for the moment any inherent survey biases, the present site typology can be used to expose gross spatial patterning in site distributions on the Tableland. To do this we can divide the study area into four essentially equal areas. In Figure 5.3, the Tableland is sectioned into quadrants

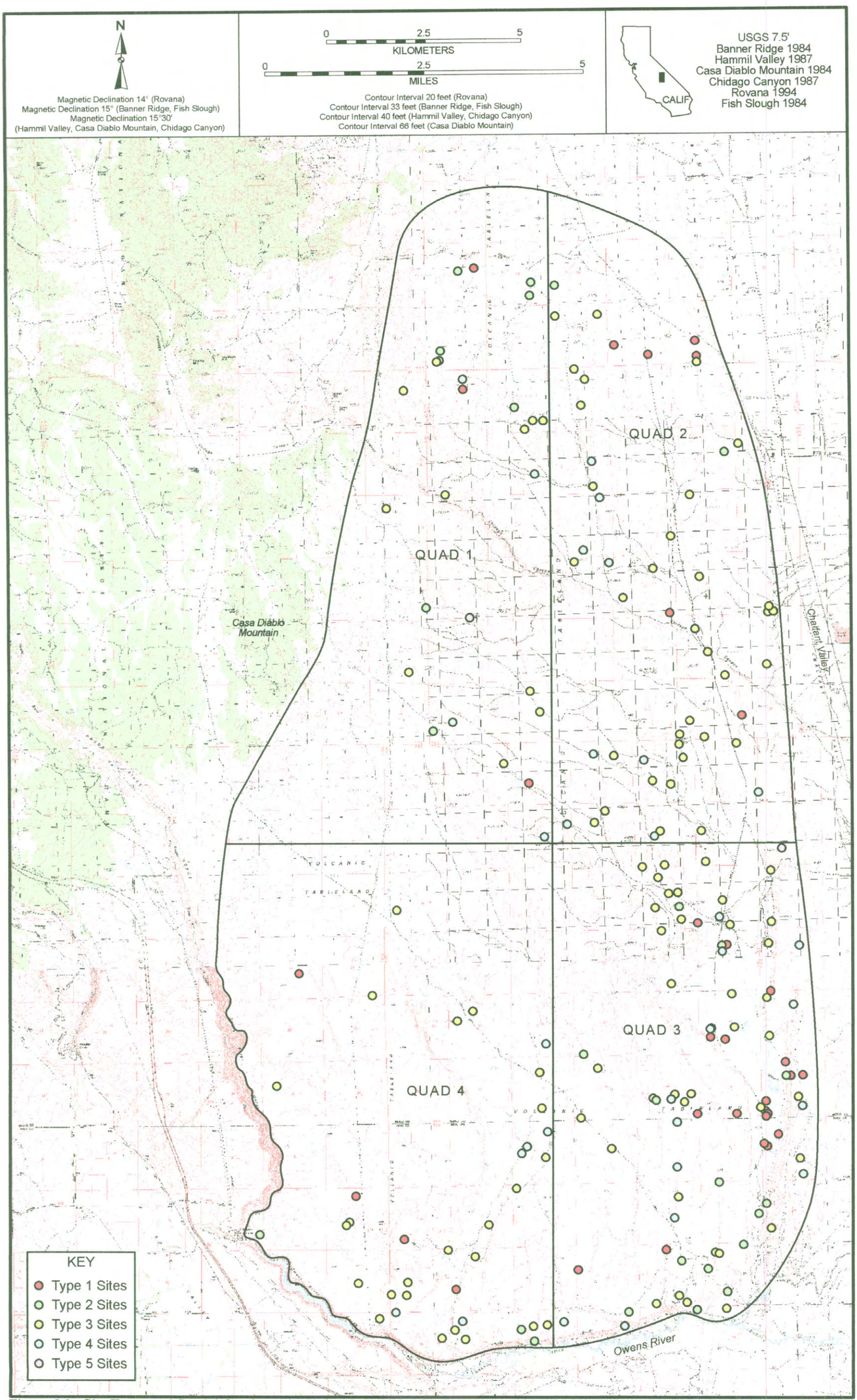

Figure 5.3. Site Types and Spatial Quads on the Volcanic Tableland

at an arbitrary point: the intersection of the T5S latitude and the R32E longitude parallels on the Benton Range Quadrangle, California-Nevada 1:100,000 Scale Planimetric Map, or the intersection of Sections 9, 10, 16 and 15 (between UTM coordinates 4153000-4154000 mN/371000-372000 mE) on the USGS White Mtn. Peak Quadrangle, California 15-Minute Topographic Map. Labeled Quad 1-4 in a clockwise fashion beginning in the northwest, each area encompasses between ca. 53-64 sq km (33-40 square miles): Quad 1, ca. 60 sq km; Quad 2, ca. 63 sq km; Quad 3, ca. 53 sq km; Quad 4, ca. 64 sq km. Though not exactly the same, the four units are near enough in total area for spatial comparisons. Topographically, Quad 1 includes the lower, east slope of Casa Diablo Mountain below the pinyon-juniper belt and the upper reaches of Red Rock and Chidago Canyons; Quad 2 contains the lower reaches of Red Rock and Chidago Canyons and terminates on the east in fairly tall, steep cliffs above Hammil and Chalfant Valleys; Quad 3 includes all of the Fish Slough drainage, its formidable eastern fault scarp, and, at its southern end, steep cliffs which overlook the meandering Owens River; Quad 4 is bounded on the west by the Owens River Gorge, to the south by cliffs and the Owens River, and encompasses more flat plateau terrain than any other quadrant.

Table 5.8 presents totals for the four arbitrary quadrants by survey project, with the six sites tested in 1987-89 included in the Enfield category (all were originally recorded by them) as well as site MNO-2381 (Nelson 1999). Quad 3 contains by far the most sites (n=82), nearly half of all known locations (41.8%), followed by Quad 2 (26.0%), Quad 4 (19.4%), and Quad 1 (12.8%). Holding each quad as roughly the same size, the density of sites per quad is easily calculated and varies in the same order: Quad 3, 1.5 sites/sq km; Quad 2, 0.8/sq km; Quad 4, 0.6/sq km; Quad 1, 0.4/sq km. While it is impossible to estimate Enfield survey coverage within each quadrant, we may divide areal coverage for the plateau survey by quadrant to cross-check site density approximations. Recalling that the 29 Plateau transects totaled 8.2 sq km in area and held 18 sites, the geographic layout of transects is such that areal coverage, adjusted sites/sq km totals, and averages for the four quadrants are:

Quad	Sites	Area Surveyed (sq km)	Sites/Sq Km
1	6	2.47	2.4
2	2	1.73	1.2
3	5	1.68	3.0
4	5	2.32	2.2

Adjusted figures for Quads 1, 2, and 4 are in rough agreement with the average calculated earlier for the plateau as a whole (1.1 sites/sq km), and the figure for Quad 3 approximates that already determined for the Fish Slough valley alone (4.3 sites/sq km). It is also evident, however, that Quad 2 is deficient in sites as compared to other portions of the Plateau.

Even though the frequency of sites in Quad 3 is exaggerated by the results of the slough survey, there is no doubt that this quadrant was the most heavily used by aboriginal people. A large fraction of Enfield sites (33%) is located in Quad 3, and combined site distributions from all surveys indicate plenty of sites on Quad 3 plateau surfaces away from the slough corridor (Figure 5.6). Thus, there must be other factors conditioning a focus of activity in this part of the Tableland. In one sense, we should expect to find more sites in Quad 3 given the high density and diversity of subsistence resources at Fish Slough. As discussed in Chapter Two, and also by Nelson (1999), potable water and plant and animal foods are available year-round at the Slough while few resources exist on the Plateau other than seeds and rodents during spring and early summer. It is easy, then, to envision the slough as a magnet location throughout the Holocene, where visitors on long-range subsistence forays could stop to replenish supplies of water and food. There seems to be ample evidence that this did occur, slough margins having been occupied repeatedly for a number of different purposes and for variable lengths of time.

By comparison, subsistence resources are more uniformly distributed across the remainder of the Tableland. Seed grasses were certainly the primary attraction for human use, though attendant fauna and migratory herd animals were also obtainable in certain seasons. If plateau environments are essentially homogenous in terms of resource potential, it is logical that site frequencies should be

Table 5.8. All study sites by spatial quad, survey project, and type.

	Type 1	Type 2	Type 3	Type 4	Type 5	Total
QUAD 1	3 (12%)	8 (32%)	9 (36%)	4 (16%)	1 (4%)	25
Enfield	1	7	7	4	-	19
Plateau	2	1	2	-	1	6
QUAD 2	6 (12%)	2 (4%)	34 (66%)	9 (18%)	-	51
Enfield	5	2	33	8	-	48
Slough	-	-	-	1	-	1
Plateau	1	-	1	-	-	2
QUAD 3	19 (23%)	14 (17%)	35 (43%)	13 (16%)	1 (1%)	82
Enfield	3	9	29	8	1	50
Slough	12	5	6	5	-	28
Plateau	4	1	-	-	-	5
QUAD 4	4 (10%)	3 (8%)	25 (66%)	6 (16%)	-	38
Enfield	3	2	22	6	-	33
Plateau	1	1	3	-	-	5
TOTAL	32 (16%)	27(14%)	103 (53%)	32 (16%)	2 (1%)	196

fairly even in Quads 1, 2, and 4. It has been shown already that Quad 2 is lacking in sites per sq km, as indicated by plateau transect results. Considering raw site totals for all surveys, however, Quad 1 has the notable deficiency (Table 5.8). Unlike the lack of sites in Quad 2, this pattern is probably not significant for two reasons. First, Quad 1 contains the most drastic topographic relief of any quadrant, ranging between 4960-6200 feet east-west (a difference of 1240 feet) across a distance of about three miles (~ 400 feet per mile). Many land surfaces throughout Quad 1 are steep enough that occupation for any length of time would be cumbersome, requiring lots of difficult traverses during daily routines. The relative instability of deep, loose alluvium throughout the quadrant has also inhibited plant growth, particularly of seed grasses like *Oryzopsis*, and there are few rock outcrops affording shelter or natural rainfall catchments to attract people or animals. Portions of Quad 1 are not far from

productive pinyon groves on Casa Diablo Mountain (above 7000 feet elevation, less than a mile to the west), but the scarcity of sites implies that Quad 1 was somewhat less important to human occupation.

Second, Enfield sites are clearly underrepresented in Quad 1. The Enfields probably faced certain logistical difficulties in accessing portions of the Tableland, particularly sections of Quad 1. Other quadrants contain major and minor roads (see Figure 5.3), but the far southwest corner of Quad 1 and the west end of Quad 4 were probably the most difficult to reach by motorized vehicle. The north-south powerline road that now cuts through Quads 1 and 4, from Chidago Flat to Pleasant Valley Campground, did not exist during the heyday of Enfield surveys (1960s - 1970s). This is demonstrated in the layout of Enfield sites in Quads 1 and 4 (Figures 5.4, 5.7), many sites being aligned along other roads but none along the powerline. Evidently, vast portions of Quad 1 were left unexplored by the Enfields, perhaps due to limited vehicle access.

Beyond raw site counts, frequencies of site types in each quadrant are better indicators of basic patterns of land-use across the Tableland. In Table 5.8 (above), site totals are provided by type according to the four spatial quadrants. In general, sites of each type are most abundant in Quad 3, an expected outcome given the preponderance of sites in that quadrant. However, type frequencies vary significantly within each quadrant. Type 1 sites are uncommon in all quads save Quad 3, where they account for more than a fifth of all sites. Type 2 sites are predisposed to Quad 1, making up nearly one-third of all sites there, but are exceedingly rare in Quads 2 and 4. All areas have an abundance of Type 3 sites, but such deposits are most prevalent in Quads 2 and 4. Type 4 sites are equally represented in all quadrants; Type 5 sites are too few to reflect any meaningful patterns. Overall, Quads 2 and 4 show the most lopsided distributions, each with mostly Type 3 sites, while Quads 1 and 3 show more balanced portions of site types. All else equal, these patterns reflect a prevalence of short-term occupations on the Tableland but with some basic occupational differences between quadrants. The Fish Slough area (Quad 3) hosts a greater number of temporary camps (Type

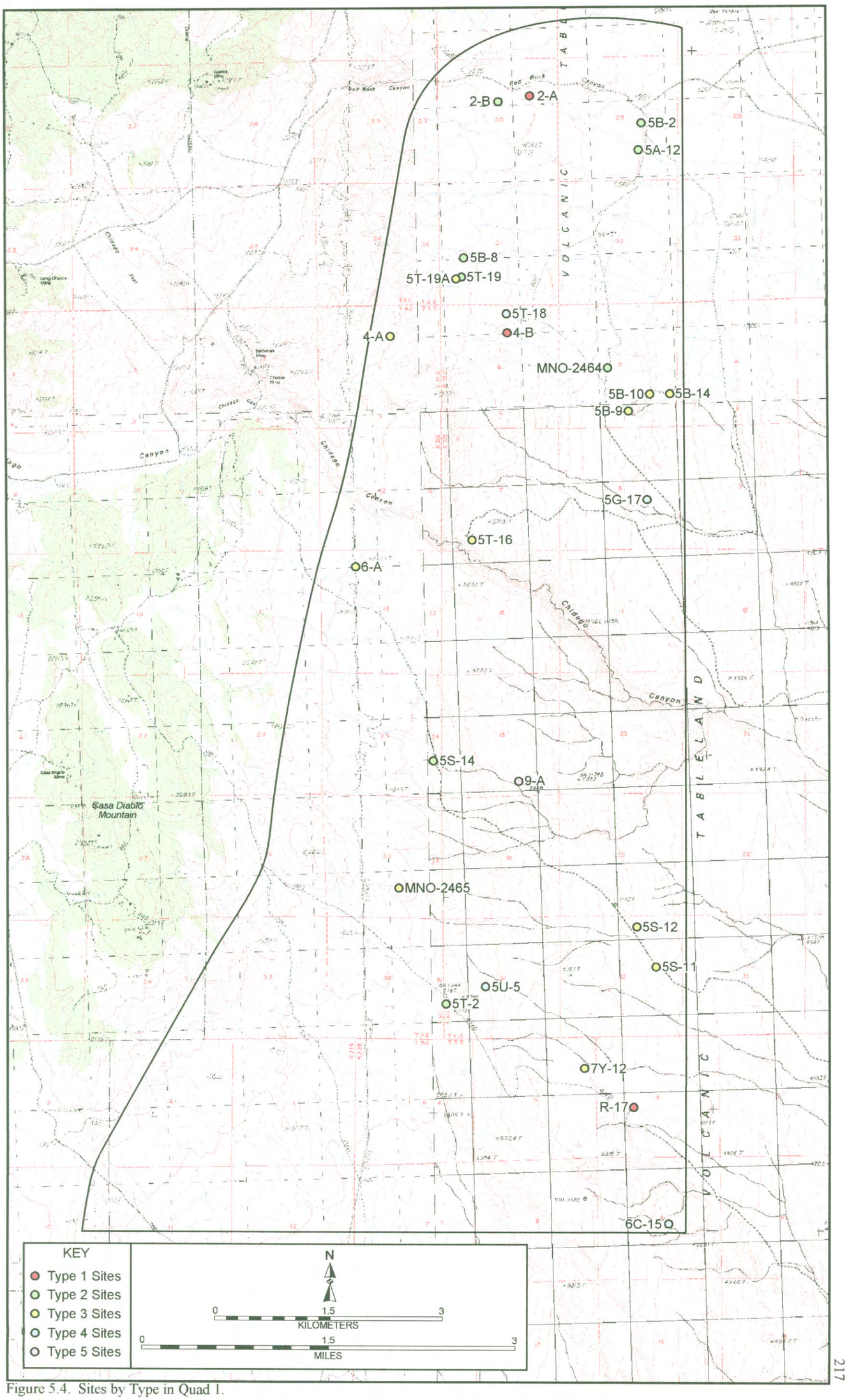

Figure 5.4. Sites by Type in Quad 1.

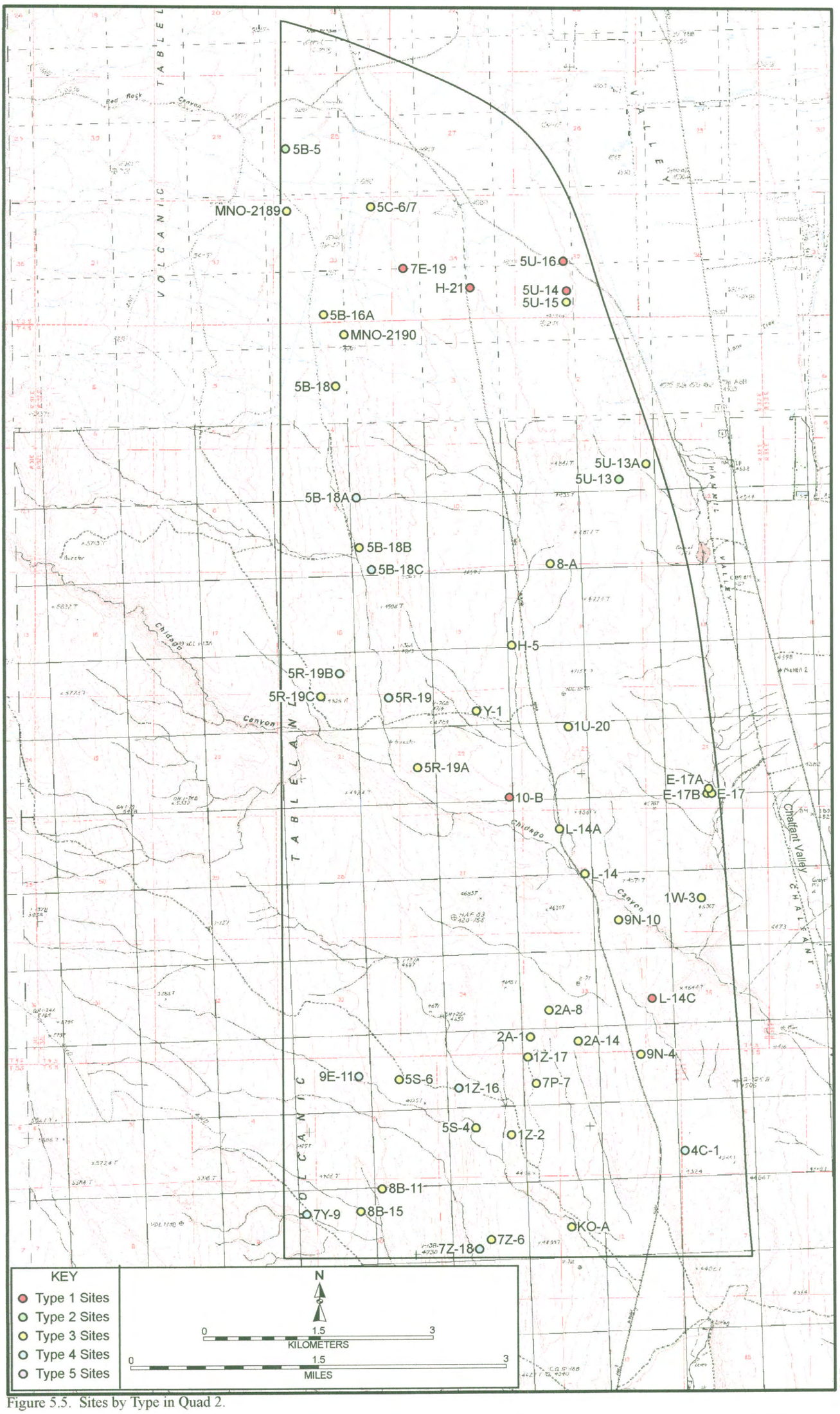

Figure 5.5. Sites by Type in Quad 2.

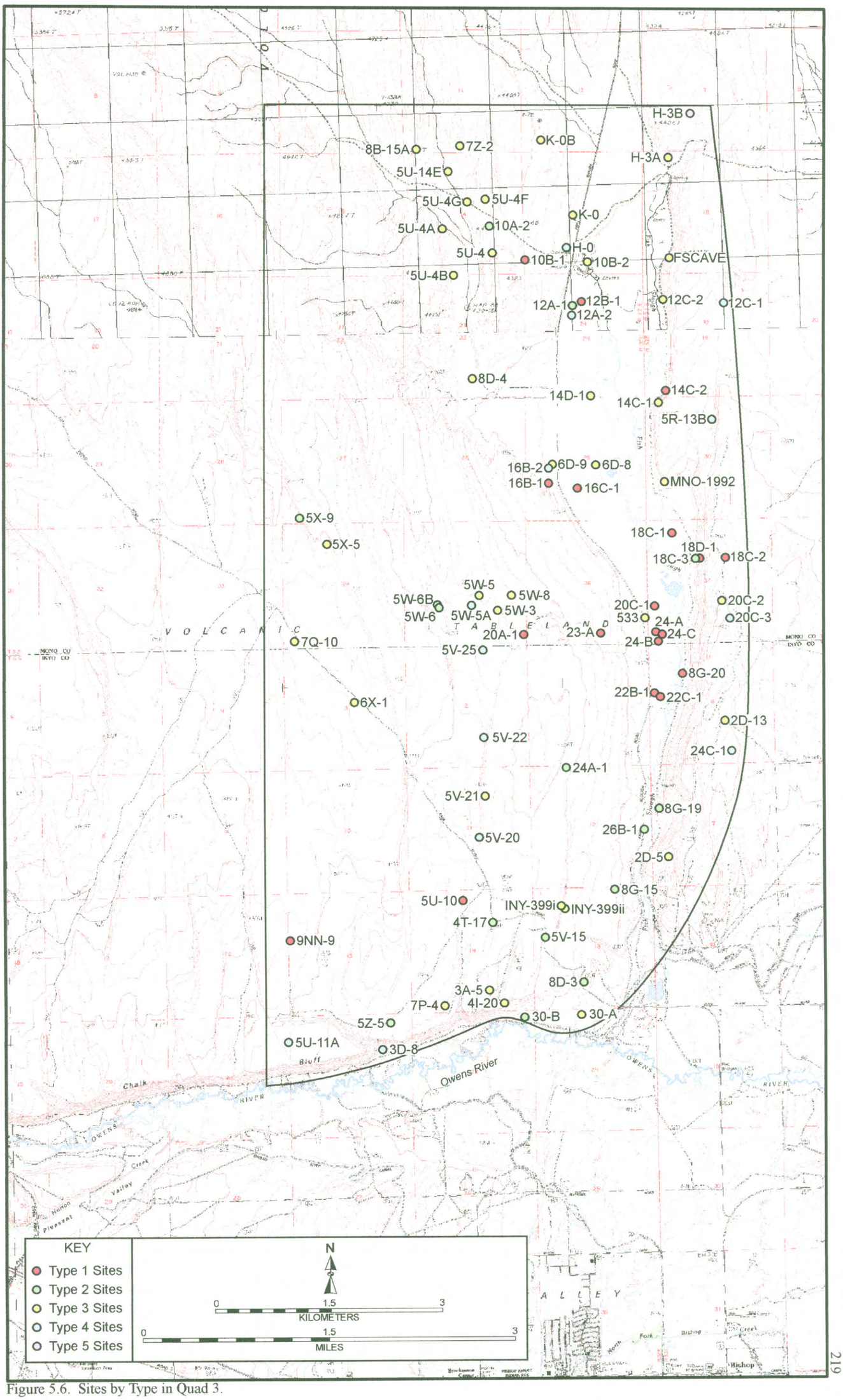

Figure 5.6. Sites by Type in Quad 3.

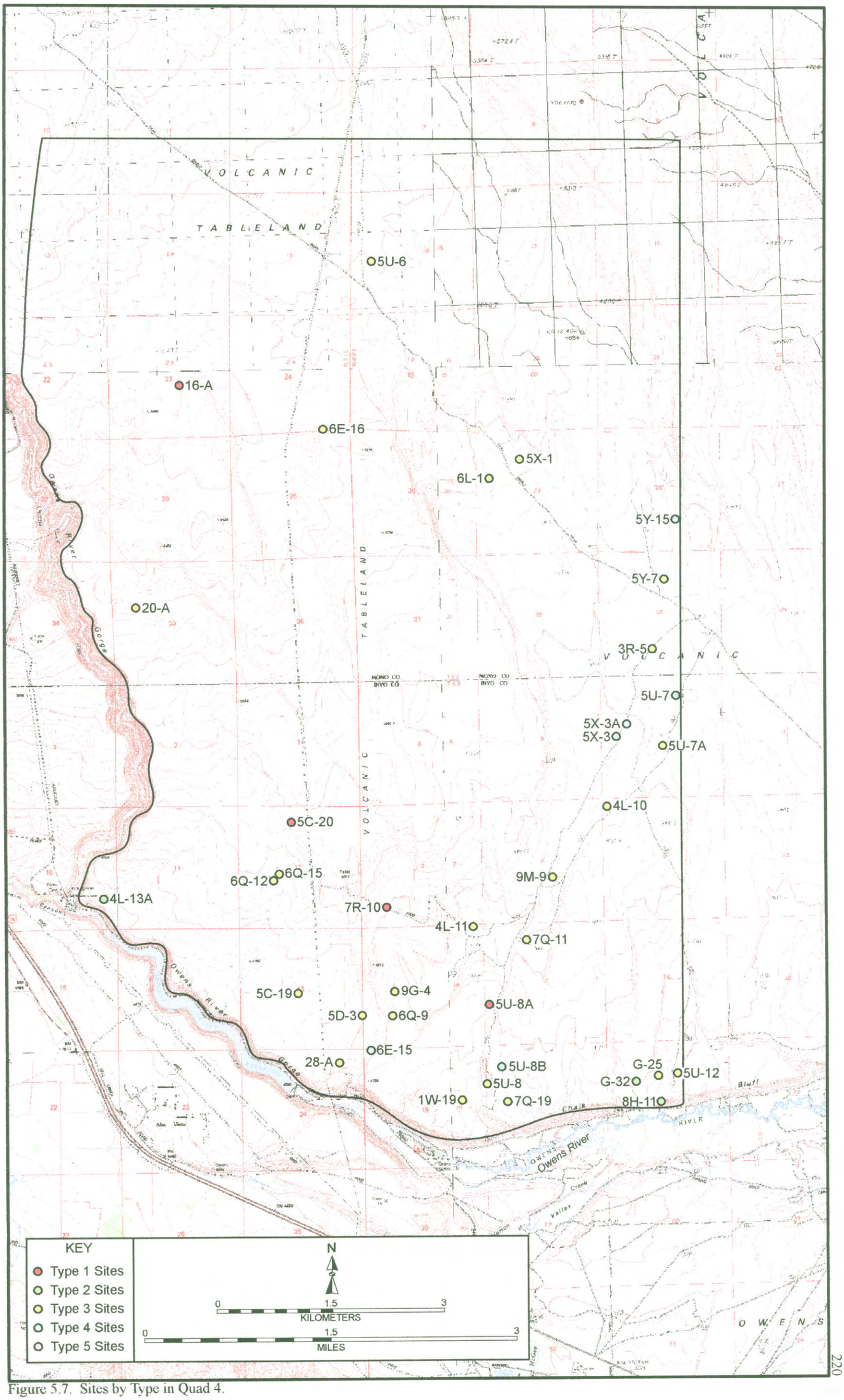

Figure 5.7. Sites by Type in Quad 4.

1 sites) where flaked stone tool repair and replacement was carried out, while the elevated northwest (Quad 1) contains a larger share of temporary camps involving both tool repair and vegetal resource processing (Type 2 sites). Sites of these types are uncommon in the Quads 2 and 4, where short-term residences (Type 3 sites) exist in relatively greater numbers. All this is indicative of two different land-use patterns, one typical of Quads 1 and 3 (temporary processing camps) and another characteristic of Quads 2 and 4 (short-term residences).

There are a few specific site attributes that also testify to this geographic polarization of prehistoric occupations. For example, Table 5.9 shows the frequencies of rock features and ceramics at all sites. Full totals indicate a slight prevalence of houses (rock rings) over threshing floors and a dominance of bedrock milling areas. This pattern shifts when sites are divided into spatial quadrants. The first grouping in the table includes all site types combined by quad. Most obvious is that many more sites in Quads 2 and 4 contain rock features as compared to sites in Quads 1 and 3. Rock rings occur at 63% and 66% of all sites in Quads 2 and 4, being present at only 32% of sites in Quad 1 and 28% of sites in Quad 3; this means that roughly 31-38% more sites in Quads 2 and 4 have rock rings. The same disparities are seen for threshing floors and isolate milling slicks; the largest difference for threshing floors is between Quad 2 and Quad 1 sites (33%) and for milling slicks is between Quad 2 and 3 sites (19%).

At first glance we might relate these divisions to variance in the frequencies of Type 3 sites found in different quadrants. It has been shown that Type 3 sites, which more often display rock features than other kinds of sites, are relatively more common in Quads 2 and 4. It stands to reason, then, that with more Type 3 sites should be more rock features, but this is not necessarily the case. The lower half of Table 5.9 displays the frequencies of rock features at Type 3 sites only. While the same general trends persist, they are less pronounced than when all site types are combined. Rock rings are again more prevalent in Quads 2 and 4 by about 30% over Quads 1 and 3, but differences

TABLE 5.9. Select site attributes from survey data by quadrant.

	Threshing Floor		Rock Ring		Isolate Milling		Ceramics	
	+	-	+	-	+	-	+	-
Total (n=196)	65 (33%)	131	88 (45%)	108	123 (63%)	73	44 (22%)	152
All Types								
Quad 1 (n=25)	4 (16%)	21	8 (32%)	17	15 (60%)	10	4 (16%)	21
Quad 3 (n=82)	22 (27%)	60	23 (28%)	59	44 (54%)	38	21 (26%)	61
Quad 2 (n=51)	25 (49%)	26	32 (63%)	19	37 (73%)	14	11 (22%)	40
Quad 4 (n=38)	14 (37%)	24	25 (66%)	13	27 (71%)	11	8 (21%)	30
Type 3 Only								
Quad 1 (n=9)	3 (33%)	6	6 (67%)	3	7 (78%)	2	2 (22%)	7
Quad 3 (n=35)	15 (43%)	20	22 (63%)	13	26 (74%)	9	16 (46%)	19
Quad 2 (n=34)	18 (53%)	16	31 (91%)	3	28 (82%)	6	9 (26%)	25
Quad 4 (n=25)	11 (44%)	14	24 (96%)	1	21 (84%)	4	6 (24%)	19

Note: Percentages denote portions of + sites relative to the total number of sites in each quadrant.

between frequencies of threshing floors and isolate milling slicks are variable. More Quad 2 sites display threshing floors but only by a margin of about 9-10% over Quads 4 and 3 and 20% over Quad 1. Isolate milling slicks are nearly equally prevalent in Quads 2 and 4, occurring at only 6-10% more sites than in Quads 1 and 3. At Type 3 sites, then, it seems that rock rings are much more common in Quads 2 and 4 but frequencies of threshing floors and isolate milling slicks are not substantially different in any quadrant. This reflects a heightened importance of houses in Quads 2 and 4 relative to other rock features, perhaps implying more intensive residential use. The fact that frequencies of threshing floors and isolate milling slicks are more consistent in all quadrants, and particularly at Type 3 sites, indicates that milling was more of a standard activity across the Tableland.

The last attribute presented in Table 5.9 is the presence of ceramics. In general, ceramics are not very common on the Tableland, found at just 22% of all sites and between 16-26% of all sites in

any quadrant. Looking at all site types combined, distributions of ceramics by quadrant are fairly even. However, when only Type 3 sites are considered, ceramics appear overabundant in Quad 3 (46%) and much rarer in other areas (between 22-26%). Though not shown in the table, even more notable is the portion of Type 3 sites within Fish Slough Valley that contain ceramics (7 of 13, or 54%). This pattern may be indicative of a specialized use for ceramic vessels involving the preparation of foods present only at Fish Slough, like freshwater mussels or tubers. At Fish Slough sites there is also a predisposition of ceramic sherds to middens that contain *Anodonta* shell, providing some support for the use of ceramics in mussel processing.

Site Types Summary

Frequencies of site types and attributes have been shown to vary across the Tableland, evidently signaling gross spatial trends in aboriginal land-use. In general, the number of archaeological sites per given unit of space is pretty consistent throughout the study area. Site densities for my surveys ranged from 1.2-3.0/sq km in the four spatial quadrants. On plateau terrain densities average 1.1 sites/sq km, but the Fish Slough valley has a much greater density (about 4.3 sites/sq km) with noticeable clusters of sites along the immediate flanks of the waterway. These patterns indicate that Fish Slough was a primary target for aboriginal occupation, but that all other portions of the Tableland were used fairly regularly as well. Spatial variability is also evident when considering the different kinds of sites and their relative abundances. Temporary camps where only lithic and/or vegetal resources were processed are predisposed to the northwest and southeast (Quads 1 and 3), the Fish Slough area containing the largest number of strictly flaked stone deposits. Short-term residential sites are relatively more common to the northeast and southwest (Quads 2 and 4) and have a greater affinity for rock ring houses than do residences in other areas. Seed milling was evidently a popular pursuit everywhere on the Tableland.

Plateau and slough environments on the Tableland may have been used for entirely separate purposes and during opposing seasons. Brief visits to the plateau, on the order of a couple of days to weeks, were probably made during spring and early summer to harvest seed grasses and shrubs. These occupations evidently targeted the northeast and southwest portions of the Tableland, where broader, flatter stretches of land may have offered seed crops and attendant fauna in greater abundance. Such a scenario might implicate use of the plateau by groups traveling northward from Owens Valley and southward from Benton, west from Fish Lake Valley, or even farther afield. Brief visits to Fish Slough may have been accomplished during the fall and winter months, when food resources were unavailable elsewhere, but it is more likely the slough was repeatedly occupied in all seasons given its constant annual productivity (Basgall and Giambastiani 1995; Ferren and Davis 1991; Nelson 1999). Most occupants of Fish Slough may have arrived from southern locations, or from the White Mountains, but given ethnographic (Steward 1933, 1938) and other evidence (Basgall and Giambastiani 1995; Giambastiani 1997b) use from the north and northeast is also expected.

Chapter Six

SITE-SPECIFIC INVESTIGATIONS

Test excavations at archaeological sites are normally conducted in an attempt to disclose the nature, duration, and age of occupation(s). Recovery tactics are often broad-based, designed to obtain a variety of constituents so that as complete a picture as possible of site use can be developed. In the present case, standard surface and subsurface recovery methods were employed but the goals of site examinations were much more restricted. Most sites at Fish Slough and on the Plateau were tested for the specific purpose of retrieving obsidian artifacts, primarily waste flakes. The result is that assemblages from some sites are incomplete, lacking many larger artifacts unrelated to flaked stone tool production and use. At other sites, only small portions of cultural deposits received attention, leaving certain chronological and functional aspects of site habitations unknown. Though I am confident that tested sites have been accurately characterized, collection strategies and analytical programs clearly reveal their bias toward acquiring obsidian samples. The goal of this chapter, then, is not to resolve the entire story of prehistoric occupation on the Tableland but simply to recount the ways in which sites were examined and outline the basic results of these investigations.

To accomplish this I will first describe all surface collections and excavations completed for the dissertation, and then summarize the artifact inventories acquired. Discussions begin with two seasons of fieldwork at 17 sites along Fish Slough, the first season completed in 1993 and the second between 1995-1996. All sites were investigated by systematic surface collection and 11 of them excavated as well. With the exception of MNO-1992 (see Basgall and Giambastiani 1995), all other sites were originally recorded during the slough survey. Excavations in 1993 focused on only two locations, MNO-1992 and 533. Work at MNO-1992 was directed to obtaining supplementary data, while testing at 533 and other locations 1995-1996 was aimed at recovering samples of obsidian

artifacts. Hence, testing volumes at MNO-1992 were comparable to earlier work at this site, but excavation levels at other Fish Slough sites were reduced considerably.

Subsequent discussions outline site testing accomplished during the Plateau survey. Examinations were designed to be even more specific than at Fish Slough, and so both surface collection and excavation totals were extremely limited at tested sites. As a result, recovered artifacts alone are insufficient for characterizations of site use, and their analytical treatment was attenuated. The final sections of this chapter provide a brief analysis of flaked stone recovered from the Slough and the Plateau. This is necessary to outline technological attributes that figure prominently in concert with obsidian studies. Closing paragraphs offer some brief comparisons to demonstrate a few key differences in lithic use between the Slough and Plateau.

1993 TESTING PROGRAM - FISH SLOUGH

Beyond the concern of selecting sites for testing that would give students opportunities to learn a variety of archaeological techniques, the primary goal in choosing Fish Slough as the location for the 1993 field school was to try and characterize its prehistoric record. At the time, a handful of sites at the slough had been discovered by the Enfields or BLM archaeologists. Besides MNO-1992, however, the only other site that had been formally investigated was MNO-2381 (Fish Slough Cave), a small shelter excavated by Bettinger during the 1987-1989 Far Western co-op project. Unfortunately, I was not able to visit the study area prior to starting fieldwork for the purpose of re-locating known sites at the slough. Considering the fact that site MNO-1992 had proven a unique locality, and that there were several archaeological issues left to be explored there, it seemed appropriate to return for one more field season. The other site examined in 1993, site "533", was possibly a single-component, Newberry-age deposit. Information available in 1993 suggested this was

a relatively rare temporal signature at the slough. The site was also located right next to Fish Slough Road, making it easily accessible, and unlike MNO-1992 it had not yet been surface collected. Students working at this site could learn how to perform such collection and how surface work relates to test excavation design.

Site MNO-1992

Also known as "BLM Spring", MNO-1992 encompasses the toe of a south-facing bedrock ridge that extends out from the Fish Slough fault scarp and overlooks a spring pond feeding the slough about midway along its course (Figure 6.1). Cultural deposits at this site are concentrated in two discrete areas. Situated on the sandy eastern flank of the ridge, Locus A comprises a light midden and broad artifact scatter that measures about 110 x 130 m. In the western part of the site, Locus B encompasses about 4700 m^2 (100 x 60 m) and includes a light scatter of artifacts that extends north from the spring up onto a bedrock terrace displaying 12 rock constructions (Basgall and Giambastiani 1995:153). A small pocket of midden lies just below the southern end of the bedrock exposure, spanning no more than 10 x 15 m.

Given that Locus B evidently had a late temporal affiliation, a period well-represented at other sites under investigation at the time (Basgall and Giambastiani 1995:153), Basgall's work at MNO-1992 focused primarily on Locus A. Surface collections and excavations revealed a rich cultural deposit with a complex horizontal and vertical arrangement of temporal components. Newberry, Haiwee, and Marana time markers were common in most portions of the deposit, but the southwest quarter of the locus yielded a number of large side-notched projectile points representing a much earlier time frame. Obsidian hydration readings implied that these "Fish Slough Side-notched" points were much older than 5000 B.P. and maybe as old as 8000 B.P.

Table 6.1. Areas of surface collection and volumes of excavation at Fish Slough.

		CSC (m^2)	EXC (m^3)
1993 Season			
MNO-1992	Loc. A	----	14.3
	Loc. B	----	1.8
	Non-Locus	----	0.3
Site "533"		4050	6.1
1995-96 Season			
4C-1		*225	----
10A-2		450	----
10B-2	Loc. A	----	1.1
	Loc. D	900	0.7
	Loc. F	225	0.8
12C-2	Loc. A	225	----
	Loc. B	225	----
14C-1		900	1.7
14C-2		675	3.4
14D-1		229	3.7
18C-1		225	----
18C-2		675	1.5
18C-3		225	----
18D-1	Loc. A	225	1.5
	Loc. B	225	0.2
	Non-Locus	----	0.3
20C-1		900	1.4
22B-1		450	1.2
22C-1		225	----
26B-1		1125	3.3
Total		12379	43.3

Unfortunately, most specimens were recovered from surface contexts or from shallow depths and were not associated with any other dateable materials. As for Locus B, this area was surface collected for tools only, and a few rock structures were mapped, but it was otherwise left untested.

At the outset of fieldwork in 1993, there were two main gaps in our understanding of MNO-1992. The first pertained to the part of Locus A that produced the Fish Slough Side-notched points. Excavations there in 1988 had been minimal, and though cultural deposits appeared quite shallow it

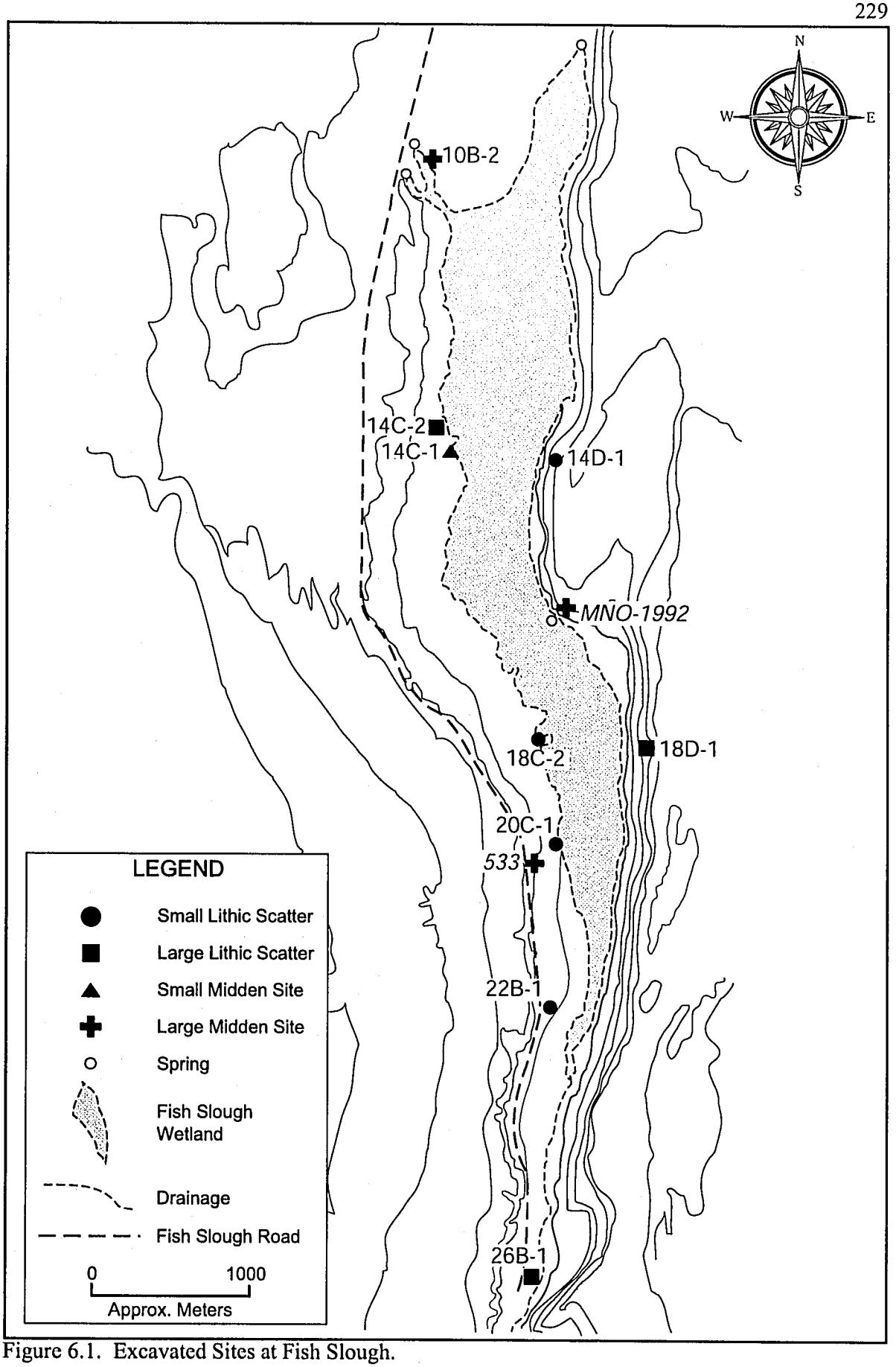

Figure 6.1. Excavated Sites at Fish Slough.

TABLE 6.2. Select artifact classes for all formally investigated locations, 1993 and 1995-96 Fish Slough programs.

	PRJ	BIF	FKT	DRL	COR	DEB	MIL	HND	COB	BED	SHE	Total
MNO-1992	17	51	35	4	-	20973	2	3	-	7	-	21092
533	6	31	10	-	-	4106	7	7	-	1	-	4168
FS4C-1	-	1	1	-	-	8	-	-	-	-	-	10
FS10A-2	2	-	3	-	-	82	4	1	-	-	-	92
FS10B-2	56	84	85	-	-	17053	8	12	2	7	-	17307
FS12C-2	4	2	7	1	-	49	-	-	-	-	5	68
FS14C-1	20	43	33	2	-	3111	2	8	1	4	-	3224
FS14C-2	6	11	17	-	-	1111	1	4	2	2	-	1154
FS14D-1	29	58	46	2	2	16060	-	4	2	9	-	16212
FS18C-1	2	2	-	-	-	42	-	-	-	-	-	46
FS18C-2	1	3	2	-	-	214	-	-	-	-	-	220
FS18C-3	2	2	3	-	-	36	-	-	-	-	-	43
FS18D-1	-	4	9	-	1	1121	-	-	-	-	-	1135
FS20C-1	-	2	6	-	-	292	-	-	-	-	-	300
FS22B-1	1	1	8	-	-	156	-	-	-	-	-	166
FS22C-1	3	1	4	-	-	76	-	-	-	-	-	84
FS26B-1	5	3	5	1	-	1713	4	1	-	-	-	1732
Total	154	299	274	10	3	66203	28	40	7	30	5	67053

Note: PRJ, projectile point; BIF, biface; FKT, formed or simple flake tool; DRL, drill; COR, core or core tool; DEB, debitage; MIL, millingstone; HND, handstone; COB, cobble tool; BED, bead; SHE, sherd.

was possible that organic materials still remained that could be radiometrically dated. The second gap was the temporal affiliation of the Locus B midden, which was presumed to be associated with structures on the bedrock terrace but had not been tested. Furthermore, BLM archaeologists and biologists were also interested in better defining the southeastern extent of Locus A so that a two-track road bordering the site on the south might be redirected farther upslope to preserve alkali habitats along the edge of the spring pond.

Having relocated Far Western's 1988 datum, a new provenience grid was constructed in the southern half of Locus A, stakes placed 15 m apart with a new N0/E0 datum established at S30/W30 m from the original datum (Figure 6.2). Excavations were initiated with five 1x1 m control units, four placed north of the new datum (N10/E4, N10/E22, N14/E12, N19/E21) and one to the south (S18/W4). Each of the first four units encountered cultural sediments of moderate depth and richness, and all were eventually terminated between 50-80 cm below surface as artifact counts dropped to near zero. In contrast, unit S18/W4 exposed rich deposits extending to only 20 cm depth where they terminated in a sterile alkali hardpan. These results agreed with previous observations about this portion of Locus A (Basgall and Giambastiani 1995:156), indicating that cultural strata narrowed considerably as one neared the two-track road bordering the site. Overall, the four units north of the new datum were fairly productive, yielding a variety of flaked stone tools (n=39), over 9000 unmodified flakes, four shell beads, 108 pieces of bone (Table 6.3), and low but consistent quantities of *Anodonta* shell detritus. Unit S18/W4 contributed only 160 flakes but contained a large patch of charcoal-laden sediment just a few centimeters below surface. This patch of soil was removed for radiocarbon assay but has not yet been analyzed.

Based on these results another 1x1 m unit was opened adjacent at N10/E3 and four 1x2 m exposures were placed south of datum (S5/E0, S17/E0, S28/W2, S33/E37) in an effort to boost formed artifact yields and search for buried features. Units S5/E0 and S17/E0 were excavated through the initial hardpan reached at about 10-20 cm depth in order to create some deeper stratigraphic exposures (50 cm and 75 cm, respectively) and to verify the lack of cultural sediments immediately below this layer. As expected, units S17/E0, S28/W2, and S33/E37 contained fewer artifacts than units established north of datum, together producing only two flaked stone tools, about 1350 flakes, and scant shell refuse. In contrast, unit S5/E0 alone contributed seven tools and nearly 2200 flakes, but still yielded only trace amounts of faunal material. Light patches of carbon-stained sediment were

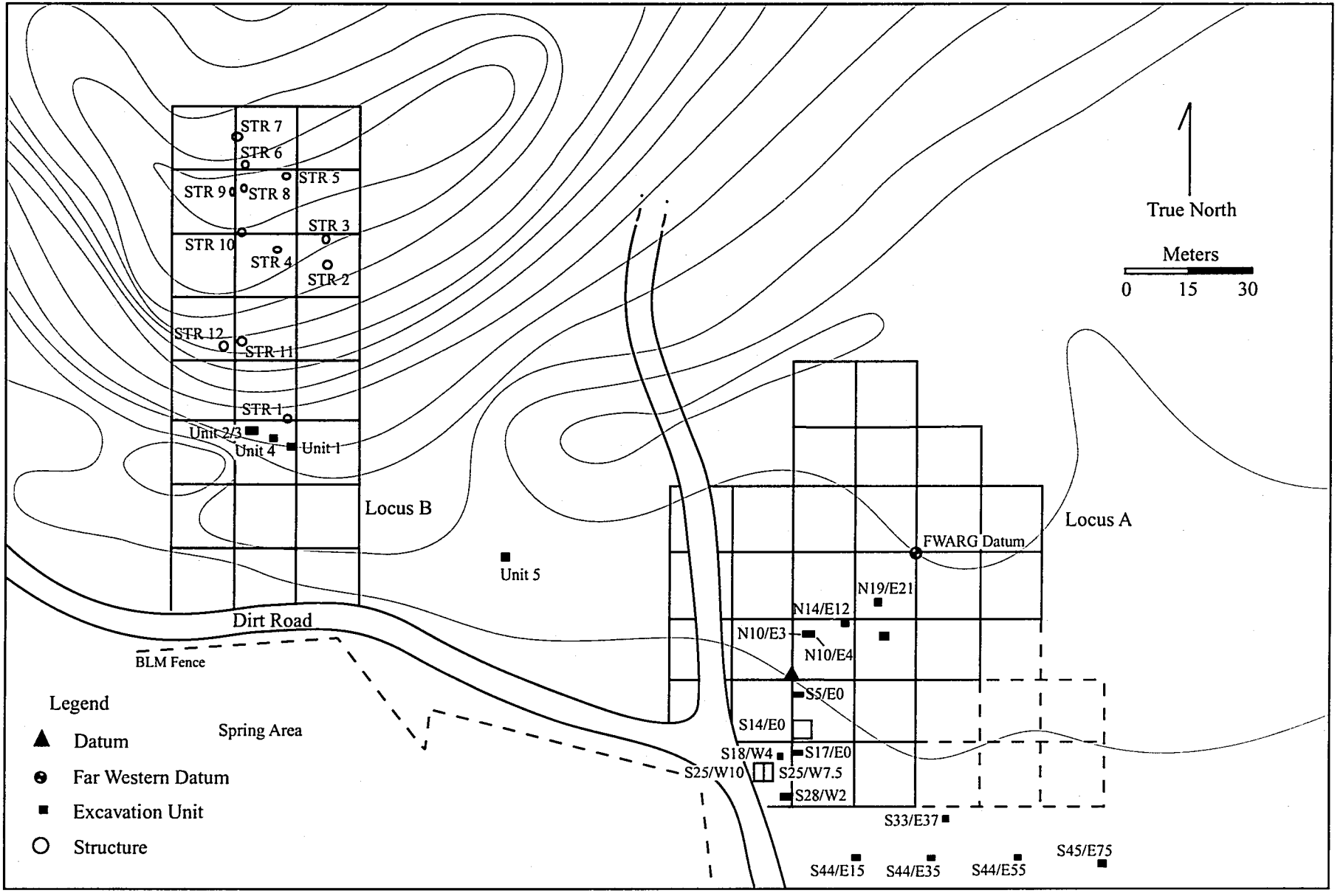

Figure 6.2. Site MNO-1992 (adapted from Basgall and Giambastiani 1995).

unearthed in the upper levels of some units, and though sampled most were judged too ephemeral for dating purposes. Ground stone was all but absent from any exposure, just one millingstone fragment recovered from unit N10/E22. A few definite Fish Slough Side-notched points were found in surface contexts around the site but excavations had produced only three provisional forms, one each from units N14/E12, N19/E21, and S5/E0.

With only a modicum of field time remaining, excavations at Locus A were completed by opening a couple of large surface scrapes, two adjacent 2.5x5 m units placed at S25/W7.5 and S25/W10 and a 5x5 m unit set at S14/E0. Although producing a combined total of more than 3000 flakes, these units failed to contribute any side-notched points and yielded only two formal tools. Organic refuse was again lacking, and no groundstone implements were recovered. Finally, in an effort to demarcate the southeast boundary of the Locus A deposit, four 1x1 m control units were set on an east-west line at the S44-S45 parallels, beginning at the E15 line and spread 20 meters apart (S44/E15, S44/E35, S44/E55, S45/E75). Each unit was excavated to 70 cm depth save for S44/E15, terminated at 50 cm. All exposures contained some flaking debris, but each had very low amounts (about 200 flakes combined) that decreased with distance from the site datum. In all, some 14.3 m^3 of sediment was removed from Locus A deposits and screened through 1/8" (3-mm) mesh, this matrix yielding more than 50 flaked stone tools and over 16,000 flakes, four beads, one bone tool, 123 pieces of bone and about 80 g of *Anodonta* shell.

At Locus B, four 1x1 m control units Units 1, 2, 3, and 4) were placed in the center of the midden to assess its vertical extent and character (Figure 6.2). Excavations proceeded to tuff bedrock in each exposure, uphill units containing deeper sediments (Unit 1, 60 cm; Unit 2, 50 cm) than downslope units (Unit 3, 40 cm; Unit 4, 30 cm). Though no buried features were encountered, Units 1 and 2 were particularly productive, each yielding a variety of flaked stone tools, more than 1000 unmodified flakes, a few pieces of milling equipment, and quantities of bone (799 pieces together)

Table 6.3. Inventory of major constituent classes by locus, unit designation and type at sites MNO-1992 and 533.

		PRJ	PTB	BIF	FLK	FRM	DRL	DEB	MIL	HND	MGS	BED	MOD	BON	Total
MNO-1992 Loc. A															
SUR		4	-	3	2	4	-	-	-	-	-	1	-	-	14
EXC	N10/E3	-	-	1	-	-	-	1416	-	-	-	2	1	11	1431
	N10/E4	-	-	5	1	2	-	1346	-	-	-	1	-	5	1360
	N10/E22	-	-	1	1	-	1	1640	1	-	-	-	-	9	1653
	N14/E12	3	-	4	5	-	1	1201	-	-	-	-	-	13	1227
	N19/E21	1	-	8	4	5	-	4962	-	-	-	1	-	81	5062
	S5/E0	1	-	6	-	-	-	2199	-	-	-	-	-	2	2208
	S14/E0	-	-	1	-	1	-	696	-	-	-	-	-	-	698
	S17/E0	-	-	1	-	-	-	599	-	-	-	-	-	-	600
	S18/W4	-	-	-	-	-	-	160	-	-	-	-	-	-	160
	S25/W7.5	-	-	-	-	-	-	1172	-	-	-	-	-	-	1172
	S25/W10	-	-	-	2	1	-	1285	-	-	-	-	-	2	1290
	S28/W2	-	-	-	-	-	-	288	-	-	-	-	-	-	288
	S33/E37	1	-	-	-	-	-	470	-	-	-	-	-	-	471
	S44/E15	-	-	-	-	-	-	27	-	-	-	-	-	-	27
	S44/E35	-	-	-	-	-	-	118	-	-	-	-	-	-	118
	S44/E55	-	-	-	-	-	-	46	-	-	-	-	-	-	46
	S45/E75	-	-	-	-	-	-	25	-	-	-	-	-	-	25
	Subtotal	6	-	27	13	9	2	17857	1	-	-	4	1	124	18044
MNO-1992 Loc. B															
SUR		2	1	-	-	-	-	-	-	-	-	1	-	-	4

Table 6.3. Inventory of major constituent classes by locus, unit designation and type at sites MNO-1992 and 533 (Continued).

		PRJ	PTB	BIF	FLK	FRM	DRL	DEB	MIL	HND	MGS	BED	MOD	BON	Total
MNO-1992 Loc. B (cont...)															
EXC	Unit 1	-	-	4	1	-	2	1004	1	-	2	-	-	535	1549
	Unit 2	4	1	7	3	-	-	1104	-	2	1	1	-	264	1387
	Unit 3	1	-	6	2	1	-	488	-	1	-	-	-	87	586
	Unit 4	-	-	4	-	-	-	520	-	-	1	-	-	39	564
	Subtotal	5	1	21	6	1	2	3116	1	3	4	1	-	925	4086
MNO-1992 Non-Loc															
EXC	N20/W45	-	-	-	-	-	-	207	-	-	-	-	-	1	208
SITE TOTAL		17	2	51	21	14	4	20973	2	3	4	7	1	1049	22148
Site 533															
SUR		1	-	2	-	-	-	-	2	-	-	-	-	-	5
CSC	N0/E0	-	-	1	-	-	-	2	-	-	-	-	-	-	2
	N0/E15	-	-	-	1	-	-	92	-	-	-	-	-	-	93
	N0/W15	-	-	1	-	-	-	104	-	-	-	-	-	1	106
	N15/E0	-	-	1	-	-	-	193	-	-	-	-	-	1	195
	N15/E15	-	-	-	-	-	-	108	1	-	-	-	-	1	110
	N15/W15	-	-	2	1	-	-	458	-	-	-	-	-	3	464
	N30/E0	-	-	2	1	-	-	150	-	-	-	-	-	1	154
	N30/E15	-	-	2	-	-	-	2	1	-	-	-	-	-	5
	N30/E30	-	-	2	-	-	-	48	1	-	-	-	-	-	51
	N30/W15	-	-	2	1	-	-	346	-	1	-	-	-	-	350
	N45/E15	-	-	1	1	-	-	98	-	1	-	-	-	-	101
	N45/E30	1	-	2	-	-	-	124	2	1	2	-	-	-	132
	S15/E0	1	-	2	1	-	-	122	-	1	-	-	-	1	128
	S15/E15	1	-	3	1	-	-	81	-	-	-	-	-	-	86
	S15/W15	-	-	1	-	-	-	19	-	-	-	-	-	-	20

Table 6.3. Inventory of major constituent classes by locus, unit designation and type at sites MNO-1992 and 533 (Continued).

		PRJ	PTB	BIF	FLK	FRM	DRL	DEB	MIL	HND	MGS	BED	MOD	BON	Total
Site 533 (Cont...)															
CSC	S30/E15	-	-	-	-	-	-	18	-	-	-	-	-	-	18
	S30/W15	-	-	-	-	-	-	10	-	-	-	-	-	-	10
	Subtotal	3	-	22	7	-	-	1975	5	4	2	-	-	8	2026
EXC	N3/W8	1	-	-	-	-	-	110	-	-	-	-	-	16	127
	N7/E1	-	-	2	1	-	-	348	-	1	-	-	-	49	401
	N20/W9	-	-	-	1	-	-	174	-	-	-	-	-	7	182
	N24/E9	-	-	-	-	-	-	40	-	-	-	-	-	4	44
	N29/W4	1	-	-	-	-	-	712	-	1	-	-	-	65	779
	N39/E3	-	-	-	-	-	-	118	-	-	-	-	-	7	125
	N45/E35	-	-	-	-	-	-	100	-	-	-	-	-	15	115
	S1/E13	-	-	-	-	-	-	115	-	-	-	-	-	4	119
	S9/E20	-	-	4	1	-	-	408	-	1	-	1	-	-	415
	S10/E28	-	-	1	-	-	-	7	-	-	-	-	-	-	8
	Subtotal	2	-	7	3	-	-	2132	-	3	-	1	-	167	2315
SITE TOTAL		6	-	31	10	-	-	4106	7	7	2	1	-	175	4345

Note: PRJ, projectile point; PTB, point blank; BIF, biface; FLK, simple flake tool; FRM, formed flake tool; DRL, drill; DEB, debitage; MIL, millingstone; HND, handstone;MGS, miscellaneous ground stone; BED, bead; MOD, modified stone or bone; BON, faunal bone.

together) and *Anodonta* shell (about 50 g combined). Unit 2 produced four dart-size projectile points, two provisional Fish Slough Side-notched forms, one Little Lake variant, and an untypable piece. The collections from Units 3 and 4 were comparable but smaller, including some 14 flaked stone tools, 1000 or so flakes, two milling implements, 126 pieces of bone, and roughly 20 g of shell. A single Eastgate projectile point was found in Unit 3. Excavations removed only 1.8 m^3 of matrix from the Locus B midden (all screened with 1/8" mesh), but this was enough to differentiate its character from deposits at Locus A. The presence of Fish Slough Side-notched points in Unit 2 probably represents late-period artifact scavenging, though we did find other Fish Slough points on the surface south of Locus B. Finally, to check locus boundaries a lone 1x1 m unit was placed in an area devoid of surface debris in between Loci A and B (at N20/W45 from the new datum prime). This exposure was excavated to 30 cm depth, yielding 200 flakes and one piece of bone. Testifying to some amount of aeolian deposition (see Basgall and Giambastiani 1995:156), this finding indicates that cultural debris is more widespread than expressed on the site surface.

Ancillary work at the site included the formal mapping of all rock constructions at Locus B and the completion of a small surface survey east of the site. At the request of BLM staff, a surface survey was conducted east of Locus A to identify any other archaeological deposits that might be impacted by the proposed realignment of the two-track road. An L-shaped transect 1500 x 150 m in size was surveyed across a broad embayment east of MNO-1992, but no other sites and only a few isolate artifacts were found.

533

The second site tested in 1993 was 533, a moderately dense artifact scatter spread across a low, sandy terrace overlooking alkali flats on the west side of Fish Slough (Figure 6.3). The entire site is bordered on the west by Fish Slough Road and it is situated about 200 meters north of the Inyo-

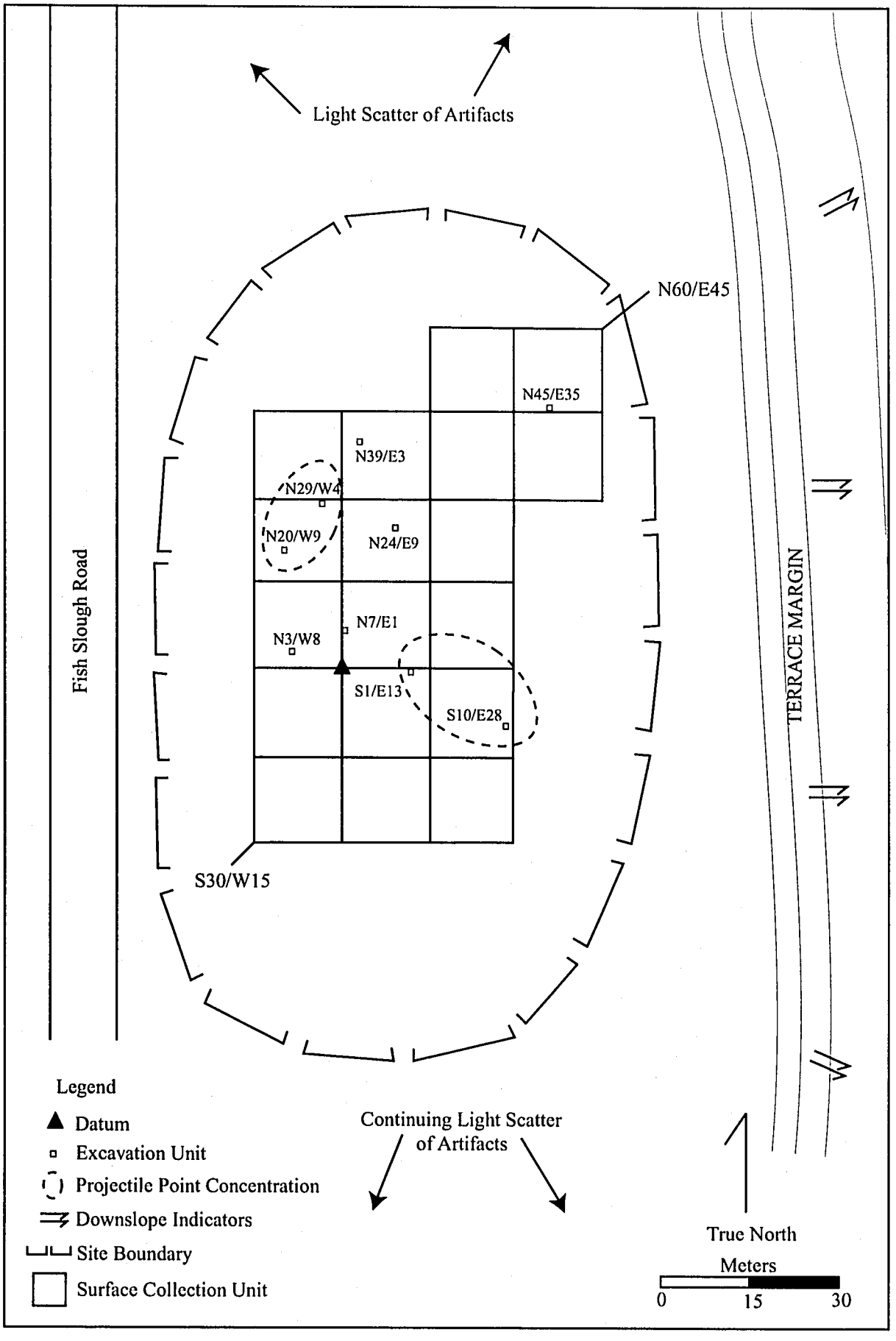

Figure 6.3. Fish Slough Site 533.

Mono County line. Flaked and ground stone artifacts are concentrated in an area measuring about 100 x 50 m, but a thin veneer of refuse encompasses a much larger area (ca. 450 x 125 m). Surface sediments are slightly darkened in spots, indicating the presence of midden deposit. Investigations commenced by establishing an extensive grid system across the densest portion of surface deposit. Wooden stakes were placed at 15 m intervals and used to mark the southwest corners of 15x15 m surface collection grids. In all, 12 collection grids were established north of datum (N0/W15, N0/E0, N0/E15, N15/W15, N15/E0, N15/E15, N30/W15, N30/E0, N30/E15, N30/E30, N45/E15, N45/E30) and six units to the south (S15/W15, S15/E0, S15/E15, S30/W15, S30/E0, S30/E15). For stricter provenience control, each 15x15 m grid was further divided into nine 5x5 m cells labeled A-I in order from southwest to northeast. Individual cells were collected to recover all artifacts and bone, but other detritus like charcoal and shell were not retrieved. The surface collected assemblage is dominated by nearly 2000 unmodified flakes, including only 29 flaked stone tools, 11 milling implements, and only eight pieces of faunal bone (Table 6.3 above). With few exceptions, units north of datum were more productive than those to the south, particularly grids N15/W15 and N30/W15 which together contained 40% of all surface collected flakes. Diagnostic projectile points were found only in southern units, one each in S15/E0 and in S15/E15.

Subsurface testing targeted the northern artifact zone with two 1x1 m control units (N20/W9, N29/W4) and the projectile point locations with two more 1x1s (S1/E13, S10/E28). Another five 1x1s were distributed across the northern half of the site to boost artifact samples (N3/W8, N7/E1, N24/E9, N39/E3, N45/E35). All site matrix was screened through 1/8" mesh, and all units were taken to at least 30 cm depth and terminated as artifact yields fell dramatically. Unit S10/E28 was excavated to 60 cm depth to create a deeper stratigraphic profile, the base of this unit unearthing a horizon of fine, dark gray sands. Judging by the moisture present in the sand, excavations appeared to be nearing the top of the slough water table at this depth. Unfortunately, artifact yields from most control units

were not appreciably greater than those from surface collection grids; subsurface contexts produced just over 1700 flakes, six flaked stone tools and two millingstone fragments. Unit N29/W4 held by far the highest artifact total (712 flakes, one projectile point, one handstone) while exposures south of datum were especially sparse, units S1/E13 and S10/E28 producing just 122 flakes, one biface, and four pieces of bone between them. The majority (66%) of debitage in these units came from the 0-10 cm levels, this indicating a concentrated, near-surface deposit. At the close of excavation the only notable difference in the makeup of subsurface deposits was a greater frequency of bone, some 167 pieces in all (though 65 pieces came from unit N29/W4 alone). A last effort was made to recover diagnostic tools by placing a 5x5 m surface scrape (10 cm depth) in the vicinity of the surface projectile points (at S9/E20). This unit failed to produce any points but yielded more than 400 flakes, several tools, and a medium-size *Olivella* Spire-lopped bead. Once subsurface work had been completed five more artifacts were piece-plotted and collected, a projectile point, two bifaces, and two millingstone fragments.

Summary of 93 Excavations

Testing at MNO-1992 and 533 ultimately produced 25,266 artifacts and 1224 pieces of bone (see Table 6.3 above), small quantities of *Anodonta* shell and loose charcoal, and a few bulk soil samples for radiometric analysis. All told, excavations at MNO-1992 removed 16.1 m^3 of sediment, most of this (14.3 m^3) from Locus A. Added to the 9.2 m^3 excavated by Basgall, some 25.3 m^3 of cultural matrix have been examined from this site, 23.5 m^3 from Locus A alone. There are still pockets of deposit at both loci that have not been examined, but given the volume of matrix already removed it seems unlikely that any further work would generate data that was not redundant in some way. At present, characterizations of the Locus A deposit by Basgall and Giambastiani (1995) stand more or less unchanged, with a variety of temporal components being represented in its northern and

central areas and a slightly older matrix present in its southern quarter. Cultural strata associated with Fish Slough Side-notched points are essentially gone, though small remnants did exist. The Locus B midden appears to represent a single component Haiwee occupation, but upper strata could overlie a sparse deposit of pre-Newberry materials that extends beyond Locus A to the west.

As for 533, this location witnessed a considerable amount of systematic surface collection (4050 m^2) and an ample amount of excavation (6.1 m^3). A total of 4162 artifacts was collected from excavation, an average of 682 items per m^3. Marker artifacts and obsidian hydration data imply that there are two temporally distinct pockets of debris at the site: a possibly older, pre-Newberry component in the vicinity of unit S20/E9, and a Newberry-age component in the north half of the site. Excavations removed a significant portion of the main deposit but the pocket of pre-Newberry materials was less intensively scrutinized. Still, constituents of the deposit as a whole are consistent with other Newberry-age assemblages from the Tableland, being typified by an abundance of bifaces, a fairly high flake:tool ratio among chipping wastes (93.3:1), and a relatively substantial groundstone assemblage featuring several shaped handstones.

1995-1996 TESTING PROGRAM - FISH SLOUGH

The Slough survey had identified more than a dozen new sites across the valley floor, most of these lying near the margins of the watercourse. In 1995, I made a short visit to the Slough with Stephen Overly to finish recording some of the sites we had found and to make some collections of obsidian flakes for hydration analysis. Knowing the temporal affinity of Fish Slough Side-notched points at MNO-1992, it seemed that many sites at the Slough were simple obsidian scatters dominated by debitage with few if any formed tools. Though only a few sites had produced early point forms, including one fluted and several Fish Slough Side-notched variants, I assumed that most of these lithic

scatters were fairly ancient mainly because they appeared to be short-term retooling camps of the sort generated by mobile foraging groups. Sites at the slough yielding more recent time markers (Elko, Rosegate, and Desert Series points, beads, ceramics) usually contained ample groundstone assemblages, middens, and quantities of *Anodonta* shell.

I was also curious that many of the simple lithic scatters were situated on alkali flats right up against the modern waterway (e.g., MNO-1992, 18C-2, 18D-1, 20C-1, 22C-1) rather than at a distance from the drainage where shelter and raw materials could be had. Several sites were even inundated with water and appeared to be regularly submerged, which raised concerns about the effectiveness of obsidian hydration dating in these contexts. Projectile points from MNO-1992, a site that was partially inundated in winter, had demonstrated that hydration rim widths fell within expected parameters for various point series (Basgall and Giambastiani 1995), but I did not know if this pattern would be consistent at other locations along the Slough. Unfortunately, sites on alkali flats were less than forthcoming with any type of formed tool, let alone diagnostics, so I was left to examine mostly unmodified flakes and only a few points. A sample of 42 artifacts assembled from ten lithic scatters along the slough returned hydration readings that, with just five exceptions, measured from 7.1-13.0 microns and indicated pre-Newberry antiquity (Giambastiani 1995, 1996). Late-period projectile points in the sample appeared to be hydrating at a normal rate, but perhaps slightly faster than expected (on the order of two or three tenths of a micron). This fact had already been recognized by Basgall (Basgall and Giambastiani 1995:44) and is attributed to the warmer temperature regime on the Tableland relative to surrounding environments. Flakes from annually flooded sites at the slough did not have significantly larger hydration rims than flakes from sites that were not submerged, indicating that increased soil humidity was not drastically affecting hydration development.

Between 1995-1996, all these data were used to construct the design for my dissertation research. I had decided that several lithic scatters in proximity to the slough should be tested, along

with other deposits having different characteristics such as middens or shelters. I already knew that this next (and final) round of excavations at Fish Slough would be conducted by an archaeological field school from U.C. Davis. However, as my research focus shifted towards obsidian study, excavation plans for the 1996 field school were altered accordingly. Rather than implement standard investigations at subject sites, I decided to focused instead on collecting samples of obsidian from the range of occupational components present at Slough sites. To this end surface collection and excavation volumes were restricted at each tested site, which allowed the investigation of more sites than originally planned. Also, surface collections made in 1995 had already acquired materials from several sites not slated for testing, thus increasing the number of locations from which sourcing and hydration data would be available. In all, some 16 sites were revisited in 1995-1996 to collect obsidian artifacts and nine sites were excavated (Table 6.4). Because all these sites are described in Chapter Five, only brief outlines of fieldwork are provided below.

FS4C-1

The most northern site found during the Slough survey, FS4C-1 is a small bedrock milling station containing just over a dozen associated artifacts. At this site an isolated, flat exposure of tuff bedrock displays a single threshing floor and four isolated milling slicks. The threshing feature still retains a semi-circular arrangement of tuff cobbles (remnants of a windbreak or shade foundation) but now lacks a visible interior slick, probably due to surface exfoliation. One of the isolate milling slicks still held a schist handstone, while several other pieces of milling equipment lay on sandy surfaces around the rim of the outcrop. In 1995, all obsidian artifacts on and around the milling station were collected, within a radius of about 10 meters around the edge of the outcrop. Recovered items include one biface, one simple flake tool, and eight unmodified flakes.

Table 6.4. Inventory of major constituent classes by unit at Fish Slough study sites, 1995-96.

	PRJ	PTB	BIF	FLK	FRM	DRL	COR	DEB	MIL	HND	MGS	COB	BED	MOD	SHE	BON	Total
FS4C-1																	
CSC Full Site	-	-	1	1	-	-	-	8	-	-	-	-	-	-	-	-	10
FS10A-2																	
CSC N0/E0	1	-	-	-	1	-	-	35	2	1	5	-	-	1	-	-	46
N15/E0	1	-	-	2	-	-	-	47	2	-	2	-	-	-	-	-	54
FS10B-2																	
SUR Non-Locus	4	-	6	7	-	-	-	10	2	2	1	-	-	-	-	-	32
Locus A	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Locus C	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Locus D	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
CSC Locus D																	
S30/W60	10	1	22	19	-	-	-	2794	-	-	-	-	2	1	-	9	2858
S30/W75	11	-	12	13	1	-	-	1101	1	-	1	1	1	-	-	2	1144
S45/W60	13	-	14	16	-	-	-	3828	-	1	6	1	-	-	-	5	3884
Locus F																	
S90/W15	10	-	17	24	1	-	-	4207	-	3	9	-	1	1	-	121	4394
EXC Locus A																	
S4/E0	-	-	2	1	-	-	-	940	-	1	2	-	1	-	-	138	1085
Locus D																	
S24/W56	1	-	4	-	-	-	-	623	-	-	4	-	-	-	-	35	667
S37.5/W54	1	1	3	-	-	-	-	1102	2	2	1	-	-	-	-	70	1182
Locus F																	
S82/W10	1	-	4	3	-	-	-	2422	3	3	8	-	2	-	-	1137	3583
Non-Locus																	
S.5/W23	-	-	-	-	-	-	-	16	-	-	-	-	-	-	-	-	16
S26/E0	-	-	-	-	-	-	-	10	-	-	-	-	-	-	-	-	10

Table 6.4. Inventory of major constituent classes at investigated sites in the Fish Slough study area (Cont....).

	PRJ	PTB	BIF	FLK	FRM	DRL	COR	DEB	MIL	HND	MGS	COB	BED	MOD	SHE	BON	Total
FS12C-2																	
SUR Locus A	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Locus B	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
CSC Locus A																	
N0/W15	1	-	1	5	1	1	-	30	-	-	1	-	-	-	-	-	40
Locus B																	
N0/E0	-	-	1	1	-	-	-	19	-	-	1	-	-	-	5	-	27
FS14C-1																	
SUR	11	-	10	2	1	2	-	2	-	-	-	1	-	-	-	-	29
CSC N0/E0	2	1	8	2	1	-	-	526	1	1	8	-	-	-	-	13	563
N0/W30	3	-	8	7	-	-	-	450	1	-	2	-	-	-	-	8	479
S15/E0	-	-	2	4	2	-	-	312	-	3	4	1	-	-	-	7	335
S15/W30	1	1	8	8	-	-	-	397	-	1	2	-	-	-	-	6	424
EXC N14/E7	1	-	-	1	-	-	-	376	-	-	1	-	-	-	-	98	477
N14/E9	2	-	3	-	-	-	-	165	-	-	-	-	-	-	-	53	223
S1/E4	-	-	-	1	-	-	-	160	-	-	-	-	2	-	-	16	179
S2/W30	-	-	4	3	1	-	-	723	-	3	1	-	2	1	-	237	975
FS14C-2																	
SUR	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	2
CSC S15/E0	3	-	5	5	2	-	-	164	-	1	-	1	-	-	-	-	181
S15/E15	-	-	2	2	1	-	-	83	-	1	2	-	-	-	-	-	91
S30/E0	1	-	-	-	-	-	-	83	-	-	-	-	-	-	-	1	85
EXC S5/E6	-	-	-	-	-	-	-	44	-	-	-	-	-	-	-	3	47
S5/E19	-	-	-	-	-	-	-	61	-	-	-	-	-	-	-	-	61
S10/E6 N½	1	-	1	4	-	-	-	261	1	1	2	1	2	-	-	13	287
S10/E6 S½	-	-	2	2	1	-	-	384	-	1	-	-	-	-	-	10	400
S20/E6	-	-	-	-	-	-	-	31	-	-	-	-	-	-	-	1	32

Table 6.4. Inventory of major constituent classes at investigated sites in the Fish Slough study area (Cont....).

	PRJ	PTB	BIF	FLK	FRM	DRL	COR	DEB	MIL	HND	MGS	COB	BED	MOD	SHE	BON	Total
FS14D-1																	
SUR	14	1	7	3	1	1	2	-	-	1	-	1	2	-	1	-	34
CSC S2/E0	1	-	2	7	-	-	-	118	-	-	6	-	-	-	1	-	135
S15/W15	3	-	16	9	3	1	-	2455	-	-	-	-	-	-	-	10	2497
EXC APRON	7	1	19	9	-	-	-	6505	-	-	-	-	3	1	-	244	6789
N5/E0	-	-	2	3	-	-	-	1394	-	3	-	-	-	-	-	2	1404
S1/E6	-	-	3	2	-	-	-	1546	-	-	-	1	-	1	-	11	1564
S9.5/W5	4	-	9	9	-	-	-	4042	-	-	-	-	4	-	-	36	4104
FS18C-1																	
SUR	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
CSC S15/W15	-	-	2	-	-	-	-	42	-	-	-	-	-	-	-	-	44
FS18C-2																	
SUR	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2
CSC N0/E0	-	-	-	-	-	-	-	64	-	-	-	-	-	-	-	-	64
N0/W15	-	-	-	-	-	-	-	23	-	-	-	-	-	-	-	-	23
N0/W30	-	-	1	2	-	-	-	63	-	-	-	-	-	-	-	-	66
EXC N0/W23	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	2
N2/E5	-	-	-	-	-	-	-	11	-	-	-	-	-	-	-	-	11
N8/W5	1	-	-	-	-	-	-	45	-	-	-	-	-	-	-	-	46
N10/W5	-	-	-	-	-	-	-	6	-	-	-	-	-	-	-	-	6
FS18C-3																	
SUR	2	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	5
CSC N15/W15	-	-	1	1	-	-	-	36	-	-	-	-	-	-	-	-	38
FS18D-1																	
SUR Locus A	-	-	-	4	-	-	1	-	-	-	-	-	-	-	-	-	5

Table 6.4. Inventory of major constituent classes at investigated sites in the Fish Slough study area (Cont....).

	PRJ	PTB	BIF	FLK	FRM	DRL	COR	DEB	MIL	HND	MGS	COB	BED	MOD	SHE	BON	Total
FS18D-1 (Cont...)																	
CSC Locus A																	
N0/E0	-	-	3	5	-	-	-	172	-	-	-	-	-	-	-	-	180
Locus B																	
N75/E0	-	-	-	-	-	-	-	15	-	-	-	-	-	-	-	-	15
N75/W15	-	-	1	-	-	-	-	44	-	-	-	-	-	-	-	-	45
EXC Locus A																	
N7/E1	-	-	-	-	-	-	-	544	-	-	-	-	-	-	-	-	544
N8/E2	-	-	-	-	-	-	-	302	-	-	-	-	-	-	-	-	302
Locus B																	
N82/W3	-	-	-	-	-	-	-	7	-	-	-	-	-	-	-	-	7
Non-Locus																	
N37/W2	-	-	-	-	-	-	-	37	-	-	-	-	-	-	-	-	37
FS20C-1																	
SUR	-	-	1	2	2	-	-	-	-	-	-	-	-	-	-	-	5
CSC S15/E0	-	-	-	-	-	-	-	50	-	-	-	-	-	-	-	1	51
S15/W15	-	-	-	2	-	-	-	78	-	-	-	-	-	-	-	-	80
S30/W15	-	-	-	-	-	-	-	42	-	-	-	-	-	-	-	-	42
S45/E0	-	-	1	-	-	-	-	53	-	-	-	-	-	-	-	-	54
EXC S7.8/E7.6	-	-	-	-	-	-	-	6	-	-	-	-	-	-	-	-	6
S12.5/E7.3	-	-	-	-	-	-	-	21	-	-	-	-	-	-	-	-	21
S17/W2	-	-	-	-	-	-	-	16	-	-	-	-	-	-	-	-	16
S37/E5	-	-	-	-	-	-	-	15	-	-	-	-	-	-	-	-	15
S40/W1	-	-	-	-	-	-	-	11	-	-	-	-	-	-	-	-	11
FS22B-1																	
SUR	1	-	1	5	1	-	-	2	-	-	-	-	-	-	-	-	10

Table 6.4. Inventory of major constituent classes at investigated sites in the Fish Slough study area (Cont....).

	PRJ	PTB	BIF	FLK	FRM	DRL	COR	DEB	MIL	HND	MGS	COB	BED	MOD	SHE	BON	Total
FS22B-1 (Cont...)																	
CSC S15/E0	-	-	-	1	1	-	-	15	-	-	-	-	-	-	-	-	17
S15/E15	-	-	-	-	-	-	-	22	-	-	-	-	-	-	-	-	22
EXC S1.5/E0	-	-	-	-	-	-	-	9	-	-	-	-	-	-	-	-	9
S2.5/E1	-	-	-	-	-	-	-	21	-	-	-	-	-	-	-	-	21
Non-Grid 1	-	-	-	-	-	-	-	87	-	-	1	-	-	-	-	-	88
FS22C-1																	
CSC N0/W15	3	-	1	3	1	-	-	76	-	-	-	-	-	-	-	-	84
FS26B-1																	
SUR	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
CSC N0/E0	-	-	1	-	-	-	-	171	-	-	-	-	-	-	-	-	172
N15/E0	-	-	2	4	-	1	-	123	-	-	-	-	-	-	-	-	130
N15/E15	-	-	-	-	-	-	-	232	1	-	-	-	-	-	-	-	233
N30/E0	1	-	-	1	-	-	-	423	3	1	2	-	-	-	-	4	435
N30/E15	-	-	-	-	-	-	-	325	-	-	-	-	-	-	-	2	327
EXC N5/W10	-	-	-	-	-	-	-	13	-	-	-	-	-	-	-	1	14
N20/E0	-	-	-	-	-	-	-	70	-	-	-	-	-	-	-	1	71
N35/E14	-	-	-	-	-	-	-	14	-	-	-	-	-	-	-	-	14
N40/E15	-	-	-	-	-	-	-	342	-	-	-	-	-	-	-	9	351
Total	131	6	217	206	23	6	3	41124	19	30	72	8	22	6	7	2304	44184

Note: PRJ, projectile point; PTB, arrow-point blank; BIF, biface; FLK, simple flake tool; FRM, formal flake tool; DRL, drill; COR, core and core tool; DEB, debitage; MIL, millingstone; HND, handstone; MGS, miscellaneous ground stone; COB, cobble tool; BED, bead; MOD, modified stone and bone; SHE, potsherd; BON, bone; SUR, piece-plot surface; CSC, controlled surface collection; EXC, excavation.

FS10A-2

This is an extensive scatter of flaked and ground stone spread around the east side of a large, isolated tuff knob. Several petroglyph panels with rectilinear and curvilinear elements were found on the tuff formation. In 1995, part of the site was surface collected with two 15x15 m grids (N0/E0, N15/E0). This produced a several obsidian tools, including one Elko and one Humboldt Basal-notched projectile points, 82 flakes (nearly all obsidian), a dozen milling tools (four millingstones, one handstone, seven pieces of miscellaneous groundstone), and a shaft straightener of vesicular basalt.

FS10B-2

FS10B-2 comprises a group of five discrete occupation zones set within a low dunefield on the east side of the northwest springhead (Figure 6.4). Several dunes host small but substantial middens (Locus A, B, C, and E), an expanse of alkali flat next to the spring contains a dense lithic scatter (Locus D), and a stretch of non-alkali surface at the east end of the site has a light midden deposit (Locus F). Loci A, D, and F were excavated in 1996. Locus A is a dark, charcoal-rich midden with a high *Anodonta* shell content but relatively few artifacts. It is situated on the highest dune at the site and was clearly the most likely of any midden to have significant depth and contain dateable organics. In contrast, Locus D showed no sign of midden. Cultural deposits are lower in elevation and near the springhead, and despite a thin veneer of alkali dust a large quantity of Elko Series point fragments was easily visible on the surface. To the south, Locus F displayed a light midden containing a substantial amount of artifactual and ecofactual remains. Nearly all flaked stone debris at the site was obsidian, with some chert and basalt represented as well.

Formal investigations began with the establishment of a provenience grid connecting the three loci. Datum prime (N0/E0) was placed atop the dune at Locus A, with lines of stakes set out to the west and south to facilitate grid layouts at Locus D and F, accordingly. A lack of surface artifacts at

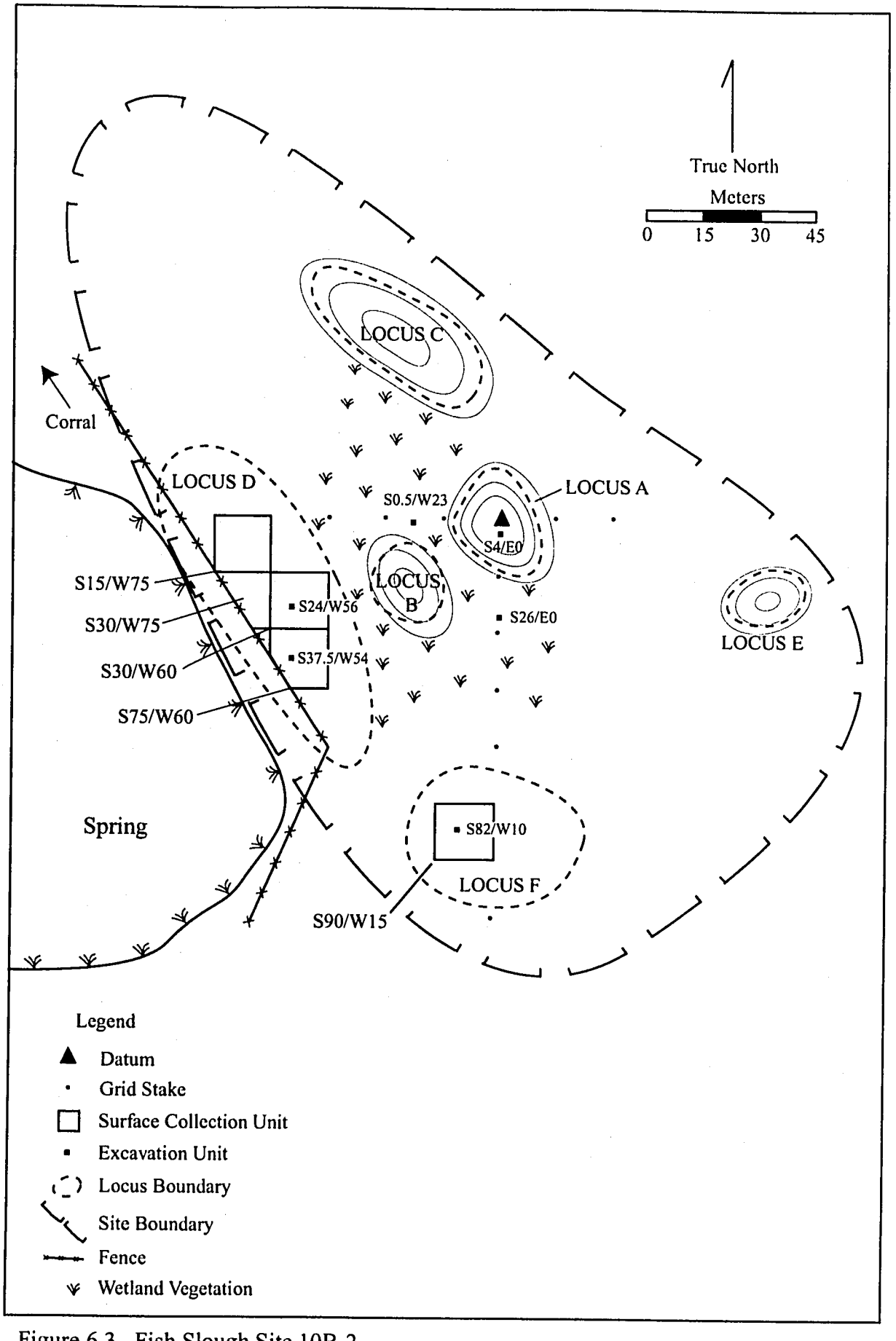

Figure 6.3. Fish Slough Site 10B-2.

Locus A precluded controlled surface work there, but three 15x15 m grids were eventually collected at Locus D (S30/W60, S30/W75, S45/W60) and one at Locus F (S90/W15). Covering a total area of about 785 m^2 (unit S30/W60 was a partial grid), these units contained 45 projectile points and 139 other flaked stone tools, nearly 12,000 unmodified flakes, 23 pieces of ground and battered stone equipment, four beads, two pieces of modified stone, and 137 bone fragments. All of the collection grids were highly productive, but unit S90/W15 alone contributed 35% of all debitage and 39% of all other artifacts obtained. Piece-plot collecting eventually gathered another 37 artifacts from the site surface, some 32 flaked stone and five ground stone tools. Unfortunately, time constraints limited excavations at Locus A to a single 1x1 m exposure (S4/E0). This unit unearthed a deep cultural deposit and was excavated to a depth of 110 cm, all matrix screened through 1/8" mesh with all cultural materials recovered. A total of 947 artifacts was recovered, mostly debitage but with two bifaces, one flake tool, one handstone and two millingstone fragments, and one *Olivella* bead. Also present in this unit, and in all others excavated at the site, were dense quantities of tiny *Anodonta* shell fragments. This required the use of a special sampling method in order to balance shell recovery with efficiency in excavation. For each 10-cm level removed, an initial 5-gallon bucket was filled to 20 cm (approximately 2.0 liters) and screened in its entirety for all artifacts and shell. Throughout the rest of each level, only diagnostic hinge elements of *Anodonta* shell were recovered from screens, all other fragments being rejected. This method allowed for consistency in shell sampling between levels and excavation units, and helped avoid the time-consuming and redundant task of collecting all shell fragments. Shell sample materials were kept separate from materials found in the remainder of each level so that relative amounts of shell could be weighed against samples of artifacts from the same volume of matrix. *Anodonta* refuse from Locus A contained many large, freshly broken fragments and the occasional half shell, a situation different than at Locus F where only minute fragments of semi-decomposed shell were present.

At 90 cm depth in unit S4/E0, excavations revealed a thick, dark lens of charcoal-rich sediment that appeared to be a house floor or similar occupation layer. Its form was ultimately revealed in profile, its surface dropping in a sloping curve from one end of the unit to the other and leveling out at about 106-110 cm depth. The feature was obviously richer in charcoal and burnt sediment than the midden above but its artifact assemblage was indistinct from that in upper horizons, lacking any formed artifacts save a single handstone found on its surface (bottom of the 80-90 cm level). The rarity of formed artifacts in late-period house structures has been noted at many other sites in Owens Valley (Basgall and Giambastiani 1995; Basgall and McGuire 1988; Bettinger 1989; Delacorte and McGuire 1993; Delacorte et al. 1995). This could indicate that processing was generally not conducted inside houses, but more likely it demonstrates that temporary occupations tend not to leave functional tools *in situ* nor do they generate many worn or broken implements.

Two 1x1 m exposures were excavated at Locus D (S24/W56 and S37.5/W54). Both units revealed a shallow, homogenous sandy deposit, artifact counts dropping rapidly below 20 cm. Nonetheless, both units were fairly productive, together yielding two projectile points, one arrow-point blank, seven bifaces, nine pieces of milling equipment, 1725 flakes and 105 pieces of faunal bone. Fragments of *Anodonta* shell were present but in limited amounts. At Locus F, a single 1x1 m unit was excavated at S82/W10, this exposure disclosing cultural matrix extending to at least 80 cm depth. The unit produced a variety of artifacts, including eight flaked stone tools, 14 milling tool fragments, two *Olivella* Spire-lopped beads, 2422 flakes, and some 1137 bone fragments, these last averaging 142 pieces per level. An Elko Eared point fragment was recovered between 70-80 cm depth. Excavations at Loci D and F also made use of the shell sampling strategy, though this procedure was more effective at Locus F given its greater volume of *Anodonta* detritus.

Finally, during initial site reconnaissance it seemed that cultural debris was restricted entirely within discrete loci, intervening areas being essentially devoid of artifacts. Some of these areas were

heavily vegetated, especially in between dune loci and in between Locus A and Locus F. As a quick check to see if cultural deposits were being masked by vegetation, two 1x1.5 m units were excavated to 10 cm depth at S0.5/W23 and S26/E0. Each of these units yielded a dozen or so unmodified flakes, indicating that at least some artifacts are present in non-locus areas.

Despite an attenuated volume of effort, it would appear that site FS10B-2 contains a variety of temporally and spatially discrete cultural deposits. Locus A contains a deep midden that is rich in *Anodonta* shell and carbon but poor in artifactual materials and vertebrate fauna. Debitage was fairly abundant but dominated by small flakes, and only three flaked stone tools were found in association. An intact occupation lens deep within the dune may indicate that some habitations at the site were relatively intensive or of more than a limited duration. In contrast, Locus D contains a deposit of stoneworking debris. Unmodified flakes were prevalent (9448 flakes) but so were flaked stone tools (142), a debitage:tool ratio (66.5:1) implying the occurrence of tool production, repair, and replacement. The recovery of many ground stone tools from Locus D (20) also suggests that subsistence activities were being conducted in this area and that occupations were not only focused on stoneworking. Locus F also contained a strong lithic component, a total of 6629 flakes and 60 flaked stone tools recovered from this area. Having a debitage:tool ratio of 110.4:1 and a sizable ground stone tool collection (25 pieces), Locus F appears similar to Locus D in some respects. However, it is most noteworthy for its faunal-rich midden, subsurface horizons yielding some 1137 bone fragments and averaging 142 pieces per excavation level. Midden deposits at Locus A cannot even approach this figure, containing only 12.5 bones per level. This implies that the Locus F midden is unique, perhaps functionally and temporally distinct from the Locus A midden.

Available chronological indices (projectile points, beads, and obsidian hydration readings) indicate that Locus A is probably of Haiwee-period age while deposits at Locus D and F were generated during Newberry times. The presence of *Anodonta* shell at all loci hints at a late-period

presence, perhaps more strongly for Locus A given its dense and less deteriorated shell component. Locus D is the most firmly dated at present, having produced several dozen Elko Eared point fragments and a consistent set of Newberry-age hydration values (see Chapter Eight). It should be noted, however, that one Desert Side-notched and two Cottonwood points were also retrieved from Locus D. More than likely, this shows that site FS10B-2 was a popular location at Fish Slough and was visited on many occasions over the last several millennia.

FS12C-2

Cultural deposits at FS12C-1 are situated atop a raised, narrow bench that lies between the Fish Slough waterway and the fault scarp on the east side of the valley. Artifacts are concentrated in an area of about 135 x 80 m, this zone encompassed by a broader, sparse distribution of debris and a thin veneer of *Anodonta* shell. Midden sediments are present in the southern part of the site (Locus B), and to the north three large tuff boulders are topped with many milling slicks and mortar depressions (Locus A). Both loci were revisited in 1995 for surface collection and a single 15x15 m grid was collected at each (Locus A, N0/W15; Locus B, N0/E0). Along with three artifacts recovered from non-grid areas, surface work produced 14 obsidian tools, 49 obsidian flakes, two pieces of miscellaneous ground stone, and five Owens Valley Brownware pottery sherds, all of the last obtained from Locus B. The site inventory also includes four obsidian projectile points, one Desert Side-notched, one Rose Spring, one Elko Eared, and one Pinto form.

FS14C-1

Located on the west flank of Fish Slough slightly above a stretch of alkali flats, this site contains a shallow, sandy cultural deposit with a zone of moderately-rich midden. Surface materials were spread widely at this location, prompting the collection of four 15x15 m grids (N0/E0, N0/W30,

S15/E0, S15/W30) and the piece-plot recovery of 29 other artifacts (including 11 projectile points). Two concentrations of debris were delineated, one just north of center and one at the western edge of the site. The north-central concentration produced an obsidian Elko Corner-notched point from the surface but displayed relatively little *Anodonta* detritus, while the west concentration had a dense shell component. The north-central area was targeted with a 1x1 m unit (N14/E9) that was excavated to 30 cm depth. This produced a modest sum of artifacts but yielded two chert Elko points from the 10-20 cm level. An adjacent 1x2 m exposure was later set at N14/E7, producing another obsidian Elko point but little else of note. In contrast, a 1x1 m unit placed in the western concentration (S2/W30) yielded a wide variety of materials. Excavated to 40 cm depth, this unit contained midden with lots of charcoal and good quantities of shell. The assemblage from S2/W30 included obsidian tools (four bifaces, one formed flake tool, two simple flake tools), over 700 obsidian flakes, three handstones, one miscellaneous ground stone fragment, two *Olivella* Spire-lopped beads, and 237 pieces of bone.

FS14C-2

As Brian Paciotti would attest, this obsidian scatter is not very far from FS14C-1, just over 100 meters to the northwest. Ground surfaces at the site lie right at the elevational contact for alkali flats. In fact, parts of the site retain a thin veneer of alkali deposit while others are characterized by low, almost imperceptible dunes, and there is minimal vegetation throughout the area. Surface artifacts were mostly obsidian debris, spread thinly across the site but still highly visible. Three 15x15 m surface collection grids were established (S15/E0, S15/E15, S30/E15), producing a variety of tools (four projectile points, seven bifaces, three formed and seven simple flake tools), 330 unmodified flakes (mostly obsidian), five ground stone tools, and one piece of bone. Past grid boundaries, another projectile point and biface were recovered from the surface. Surface debris was clustered in grid S15/E0 but three 1x1 m excavation units were laid out so that one fell within each collection grid

(S5/E6, S5/E19, S20/E6). All 1x1s were taken to 30 cm depth with all matrix screened through 1/8" mesh. Excavation yields totaled 136 flakes and four pieces of bone, the flakes distributed evenly between exposures and restricted mainly to the upper 10 cm level in each unit. This prompted the excavation of a 5x5 m surface scrape at (S10/E6), taken to 10 cm depth and removed in two halves (north and south). As compared to others this unit was extremely productive, contributing a variety of flaked and ground stone tools (with one projectile point), two beads (stone and shell), 645 flakes, and 23 bone fragments. The large amount of debris found in the scrape was unexpected, presumably a result of deflationary episodes that condensed artifact volumes into a shallow deposit.

FS14D-1

This large midden site is located on the eastern flank of Fish Slough on an elongate, narrow bench between the east fault scarp and the slough waterway. Cultural materials extend for nearly 150 meters along the terrace, but the central part of the site hosts a dark, shell-rich midden flanked by two massive tuff boulders that served as shelters (Figure 6.5). The largest of the boulders, measuring over 10 m tall and in diameter, has nearly vertical sides yet displays heavy concentrations of artifacts on its west and east flanks. About 10-15 m to the southeast, the smaller boulder rests in a position creating a small, cave-like shelter. This alcove was the site of more intense habitation that produced a high, semi-circular apron of midden refuse.

Although surface artifacts cover an extensive area, the sheer number of artifacts and time limitations of the field program allowed for collection of only two surface grids, a 2x2 m grid at S2/E0 (collected in 1995) and a 15x15 m unit at S15/W15. As intimated, these two units were extremely productive, together yielding 42 flaked stone tools, 2573 unmodified flakes, six pieces of miscellaneous ground stone, one Owens Valley Brownware sherd, and ten pieces of bone. Another 30 artifacts were piece-plot collected from the rest of the site, including 14 projectile points, one point

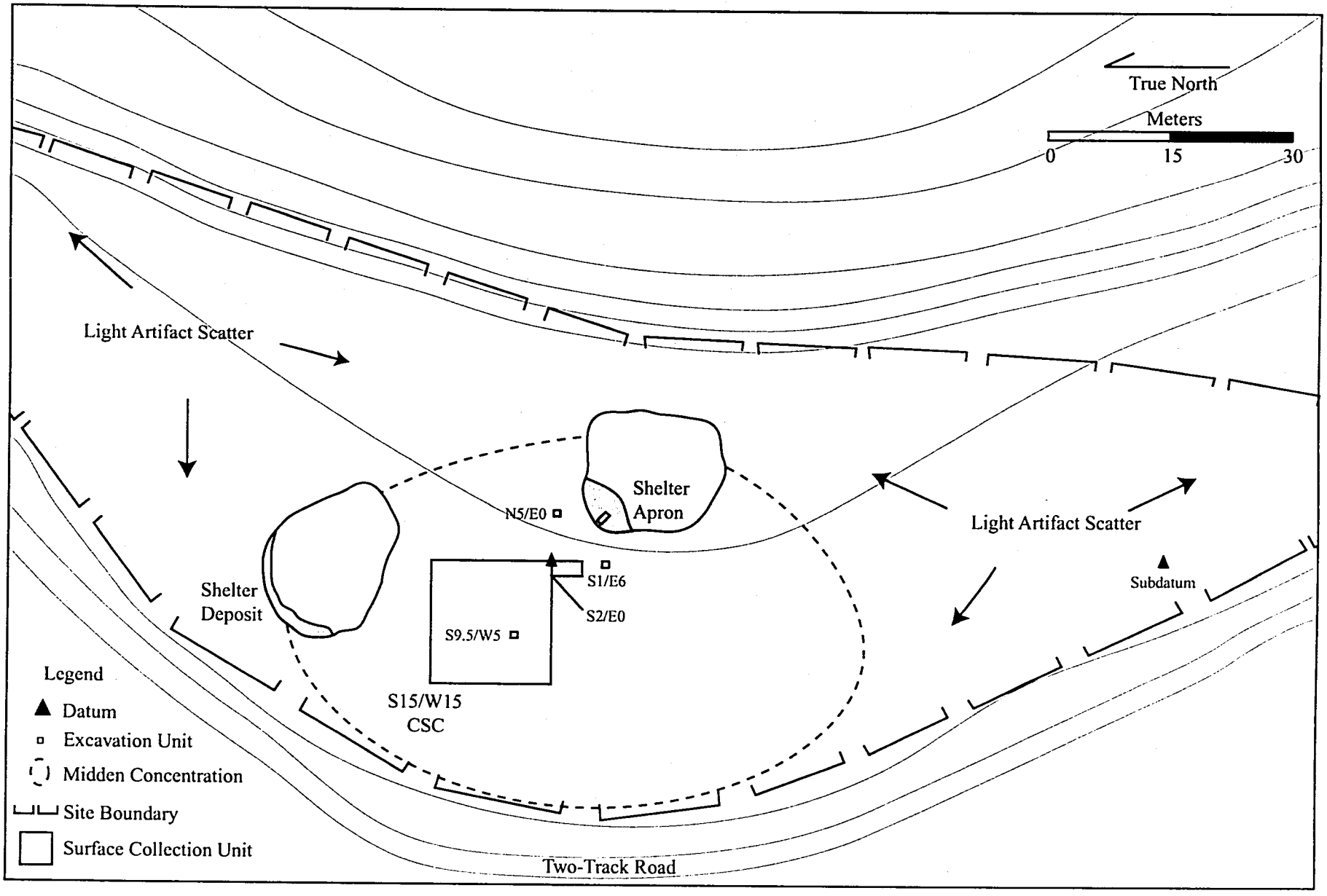

Figure 6.5. Fish Slough Site 14D-1.

blank, seven bifaces, one formed flake tool and three simple flake tools, one drill, two glass beads, and one Brownware sherd. Most of these artifacts were found in the central midden, but the glass beads were retrieved from the apron of the smaller shelter.

Subsurface testing was directed to the central midden and to the apron of the alcove shelter. Three 1x1 m control units were placed in the midden (N5/E0, S1/E6, and S9.5/W5). Situated a bit upslope, unit N5/E0 was relatively shallow, terminating in talus rubble at about 60 cm depth. The unit produced 1402 artifacts, mostly debitage (1394 pieces) but also two bifaces, three flake tools, and three handstone fragments. Other units were placed downslope and had deeper strata, S1/E6 reaching 80 cm depth and S9.5/W5 reaching 90 cm. Each of these units was also very productive and the latter especially so, adding four projectile points, 18 flaked stone tools, 4042 flakes, four shell beads, and a piece of a turquoise pendant to the site inventory. *Anodonta* shell was common in all midden units but bone was scarce, just 49 pieces collected in all (an average of 2 pieces per level). A slightly different deposit exists in the shelter apron. A single 1x2 m unit was oriented perpendicular to the shelter to bisect the width of the refuse apron. This unit was excavated to a depth of 70 cm, producing seven projectile points, 29 flaked stone tools, 6505 flakes, three shell beads, and another turquoise pendant fragment. More interesting were 244 bone fragments recovered, these occurring at an average of 17 per 1x1-m, 10-cm level. Though not wildly divergent from yields in the central midden, the large quantities of bone from the apron imply that fauna were treated differently by shelter occupants.

Most unusual in the site inventory are the non-utilitarian goods, which include two glass beads, seven shell beads, and two fragments of shaped turquoise. Both glass beads are monochrome and opaque, one milky-white and the other antique or pearl-white in tone. The former has straight, parallel sides and flat ends that slant in the same direction, giving the bead an almost parallelogram profile. The second bead is similar in shape but is a bit more rounded, appearing more spherical in outline. The scarcity of glass beads in the Tableland precludes classifications for these pieces, but

they seem to correspond best to Type 3 beads in Sorenson and Leroy's (1968) typology and to Type 9 forms following Motz and Schulz (1980). As for the shell beads, these are quite variable in form. One is a rectangular sequin of *Olivella* shell, two are clam disk beads, and the other three are *Olivella* wall beads, with drilled perforations but unshaped edges. Judging by differences in stone color and shape, the turquoise fragments appear to derive from two separate artifacts, at least one of which bore a conically-drilled perforation. The glass beads indicate that the site was occupied during the Protohistoric period (200-100 B.P.) while others are indicative of at least terminal Marana habitations (700-200 B.P.). Added to the array of projectile points, some of which imply Newberry (3200-1400 B.P.) and others Pinto age (pre-5000 B.P.), the sample of non-utilitarian goods shows that the site was occupied on many separate occasions over the last five millennia.

FS18C-2

This site is one of many simple flaked stone scatters located on alkali flats against the western margin of Fish Slough. Covering an area of about 120 x 135 m, the artifact scatter lies on silty sediments that are covered with alkali crust in summer and submerged under several centimeters of water in winter. Between 1995-1996, three 15x15 m surface grids were collected in the main part of the scatter (N0/E0, N0/W15, N0/W30). Collections amassed mostly debitage, 150 flakes in addition to one biface and two simple flake tools. Two other bifaces were retrieved from the surface beyond grid outlines. Subsurface testing was accomplished with three 1x1 m control units, one placed in each collection grid (N2/E5, N10/W5, N0/W23). Each of these units produced few artifacts, a total of just 19 flakes combined, and all units were terminated at 20 cm depth upon reaching a layer of gravel/sand mix. Slightly deeper cultural sediments were observed in the vicinity of unit N10/W5, and a 2x5 m surface scrape (10 cm depth) was placed at N8/W5 (encompassing the nearby 1x1). This unit produced 45 flakes and an undiagnostic dart point fragment. The assemblage recovered from FS18C-

2 is comparable to those from other simple lithic scatters in the area, debitage being prevalent and formed tools being either rare or absent. At the very least, this pattern points to a common function in the use of habitats along the edge of Fish Slough, but it probably implies an early temporal signature as well.

FS18D-1

Located on the east side of Fish Slough directly across from FS18C-2, this deposit is a simple lithic scatter spread across the same narrow bench containing FS14D-1 farther to the north. Flaking debris covers an area of about 100 x 35 m but is clustered in two separate zones, one to the south (Locus A) measuring 50 x 35 m and one to the north (Locus B) spanning about 30 x 30 m. Surface collections at Locus A were completed in 1995 with a single 15x15 m grid at datum (N0/E0) and in 1996, portions of two 15x15 m grids were collected at Locus B (N75/E0, cells A, D, G; N75/W15, all cells save A, D, and G). The grid at Locus A produced 172 flakes, three bifaces, and five simple flake tools, while grids at Locus B contained just 59 flakes and a biface. Five more tools were collected from non-grid areas, four flake tools and a small, cone-shaped bipolar core of white chert.

Subsurface testing examined both loci and the intervening space as well. Three 1x1 m control units were excavated, at N8/E2 (Locus A), N82/W3 (Locus B), and N37/W2 (non-locus). Taken to 50 cm depth, unit N8/E2 produced 302 flakes and a bit of *Anodonta* shell, the latter from 0-10 cm only. Unit N82/W3 yielded just seven flakes from 20 cm of deposit and unit N37/W2 yielded only 37 flakes from 30 cm of depth. To boost samples from Locus A, a 1x2 m control unit was opened at N7/E1, this exposure also excavated to 50 cm. Another 544 flakes were collected from this unit but not a single tool or bit of ecofactual material were found in association. Even though it is situated on a slightly raised bench above alkali habitat, FS18D-1 produced an assemblage that is highly consistent with other lithic scatters set nearer to the slough margins.

FS20C-1

This simple lithic scatter lies a full kilometer downstream from FS18C-2 but occurs in a comparable alkali flat setting. Also like FS18C-2, this site is submerged by shallow water in winter. On the surface, artifacts are dispersed over an area of about 135 x 80 m. Investigations in 1996 began with the collection of four 15x15 m surface grids (S15/E0, S15/W15, S30/W15, S45/E0). Artifact yields were highly consistent between collection grids, totals varying between 42-80 items. In all, controlled collections produced one biface, two flake tools, 223 unmodified flakes, and one piece of bone. A few tools were retrieved from outside grid areas as well, these including one biface, two formed flake tools and two simple flake tools. Next, subsurface investigations commenced with three 1x1 m control units placed at S7.8/W7.6, S12.5/S7.3, and S40/W1 (some units were set at uneven meter intervals to avoid sensitive plants). As seen at other lithic scatters, all units encountered an extremely shallow cultural deposit restricted mainly to the upper 10 cm. Artifact production was again low, yields from each exposure ranging between 6-21 items with just 43 flakes recovered in all. Two 2x2 m surface scrapes (10 cm depth) were placed at S17/W2 and S37/E5 to boost obsidian samples, the former producing just 16 flakes and the latter one biface and 53 flakes. The sparse production from this site and the homogenous nature of its deposit serve to underscore similarities between the many obsidian lithic scatters on alkali flats along the margins of Fish Slough.

FS22B-1

FS22B-1 is near the south end of an elongate dunefield paralleling Fish Slough on the west, lying atop a flat sandy terrace only a few meters high. Obsidian artifacts are scattered loosely over an 80 x 40 m area but cluster within a 30 x 30 m zone. In this concentration we placed two 15x15 m surface collection grids (S15/E0, S15/E15). Artifact recovery was poor, collections yielding just one formed flake tool, one simple flake tool, and 37 flakes. Outside the grids, tools were common but

debitage was not. Ten artifacts were piece-plotted and retrieved from non-grid surface contexts, including one fluted projectile point, one biface, one formed flake tool, five simple flake tools, and two unmodified flakes (originally mistaken for tools). The fluted point displays a single, broad fluting removal on each face and is fractured across its mid-section. One edge of the broken plane was used as a scraping or cutting tool, evidently around the time the tool was manufactured (see Chapter 8).

The concentration area was tested with a single 1x1 m control unit (S1.5/E0), and a zone lacking surface artifacts a few meters northwest of grid S15/E0 was also tested with a 1x1 m unit for comparison (Non-Grid Unit 1). Unit S1.5/E0 conformed to expectations, yielding a few flakes (nine) in the upper 10 cm but none between 10-30 cm; a 2x2 m surface scrape was later placed adjacent to the unit (at S2.5/E1), faring only slightly better (21 flakes). In contrast, Non-Grid Unit 1 had a substantial artifact deposit beneath a veneer of aeolian sand. This unit was excavated to 70 cm, producing 87 flakes and a piece of unclassified ground stone, most of which were found between 30-60 cm depth. The relationship of the fluted point to the site assemblage is not yet understood, but hydration data show consistencies between the point and the collection of flakes from Non-Grid Unit 1 (see Chapter 8).

FS26B-1

FS26B-1 is the southernmost site we discovered, situated downstream from the bedrock bottleneck that may have halted the spread of granitic alluvium from farther up the slough (see Chapter Two). The accumulation of flaked and ground stone here lies within thin tuff sediments that cover a basement of tuff bedrock by less than 10 cm in some areas. Surface artifacts were found scattered across a 160 x 50 m area, with a few dense concentrations of flaking waste and ground stone tools. Controlled surface collections were conducted in 1995 and 1996 with five 15x15 m grids (N0/E0, N15/E0, N15/E15, N30/E0, N30/E15). As compared to surface grids at most other slough

sites, those at FS26B-1 were quite productive. Artifact yields from individual grids ranged from 130-435 items, the combined assemblage including one projectile point, three bifaces, a drill, five simple flake tools, 1274 unmodified flakes, four millingstones, one handstone, two groundstone fragments, and six pieces of bone. Initial reconnaissance of the site found four other projectile points that ultimately remained outside grid areas; these were plotted and collected.

Subsurface testing began with three 1x1 m control units placed at N5/W10, N20/E0, and N35/E14, all matrix screened with 1/8" mesh. Each unit encountered very thin sediments, the deepest excavated to 40 cm (N20/E0) and the most shallow barely reaching 10 cm (N35/E14). As expected no unit was really productive, a sum of 97 flakes and two pieces of bone constituting the lot. However, debitage counts were bolstered by a 5x5 m scrape (10 cm depth) at N40/E15, this unit alone producing 342 flakes (and 9 bone).

Summary of 95-96 Excavations

Investigations at the 15 sites described above yielded abundant data regarding habitation residues left along the margins of Fish Slough. Many sites appear to contain only obsidian flaking debris and a few tools, refuse from brief encampments at which stoneworking was the main activity (FS14C-2, FS18C-1, FS18C-2, FS18D-1, FS20C-1, FS22B-1, FS22C-1). These sites are generally located in close proximity to the edges of the current drainage channel, some present on alkali flats that are flooded in winter (e.g., 18C-2, 20C-1). Formed artifacts are rare at these locations and time-sensitive items are all but absent. As discussed elsewhere (Giambastiani 1995, 1996), and in subsequent chapters, previous hydration studies indicate considerable age for these deposits, perhaps on the order of 7000-8000 years.

Still other sites held evidence of more substantial habitation, some with strong flaked stone and ground stone components (FS18C-3, FS26B-1) and a few with organic middens (FS10B-2,

FS12C-2, FS14C-1, FS14D-1). Site FS10B-2 is actually a complex of six depositional loci, five with middens (Locus A-C, E, F) and one without (Locus D). All sites with midden components are situated on more stabilized surfaces at slightly higher elevations than the slough itself. *Anodonta* shell detritus in normally present in these middens in varying degrees of preservation; vertebrate fauna are often poorly represented. Formed tool assemblages are substantial at many sites, particularly those with middens, and samples of diagnostic artifacts often include a wide range of temporal markers. In some cases it can be argued that a place was occupied for substantial durations several times (e.g., FS10B-2, FS14D-1), but in others the variety of marker artifacts may simply indicate brief, sequential re-visits by parties interested in scavenging raw materials for use elsewhere (e.g., FS26B-1). Of two sites located outside the Slough, one is a small bedrock milling facility (FS4C-1) and the other is an accumulation of flaked and ground stone debris associated with a petroglyph-bearing outcrop (FS10A-2). Neither of these sites was subjected to subsurface testing, though both are interesting if for nothing else than their unusual attributes. They are also similar to many sites outside the valley located at rock formations, perhaps signaling the importance of such formations to occupations beyond the slough.

More than 12,000 m^2 of site surface was examined at the 15 locations investigated during the 1995-96 program and over 43 m^3 of cultural matrix excavated at nine sites. Collection from all sites recovered some 44,178 items, including 586 flaked stone tools, 41,124 pieces of assorted debitage, 129 milling implements, 22 beads, six pieces of modified stone and bone, seven pottery sherds, and 2304 pieces of bone (Table 6.4). Excavated sites yielded 43,825 items, midden sites FS10B-2 and FS14D-1 together contributing 81% of this total (43% and 38%, respectively); no other location produced more than 9% of the whole. This discrepancy relates in part to variation in the extent of excavation levels, sites FS10B-2 and FS14D-1 receiving more attention than other locations (see Table 6.1, above), but it also reflects the sparse nature of most Fish Slough sites where increased excavation volumes did not materially increase artifact returns (e.g., FS14C-2). Without exception, site flaked

stone assemblages are overwhelmingly dominated by obsidian, other materials like chert, basalt, and unclassified igneous stone being present in low to trace amounts.

1997 SURVEY AND TESTING PROGRAM

I noted at the outset of this chapter that artifact recovery during the Plateau survey was directed specifically to obtaining samples form obsidian study. Normally, a single surface collection was made at each site found on the survey. Where sites had multiple loci, a surface collection was completed at each locus. Recovery was usually accomplished in a "grab sample" fashion, collecting all obsidian flakes in no particular pattern within a radius of a chosen point (usually the site datum) until roughly 50 pieces had been obtained. In some cases, collection areas were expanded to achieve desired samples and in others entire site surfaces were fully collected. Whenever possible, only technologically diagnostic flakes with intact bulbs of percussion were retrieved.

It is well known that surface collections are normally biased toward larger flakes, yet samples of pressure debris were required for certain obsidian technological studies. To get samples of small debitage, buried deposits were tested where possible. Following methods used by R. Jackson (1985), limited excavations were made by digging a single 1x1 m test unit near each site datum and locus datum. Matrix was removed with short-handled shovels and was sifted through small screens (roughly 60x30 cm in size) fitted with 1/8" mesh, both carried by surveyors atop backpacks. Given the shallow nature of cultural deposits on the Tableland (Basgall and Giambastiani 1995), excavations were limited to 10 cm depth, units expanded horizontally up to 1x2 m as needed. The goal of excavation was to obtain between 30-50 flakes from each unit without spending inordinate amounts of time; this met at all but three sites where a lack of buried deposit precluded excavation. To preserve assemblage composition, all artifacts were collected from excavated units regardless of type or material.

Surface collections were eventually obtained from 18 areas at 16 different sites. Total areal coverage within standard surface collection zones (from 10x10 to 20x20 m in size) is estimated at over 4000 m^2, several locations being completely scoured for flakes (e.g., T4-B, T8-A, T10-B, T16-A, T23-A, T24-A). A total of 18 units was excavated at 14 sites, ten 1x1-m in size and eight 1x2-m in size. All units were excavated to a depth of 10 cm, totaling some 2.6 m^3 of examined deposit. Without exception subsurface tests encountered sandy matrix, sites on the Plateau having mantles of loose, coarse sand and sites near the slough having more compact, finer sediments. In all, Plateau survey sites produced 1976 artifacts, 38 surface piece-plotted, 814 from surface collection units, and 1074 from excavation. As shown in Table 6.5, artifact yields were not overwhelming at any site, totals ranging from 19 to 246 items. Formed artifacts were rare in buried situations, just two items recovered from sites T20-A and T30-B. Though surface work was aimed at recovering flakes, cataloguing revealed one biface and eight simple flake tools had been collected fortuitously.

Given the methods by which the Plateau survey assemblage was recovered there is little to be gained in discussing its constituent and technological profiles on their own. The Plateau assemblage is not really amenable to comparisons with the slough survey assemblage either, but some of its classes, like projectile points, can be used to measure site occupation frequency and duration on the Plateau. Discussions of this sort are provided in the following section where appropriate.

FLAKED STONE ASSEMBLAGES AND TECHNOLOGY AT FISH SLOUGH

At this juncture we can briefly examine technological trends in Fish Slough flaked stone assemblages in order to frame later discussions of long-term change on the Tableland (Chapter Nine). A lot has been done along these lines already (Basgall and Giambastiani 1995), but it is important to explore Slough assemblages as they are different in many ways from site assemblages in other

Table 6.5. Surface and subsurface collection totals for the Plateau survey by site and unit type.

		PRJ	BIF	FRM	FLK	DEB	SHE	MDT	Total
T2-A	PP	-	-	-	-	-	-	1	1
	CSC	-	-	-	-	28	-	-	28
	EXC	-	-	-	-	31	-	-	31
T2-B	CSC	-	-	-	-	50	-	-	50
	EXC	-	-	-	-	164	-	-	164
T4-A	PP	2	-	-	-	-	-	-	2
	CSC	-	-	-	2	96	-	-	98
	EXC	-	-	-	-	121	-	-	121
T4-B	CSC	-	-	-	1	40	-	-	40
T6-A	PP	1	-	-	-	-	-	-	1
	CSC	-	-	-	-	52	-	-	52
	EXC	-	-	-	-	25	-	-	25
T8-A	PP	3	-	-	-	-	-	-	3
	CSC	-	-	-	-	33	-	-	33
	EXC	-	-	-	-	3	-	-	3
T10-B	CSC	-	-	-	-	19	-	-	19
T16-A	PP	1	-	2	-	-	-	-	3
	CSC	-	-	-	-	30	-	-	30
	EXC	-	-	-	-	11	-	-	11
T20-A	PP	5	-	-	-	-	5	2	12
	CSC	-	-	-	1	104	-	-	105
	EXC	-	-	-	1	117	-	-	118
T23-A	PP	1	-	-	-	-	-	-	1
	CSC	-	-	-	-	28	-	-	28
	EXC	-	-	-	-	34	-	-	34
T24-A	PP	2	-	-	-	-	-	-	2
	CSC	-	-	-	-	45	-	-	45
	EXC	-	-	-	-	60	-	-	60
T24-B	CSC	-	-	-	2	49	-	-	51
	EXC	-	-	-	-	125	-	-	125
T24-C	PP	1	-	-	-	-	-	-	1
	CSC	-	-	-	-	46	-	-	46
	EXC	-	-	-	-	23	-	-	23
T28-A	CSC	-	1	-	2	48	-	-	51
	EXC	-	-	-	-	140	-	-	140
T30-A	PP	4	-	-	-	-	-	-	4
	CSC	-	-	-	-	89	-	-	89
	EXC	-	-	-	-	79	-	-	79
T30-B	PP	7	-	-	-	-	-	-	7
	CSC	-	-	-	-	99	-	-	99
	EXC	1	-	-	-	139	-	-	140
	TOTAL	28	1	2	9	1928	5	3	1976

Note: PRJ, projectile point; BIF, biface; FRM, formed flake tool; FLK, simple flake tool; DEB, debitage; SHE, pottery sherd; MDT, modified tuff; PP, piece plot; CSC, controlled surface collection; EXC, excavation.

landscape settings. The occupational history of Fish Slough is also unique on the Tableland and can be glimpsed using flaked stone data.

Testing at Fish Slough sites recovered 747 flaked stone tools and 66,204 assorted flakes (see Tables 6.2 and 6.3). The full tool collection is dominated by bifaces (n=298), followed by simple flake tools (237), projectile points (154), formed flake tools (37), drills (10), point blanks (8), cores (two) and a core tool (1). Flaked stone tools outnumber ground stone implements by a factor of 4.9:1, and each tool is accompanied by an average of 88.6 flakes. For the most part, the entire Fish Slough tool assemblage consists of various fragments. Fewer than 9% of all tools are whole and only 18% are either whole or near-complete (Table 6.6). Of 137 whole/near complete specimens, 92 are simple flake tools (67%) and 23 are projectile points (17%). This is expected since flake tools are used briefly for light-duty tasks and discarded, and projectile points are often rejected in "whole" form after failed rejuvenation attempts. The fact that most recovered points are proximal ends (78%) relates in part to bias in identifying these artifacts (proximal ends have diagnostic attributes and are easier to spot), but it also implies that most points were fractured in the haft, being removed and discarded during retooling. Complete bifaces are exceedingly rare, only three (1% of all bifaces) being whole or nearly so. Relative consistency in the apportionment of biface fragment types is indicative of tool production, items being fractured and discarded during manufacture or reworking. Overall, the fragmented state of most tools implies that few were abandoned while still serviceable, a premise that is consistent with the near-absence of quality toolstone on the Tableland and with elevated levels of artifact use and re-use. The scarcity of cores supports this notion, as it appears that whatever toolstone was imported to the Tableland was eventually reduced down to small, spent fragments and debitage.

Obsidian is clearly dominant in all tool classes and among debitage as well, accounting for 93% of all tools and 96% of all flakes (Table 6.7). Cryptocrystallines (chert) are the only other material to occur in more than trace quantities (6% of all tools, 1.5% of all debitage) though several

TABLE 6.6. Fragment types by flaked stone tool class, 1993 and 1995-96 testing programs.

	WHL	NRC	MED	MRG	DST	PRX	END	Total
Projectile Point	8	15	7	1	1	120	2	154
Point Blank	3	1	1	2	-	-	1	8
Biface	1	2	64	98	62	20	51	298
Simple Flake Tool	46	46	21	48	36	28	12	237
Formed Flake Tool	4	6	5	7	5	7	3	37
Drill	1	1	4	-	3	1	-	10
Core/Core Tool	3	-	-	-	-	-	-	3
Total	66	71	102	156	107	176	69	747

Note: WHL, whole; NRC, near-complete; MED, medial; MRG, margin; DST, distal; PRX, proximal; END, indeterminate end.

other lithic types occur as debitage (basalt, rhyolite, quartz, quartzite, and schist). With the exception of small obsidian nodules, distributed sparsely across much of the Tableland formation, all obsidian comes from sources outside the study area. The cryptocrystallines are probably also of foreign origin, especially green-gray chert that is native to Eureka Valley (cf. Bettinger 1989; Delacorte 1988, 1990). All other lithics are not native to the Tableland but are found in northern reaches, arriving in alluvium carried through Chidago Canyon and Red Rock Canyon from the Casa Diablo area. Obsidian was obviously preferred for tool production but cryptocrystallines account for relatively large fractions of drills (30%) and formed flake tools (16%), artifact forms that often served in heavy-duty processing. The variety of non-obsidian stone represented as debitage but not as tools is suggestive of expedient, local use. Some non-obsidian debitage probably results from shaping and rejuvenating ground stone tools, but it is also likely that local stones were acquired as needed to supplement obsidian stores, tools made from them being discarded away from sites or taken off the Tableland.

TABLE 6.7. Material types by flaked stone artifact class, 1993 and 1995-96 testing programs.

	OBS	CCR	BAS	RHY	IGN	QTZ	QZT	SCH	OTH	Total
Projectile Point	147	7	-	-	-	-	-	-	-	154
Point Blank	8	-	-	-	-	-	-	-	-	8
Biface	277	19	1	-	-	1	-	-	-	298
Simple Flake Tool	226	9	2	-	-	-	-	-	-	237
Formed Flake Tool	31	6	-	-	-	-	-	-	-	37
Drill	7	3	-	-	-	-	-	-	-	10
Core/Core Tool	1	1	-	-	1	-	-	-	-	3
Debitage	63837	1017	187	66	83	23	961	15	14	66203
Total	64534	1062	190	66	84	24	961	15	14	66950

Note: OBS, obsidian; CCR, cryptocrystalline; BAS, basalt; RHY, rhyolite; IGN, unclassified igneous; QTZ, quartz; QZT, quartzite; SCH, schist, OTH, other.

Projectile Points

The vast majority of projectile points are obsidian (95.5%), seven cryptocrystalline specimens accounting for the rest. Regardless of point type, few specimens remain whole or near-complete (n=23), most are proximal fragments (120), and others are medial (7), end (3), and margin fragments (1). Blade reworking is common on dart-size forms but rare on arrow-points. Several larger points have also been reshaped along the base, as evidenced by unique morphologies and/or by hydration rim measurements (see Chapter Eight). Basgall and Giambastiani (1995:240) suggested these patterns are typical for projectile points and other tools on the Tableland, as the conservation, extended use, and scavenging of lithic materials has created artifact assemblages composed largely of spent implements and scrap.

The collection of projectile points from investigated sites includes 118 diagnostic forms. These are dominated by the Elko type (n=68), a large portion of which (32) derives from FS10B-2. When this site is excluded, the distribution of projectile points evens considerably, the Elko type still dominating but others present in substantial relative frequencies. Older dart-size points outnumber arrow-points 94 to 24, with pre-Elko types (Pinto/Little Lake, Fish Slough Side-notched, Great Basin Concave-base) being well-represented (26%). Arrow points are split fairly evenly between the Rosegate (11) and Desert Series (13), with Rose Spring (10) and Desert Side-notched types (9) taking precedent over Eastgate (1) and Cottonwood types (4).

Point Blanks

Eight obsidian point blanks were collected from subject sites. These few come from just four locations, two apiece obtained from MNO-1992, FS10B-2, FS14C-1, and FS14D-1. Half are whole or near-complete, others are margin (two), medial or end fragments (one each). Six are essentially triangular in shape and two are more ovoid, but all are of arrow-point dimensions; whole/near-complete pieces vary between 26.6-17.4 mm in length, 16.4-11.4 mm in width, and 4.1-2.6 mm in thickness. Each point blank displays unmodified dorsal and ventral surfaces of the flake used in its production. Edge-shaping is evident on all unfractured margins, just one specimen showing evidence of pressure retouch across the body.

Bifaces

Bifaces (298) are the most common tool form in the overall assemblage, being present at 14 of 17 examined locations. The vast majority are obsidian (n=277, or 93.0%), the others being cryptocrystalline (19), basalt (1), and quartzite (1). Bifaces are more heavily fragmented than other tool forms. Only three specimens are whole or near-complete, margin fragments occurring most often

(98) and the remainder divided fairly evenly between medial (64), distal (62), indeterminate end (51), and proximal (20) sections. Fragment sizes are small, ranging between 0.5-5.8 cm in length, 0.3-4.6 cm in width, and 0.2-1.6 cm in thickness. All bifaces were placed into relative size and reduction stage categories. Of 218 items that were intact enough to estimate, 47 are sections of large bifaces that were probably knives or tool preforms, 111 are of dart-point size, and the rest (51) are arrow-size. Stage distributions are as follows: 6 Stage 1, 31 Stage 2, 79 Stage 3, 80 Stage 4, 42 Stage 5; another 60 pieces could not be placed with confidence in any class. Thus, the late-stage (Stage 4-5) is dominant in the identifiable sample (51.3%), succeeded by the middle-stage (Stage 3; 33.2%) and the early-stage (Stage 1-2; 15.5%). Generally, stage assignments track biface size classifications. Most early-stage bifaces belong to the large biface class as well (20 of 31 sizeable items [64.5%]). Most middle-stage bifaces are dart-size forms (36 of 60 items [60%]), while late-stage bifaces are more evenly divided between dart-size (56.1%) and arrow-size (40.2%) classes. This implies that bifaces arrived on the Tableland in many different forms, to be reduced, reshaped, sharpened, or simply discarded on-site. Still, just over half of all classifiable bifaces are late-stage dart- or arrow-size pieces, which indicates that projectile point manufacturing and repair was as significant an activity as biface production.

Formed Flake Tools

Only 37 formed flake tools were recovered from slough sites, all obsidian save for 6 cryptocrystalline specimens. A relatively large number of formed flake tools is whole or nearly intact (10), the remainder including proximal (7), margin (7) distal (5), medial (5), and indeterminate end fragments (3). Regardless of condition all formed flake tools are basically small, spent masses. Full metrics range from 2.7-7.3 cm in length, 1.7-3.9 cm in width, and 0.3-1.8 cm in thickness, the average piece measuring only 4.4 x 2.8 x 0.8 cm in size. Cryptocrystalline specimens tend to be slightly larger

than obsidian ones, full metrics for the former averaging 4.5 x 3.4 x 1.3 cm and for the latter 4.2 x 2.5 x 0.7 cm. More than one-third of all tools (14, 38%) derives from MNO-1992 (13 from Locus A alone), the remainder spread between nine other locations (FS10A-2, FS10B-2, FS12C-2, FS14C-1, FS14C-2, FS14D-1, FS18C-3, FS20C-1, FS22B-1). Considering that 29 formed flake tools were recovered previously from MNO-1992 (Basgall and Giambastiani 1995), it seems this artifact class shows a strong affinity to this particular locality. This is a pattern not seen in any other tool class or at any other site, one that probably relates to the unique temporal signature of habitations and to the presence of distinctive formed flake tool type at MNO-1992 (see below).

Formed flake tools were examined to determine the kind of flake blank used and to sort items into general shape categories. Employing the classification described in Chapter Four, only 18 tools could be placed into flake type groups, decortication (3), interior percussion (11), and biface thinning (4). Nonetheless, all 37 tools could be sorted into shape classes, amorphous tools (27), spokeshaves (1), and "keeled" forms (9). Amorphous tools are those with edges that are intentionally shaped but with overall outlines that still conform to the original flake blank. Most edges on amorphous tools are convex or straight, and it is assumed these tools served in moderate- to heavy-duty cutting or scraping tasks. The lone spokeshave bears two deep concavities that are nearly semi-circular in shape; this piece was recovered from FS22B-1 along with a fluted projectile point. Seven tools in the keeled group were found at site MNO-1992 where they were previously reported (Basgall and Giambastiani 1995:177), indicating a predilection of keeled tools for this particular site. Recent discoveries of keeled unifaces in Deep Springs Valley shows they may also have an affinity for early Holocene occupations in wetland settings (Giambastiani, Delacorte, and Basgall 2001).

Simple Flake Tools

The collection includes 237 simple flake tools, all obsidian save nine cryptocrystalline and two basalt. These artifacts are unmodified flakes which have been used in light-duty processing activities, damaging the edges without intentionally altering the outline of the original flake blank. Such tools are common at archaeological sites on the Tableland and the present sample is divided widely between examined sites. Except for FS18C-1 all sites have at least one, the largest share of them from FS10B-2 (83, or 35%). Since I had decided that simple flake tools would not figure prominently in obsidian studies, each tool was examined only to determine flake type. Setting aside 99 tools for which flake type could not be determined, the remaining 138 items are mostly biface thinning flakes (96, or 69.6%); cortical blanks (22 [15.9%]) and interior percussion flakes (18 [13%]) make up smaller but notable amounts. Two other simple flake tools were made from percussion fragments, displaying edge damage along previously broken planes.

Drills

Just 10 artifacts are classified as drills, seven obsidian and three cryptocrystalline. Only two items are complete or nearly so, others comprising bit fragments (three distal, two medial) and a proximal end. These implements were simply categorized by form into two groups, those made from bifacial tools (8) and those made from flakes (2). The former class includes a wide range of robust and gracile drills, five larger ones having more sizeable bits (averaging 11.9 mm in width and 6.1 mm in thickness) and others having much smaller ones (mean 6.0 x 2.6 mm). Both flake drills have a single, delicate protrusion rather than a formal bit that might have been used as a perforators to work cane, shell, or other soft material. The relatively high proportion of cryptocrystallines among drills (30%) suggests a need for more durable stone in these cases.

Cores and Core Tools

Only two cores and a single core tool were recovered. Cores include one obsidian specimen from FS14D-1 and one cryptocrystalline specimen from FS18D-1. The lone core tool is made of an unclassified igneous stone and is also from FS14D-1. Both cores are exceedingly small. The obsidian piece is a complete, tiny bipolar core 12.5 mm long (across platform), 10.9 mm wide, and 23.2 mm thick (from platform to base). The cryptocrystalline piece is also complete and bipolar but conical in shape, measuring 30.6 mm long, 27.9 mm wide, and 24.0 mm thick. When discarded both cores could produce only very small flakes, the largest scar on each measuring 22.2 x 6.2 mm and 27.9 x 12.5 mm, respectively. The core tool is quite different, a relatively large end fragment measuring 107.1 x 90.3 x 62.0 mm in size. In addition to a half dozen flake removals from a single unidirectional platform, the pointed, unbroken end of the implement displays battering damage probably the result of some type of chopping activity. The rarity of cores at Fish Slough is in agreement with previous reports (Basgall and Giambastiani 1995) and the Enfield collections (see Chapter Seven). This must signify that cores were imported to the Tableland in limited quantities, most being reduced to unrecognizable scrap before finally discarded.

Debitage

Testing at Fish Slough produced a total of 66,203 unmodified flakes. Practically the entire sample is obsidian, 63,837 flakes accounting for 96.4%. A wide variety of other materials is present but each in limited quantity, only cryptocrystalline (1.6%) and quartzite (1.5%) occurring in more than trace amounts. The debitage assemblage is heavily biased to only a few sites, MNO-1992 (20,973 flakes), FS10B-2 (17,053 flakes), and FS14D-1 (16,060 flakes) together producing more than 81% of the total. Most of the quartzite debitage comes from MNO-1992 (66.9%) but other non-obsidian materials seem not to cluster anywhere.

The nature of this research precludes standard debitage analysis in which unsorted samples of flakes are drawn from each site for technological classification. Although some 655 obsidian flakes were selected from slough sites and classified prior to hydration, sampling targeted only complete flakes of known reduction affinity and the resulting technological profile is not representative of the range or relative importance of different reduction stages. However, I completed a technological examination of debitage from slough sites a few years back (Giambastiani 1995) and found that most assemblages have ample quantities of biface thinning and pressure flakes with relatively few cortical and interior flakes. By looking at technological profiles developed in prior research, we can gain a sense of reduction activities that occurred at Fish Slough sites. Table 6.8 presents analysis totals for the majority of Fish Slough sites. Figures for MNO-1992 derive from surface and excavated contexts contexts (Basgall and Giambastiani 1995:180) while others are from unpublished data for surface debris (Giambastiani 1995). Ignoring the indeterminate column, totals for MNO-1992 clearly show a prevalence of pressure waste and biface thinning debris, with interior and cortical flakes present in decreasing amounts. Smaller samples at other sites show an importance of biface thinning flakes over other flake types, but there is more variation in quantities of interior and cortical flakes. Cortical waste is generally the least plentiful of all percussion removals. Considering that the surface samples are biased against pressure flakes, it appears that the pattern at MNO-1992 is supported by preliminary data. Only FS26B-1 deviates from the expected pattern with enhanced proportions of cortical and interior debris. Though not shown in the table, flakes at all sites are quite small. Of the 700 flakes examined from sites other than MNO-1992, just ten (1.4%) were larger than 3.0 cm in diameter and none were larger than 5.0 cm across. The near-absence of cores is consistent with the rarity of large flakes, indicating that large toolstone masses imported to the Tableland were almost never rejected while still useful.

TABLE 6.8. Preliminary technological profiles for obsidian debitage by site and reduction group.

	Cortical	Interior	Biface Thinning	Pressure	Indeterminate	Total
MNO-1992	7	58	206	545	448	1264
FS12C-2	4	4	13	5	19	45
FS14D-1	5	15	38	10	45	113
FS18C-1	1	1	15	5	16	38
FS18C-2	2	7	9	2	5	25
FS18C-3	2	3	8	13	8	34
FS18D-1	4	16	82	29	38	169
FS20C-1	7	14	29	3	19	72
FS22B-1	3	6	12	4	6	31
FS22C-1	12	9	24	6	15	66
FS26B-1	30	21	30	2	24	107
Total	77 (5.8)	154 (11.7)	466 (35.3)	624 (47.2)	643 (--)	1964

Note: Data from Basgall and Giambastiani 1995, Giambastiani 1995 (unpublished).

COMPARISONS AND DISCUSSION

In many ways, flaked stone assemblages from Fish Slough sites are similar to those from sites excavated by Basgall in 1987-89 (Basgall and Giambastiani 1995). Bifaces are most abundant, with simple flake tools not far behind in overall numbers. Points are also a regular part of flaked stone assemblages but other tools are scarce, implying a narrow range of stoneworking practices. Debitage is profuse, showing an importance of lithic reduction, but cores are rare. Judging by the volumes of debitage at some sites, lots of obsidian was brought onto the Tableland but none was discarded that could still be used to make large tools or flakes. Salvaging broken tools and flakes from older lithic deposits was probably a routine exercise as well. It may be that groups visited the area not only for its food resources but to place themselves nearer to the Casa Diablo and Truman-Queen sources.

Despite broad similarities between site assemblages, closer comparisons show important qualitative differences by site type (Table 6.9). In general, Type 1 and Type 2 sites have like numbers of artifact classes (richness) and comparable tool:debitage ratios, although Type 2 sites have slightly higher overall averages for both calculations. Flake tools and bifaces occur in roughly equal portions at both types of sites. In contrast, Type 3 sites routinely have two additional artifact classes (point blanks and drills), averaging 6.3 artifact classes per site. With a couple exceptions they also have lower tool:debitage ratios on average (more flakes per tool) and they generally have more bifaces than flake tools. The overall tool:debitage ratio is perhaps more meaningful (1:97), as are overall counts of bifaces and flake tools, because they better differentiate Type 3 sites from Type 1 and 2 sites. Biface stages also vary between site types. Of eight bifaces staged from Type 1 sites, just one is early-stage (12.5%) and the others middle- (50%) or late-stage pieces (37.5%). A similar trend occurs at Type 2 sites; few bifaces are early-stage (13.3%), more are middle-stage (20%), and most are late-stage forms (66.7%). Type 3 sites, however, show a more consistent stage distribution, early- (26.3%), middle- (35.3%), and late-stage bifaces (38.3%) present in fairly even proportions.

It is useful to view these contrasts in two ways. First, it is likely they indicate a difference in the kinds of stoneworking conducted at lithic scatters (Type 1 and Type 2) and at occupation sites (Type 3). Viewing Type 1 and Type 2 sites as temporary camps, or forager "residential bases" (sensu Binford 1980) that were occupied briefly for retooling purposes, flaked stone debris at these sites should primarily represent tool maintenance activities. If Type 3 sites are viewed as temporary residences, or collector "field camps" (Binford 1983:346), we should expect to see flaked stone refuse from tool manufacture and wholesale tool replacement. Costs in replacing hafted tools (raw material procurement, manufacturing time) are more easily mitigated at residences where raw materials can be stockpiled and more free time is available (Binford 1979; Keeley 1982; Kelly 1988; Nelson 1991).

TABLE 6.9. Flaked stone assemblages by site type for Fish Slough sites and MNO-1992.

	PRJ	PTB	BIF	FLK	FRM	DRL	COR	DEB	Total	Classes	T:D
FISH SLOUGH											
Type 1											
FS18C-1	2	-	2	-	-	-	-	42	48	3	1:11
FS18C-2	1	-	3	2	-	-	-	214	220	4	1:36
FS18D-1	-	-	4	9	-	-	1	1121	1135	3	1:80
FS20C-1	-	-	2	4	2	-	-	292	300	4	1:37
FS22B-1	1	-	1	6	2	-	-	156	166	5	1:16
FS22C-1	3	-	1	3	1	-	-	76	84	5	1:10
Subtotal	7	-	13	24	5	-	1	1901	1951	4.0	1:38
Type 2											
FS10A-2	2	-	-	2	1	-	-	82	87	4	1:16
FS14C-2	6	-	11	13	4	-	-	1111	1145	5	1:33
FS18C-3	2	-	2	2	1	-	-	36	43	5	1:5
FS26B-1	5	-	3	5	-	1	-	1713	1727	5	1:122
Subtotal	15	-	16	22	6	1	-	2942	3002	4.75	1:49
Type 3											
MNO-1992	17	2	51	21	14	4	-	20973	21082	7	1:192
"533"	6	-	31	10	-	-	-	4107	4154	4	1:87
FS10B-2	56	1	84	83	2	-	-	17053	17279	6	1:75
FS12C-2	4	-	2	6	1	1	-	49	63	6	1:4
FS14C-1	20	2	43	28	5	2	-	3111	3211	7	1:31
FS14D-1	29	2	58	42	4	2	2	16060	16199	8	1:115
Subtotal	132	7	269	190	26	9	2	61353	61988	6.3	1:97
Type 4											
FS4C-1	-	-	1	1	-	-	-	8	10	3	1:4

Note: PRJ, projectile point; PTB, point blank; BIF, biface; FLK, simple flake tool; FRM, formed flake tool; DRL, drill; COR, core or core tool; DEB, debitage; T:D, tool:debitage ratio.

It is curious that simple flake tools are more important at temporary camps than at occupation sites, given that expedient tools relate directly to increased raw material availability (Andrefsky 1994; Parry and Kelly 1987). However, given the prevalence of percussion debitage at Type 1 and 2 sites, it would seem that repairs usually generated chipping wastes from which flakes could be culled and

used as expedient tools. In this context, the use of simple flake tools rather than more expensive, maintainable tools (e.g., bifaces) does not appear wasteful; in fact, this strategy may have served as a risk management tactic, lowering the chance that more costly tools would be damaged or broken. Following Shott (1986), flake tools also probably served in many different tasks at temporary camps, as requirements for tool versatility are amplified when tool-kit diversity narrows.

Along the same lines, it is also logical that occupation sites contain a variety of specialized tools and high quantities of production debitage (Binford 1977, 1979; Ebert 1992; Nelson 1991). The preponderance of bifaces at Type 3 sites, and their even stage distributions, is due partly to high discard rates in preform manufacture and tool production. Point blanks and drills are also expectable, the former being manufactured for export and use elsewhere and the latter made and used at occupation sites. The significant quantities of debitage found at occupation sites also imply that stores of lithic material were indeed more substantial than those sustained at temporary camps. Beyond insinuating that more raw stone was brought to and reduced at occupation sites, this trend could also reflect a greater length of site habitations and/or the presence of larger group complements.

Another way to interpret variance between site type assemblages is in terms of temporal affiliation. As argued elsewhere (Basgall and Giambastiani 1995; Giambastiani 1995, 1996) and later in this document, hydration data show that most Type 1 sites at Fish Slough are probably of early Holocene antiquity. There is also a scarcity of these sites away from the slough, suggesting that early occupations on the Tableland had specifically targeted slough wetlands (see Chapter Five). Type 2 site assemblages tend to produce Newberry period hydration readings, and contain mostly Elko and Humboldt Series points. Type 3 site assemblages are more variable, displaying wide ranges in hydration readings. However, this is the only site type showing strong evidence for Haiwee and Marana period occupations, in the form of hydration readings and by the presence of Rosegate and Desert Series points, Owens Valley Brownware ceramics, and *Anodonta* shell components.

TABLE 6.10. Diagnostic projectile points by site type from Slough and Plateau surveys.

	DN	CT	RS	EG	EE	EN	EC	ES	HB	PL	FS	GB	Total
SLOUGH													
Type 1													
FS18C-1	-	-	-	-	-	-	-	-	-	1	1	-	2
FS22B-1	-	-	-	-	-	-	-	-	-	-	-	1	1
FS22C-1	-	-	-	-	1	-	-	-	-	2	-	-	3
Type 2													
FS10A-2	-	-	-	-	-	1	-	-	1	-	-	-	2
FS14C-2	-	-	1	-	1	-	-	1	1	-	-	-	4
FS18C-3	-	-	-	-	-	1	-	-	-	-	-	-	1
FS26B-1	-	-	2	-	1	-	-	-	-	1	-	-	4
Type 3													
MNO-1992	-	-	1	1	1	2	-	1	-	4	5	-	15
533	-	-	-	-	1	1	-	-	2	-	-	-	4
FS10B-2	1	2	3	-	32	4	-	-	-	-	1	-	43
FS12C-2	1	-	1	-	1	-	-	-	-	1	-	-	4
FS14C-1	1	-	1	-	5	5	1	1	-	-	-	-	14
FS14D-1	6	2	1	-	7	-	-	-	1	4	-	-	21
Subtotal	9	4	10	1	50	14	1	3	5	13	7	1	118
PLATEAU													
Type 1													
T16-A	-	-	-	-	-	-	-	-	-	1	-	-	1
T23-A	-	1	-	-	-	-	-	-	-	-	-	-	1
T24-A	-	-	-	-	-	-	-	1	-	1	-	-	2
T24-C	-	-	-	-	-	-	-	1	-	-	-	-	1
Type 2													
T30-B	-	-	-	-	3	-	-	1	-	-	-	2	6
Type 3													
T4-A	-	-	2	-	-	-	-	-	-	-	-	-	2
T6-A	-	-	-	1	-	-	-	-	-	-	-	-	1
T8-A	1	-	2	-	-	-	-	-	-	-	-	-	3
T20-A	-	-	1	-	2	-	-	-	1	-	-	-	4
T30-A	-	-	-	-	-	-	-	1	-	1	-	1	3
Subtotal	1	1	5	1	5	-	-	4	1	3	-	3	24
All Type 1	-	1	-	-	1	-	-	2	-	5	1	1	11
All Type 2	-	-	3	-	5	2	-	2	2	1	-	2	17
All Type 3	10	4	12	2	49	12	1	3	4	10	6	1	114

Note: DN, Desert Side-notched; CT, Cottonwood; RS, Rose Spring; EG, Eastgate; EE, Elko Eared; EN, Elko Corner-notched; EC, Elko Contracting-stem; ES, Elko Side-notched and untypable Elko; HB, Humboldt Basal-notched; PL, Pinto-Little Lake; FS, Fish Slough Side-notched; GB, Great Basin Concave-base.

Distributions of projectile points by site type are particularly illustrative in this regard (Table 6.10 above). Comparing site types for Slough and Plateau surveys, several trends are immediately obvious. Type 1 sites from both surveys show a penchant for pre-Newberry period point types, especially at the slough. Projectile points from Type 2 sites at the Slough contain a majority (55%) of Newberry period forms (Elko and Humboldt Series). The one Type 2 site from the Plateau (T30-B) also has mostly Elko points (67%), though the presence of two Great Basin Concave-base points suggests multiple occupations or tool scavenging. Type 3 sites are quite distinct, displaying a wide variety of points from pre-Newberry to Marana period types. While Type 1 and Type 2 sites have extremely low quantities of projectile points, Type 3 sites generally have large samples. Six Type 3 sites at the slough produced 101 points between them, an average of 16.8 points per site. This average is exaggerated by the 43 points recovered from FS10B-2, but only two sites actually have less than 14 points represented. Type 3 sites from the Plateau survey, however, have much smaller samples. In part this relates to discrepancies in excavation amounts, especially when considering the large volumes removed from MNO-1992 and 533, but it also hints at differences in how often Slough occupation sites were revisited as compared to Plateau occupation sites. Most importantly, point distributions are compelling for their implications about past settlement-subsistence organization. Type 1 sites appear to be quite ancient and to represent a distinct land-use pattern that favored the use of Fish Slough. Type 2 sites probably result mainly from Newberry occupations, though some sites were revisited during the Haiwee period. Type 3 sites show evidence of repeated occupations over a long time span. As in the case of MNO-1992, some may have begun as early Holocene lithic scatters but were successively used as longer-term residences. The most recent Tableland occupations specifically targeted previously inhabited sites. Desert Series points (Desert Side-notched and Cottonwood) occur only at Type 3 sites, indicating a late-period settlement strategy favoring midden contexts. Recent visitors may have also chosen these locations in order to supplement personal toolstone supplies.

Chapter Seven

PROJECT OBSIDIAN COLLECTIONS

Any project attempting to understanding large-scale patterns of obsidian procurement requires an archaeological collection of considerable size that derives from many different locations in a given region. Such collections can take years to accumulate, especially without the benefits of a substantial research budget. Nonetheless, given the right circumstances large archaeological databases can be generated by combining many smaller artifact collections. This is most easily done if the study area has witnessed intensive work by a single researcher or team for an extended period of time. More often than not, though, efforts to merge archaeological collections must deal with materials recovered by many different individuals, for a variety of research goals, and through many different collection methods. The result of this is that, when combined for a regional sample, many collections are inadequate, either lacking a particular kind of data or having been acquired in a way that does not facilitate direct comparisons. Efforts to re-organize and re-classify collections can alleviate some problems, but in the end there are always caveats to be given and exceptions to be justified if a combined set of archaeological collections is used.

The present study is no exception and serves to highlight the difficulties faced in trying to combine several different collections into one cohesive sample. Still, its use of Enfield materials testifies to the potential utility of older museum collections, especially where research goals are not compromised by deficiencies in such collections or where sampling strategies can be employed to overcome them. Also demonstrated is the fact that an old collection may be *better* suited to addressing a particular research question than any recent set of materials, due to the aims and methods that guided its recovery. The approaches used here in the treatment of archaeological collections are by no means novel, but they may provide insight for other researchers attempting to conduct similar endeavors.

There are two main purposes of this chapter. The first is to give an account of Enfield collections from the Tableland. The focus is on obsidian artifacts used in current analyses - where they came from and what were the basic methods used to acquire and organize them. The second goal is to describe other obsidian collections used in the study, beginning with materials from the 1987-1989 Far Western project (Basgall and Giambastiani 1995) and followed by artifacts recovered by the author in 1993, 1995-96, and 1997. The various strategies and techniques used to create classificatory and analytical consistency between these collections will be discussed as appropriate.

THE ENFIELD COLLECTIONS: 1960-1993

The period between 1950-1970 witnessed a surge of archaeological interest in eastern California. Among the many avocational archaeologists at that time were Bishop residents Grace and Rollin Enfield, who began working with professional archaeologists and conducting their own judgmental surface surveys throughout southern Mono and northern Inyo counties. Between about 1960-1985, the Enfields (with friend Norman Weller) surveyed parts of the Volcanic Tableland and areas around Mammoth Lakes, Long Valley, Casa Diablo, Round Valley, the Benton Ranges, and Truman Meadows, ultimately recording and collecting surface artifacts from well over 1000 sites. Most of the Enfield collections from the Tableland were turned over to the Inyo National Forest (INF) sometime in the mid-1980's. Grace Enfield and Weller continued to visit the Tableland until about 1993, after which time all of their more recent collections were transferred to the INF and Grace Enfield moved to Davis, California.

The Enfields found more than 150 sites on the Tableland, producing site records that documented basic artifact constituents and non-portable items and features (large millingstones, bedrock mortars and milling slicks, rock constructions, and petroglyphs). An unsystematic surface

collection was also made at each site. At many sites the Enfields covered a large area and recovered a wide range of artifacts made from a variety of materials. The Enfields were not concerned with noting intrasite provenience or maintaining consistent sample size, but their recovery methods had three main benefits. First, it appears that the Enfields attempted to retrieve all recoverable artifacts from the surface of a site instead of seeking only the "goodies" (e.g., projectile points, beads and ornaments, whole milling tools, etc.) that often typify private collections. Enfield site collections usually contain a variety of whole and broken tools as well as samples of debitage that include a range of different toolstone materials (obsidian, chert, quartzite, etc.). Second, the Enfields did not excavate, leaving the many sites they encountered with intact subsurface deposits. This proved important during the 1987-89 excavations on the Tableland (Basgall and Giambastiani 1995), tested Enfield sites still having deposits with sensitive vertical stratigraphy and house structures with undamaged interiors. Third, the Enfields produced a crude catalog of all artifacts recovered during each visit to a site. Catalogues were accompanied by artifact and plant lists, full site records for most locations, and written numbers on formed artifacts. Their site numbering program (see Chapter Four) also allowed for the cross-referencing of artifacts obtained from the same location on multiple occasions. Though not without problems, the Enfield catalogues were critical during collections reorganization, as stray artifacts could be traced to particular sites and, in one instance, as many as four separate collection episodes over a 30-year period could be linked to a single site.

Despite these advantages, I still had concerns about using Enfield collections. The lack of intrasite provenience prohibited making estimates of the size and density of surface assemblages. Other, more significant problems pertained to inconsistencies in artifact recovery methods. Based on previous work I knew that Tableland sites were quite variable in size and composition (Basgall and Giambastiani 1995). How much area did Enfield collections cover at each location? Did they always pick up broken tools and debitage, and if so how many? These questions would ultimately resurface

when I attempted to classify Enfield sites based on constituent classes and when I tried to assess the relative importance of different artifact classes across the Tableland. Clearly, a more thorough investigation of Enfield recovery biases was necessary to either support or discount the use of Enfield materials in this research.

To evaluate the utility of Enfield collections, I developed several tests to match their constituent makeup against those of contemporary surface collections made at the same sites (see Giambastiani 1996). At the time of the test, 48 Enfield collections were sufficiently re-organized for use. These were compared against controlled collections made at five sites during the 1987-89 excavations (MNO-1992, MNO-2189, MNO-2190, MNO-2464, MNO-2465) and at thirteen sites at Fish Slough (533, FS10A-2, FS12C-2, FS14C-2, FS14D-1, FS18C-1, FS18C-2, FS18C-3, FS18D-1, FS20C-1, FS22B-1, FS22C-1, FS26B-1). Figure 7.1 shows the 14 artifact classes used in the test and their totals from collections at subject "Enfield", "Slough", and "Tableland" sites. Artifact counts from Tableland sites (represented by white bars) are quite high relative to those in other site groups, even though they derive from only six locations. By comparison, Slough sites (shaded bars) are relatively sparse, containing mostly debitage, while Enfield sites (in black) fall somewhere in between the other groups. In part, differences in sample size may be explained by the amount of surface coverage at subject sites. Collections at Tableland sites normally encompassed large areas, ranging from 2475 m^2 at MNO-2465 to 15,075 m^2 at MNO-2190. Areal coverage at most Slough sites was minimal, varying only from 225-450 m^2. Enfield collection areas are unknown, but these data imply that they may have ranged somewhere between 500-2500 m^2. It is also notable that high debitage and bone totals contribute have amplified sample sizes in the Tableland group, an outcome of the intensive surface collections made at those sites (Basgall and Giambastiani 1995).

Figure 7.2 presents logarithmic plots of class richness against sample size for the three site groups, including totals for debitage and bone. Richness generally correlates with sample size, larger

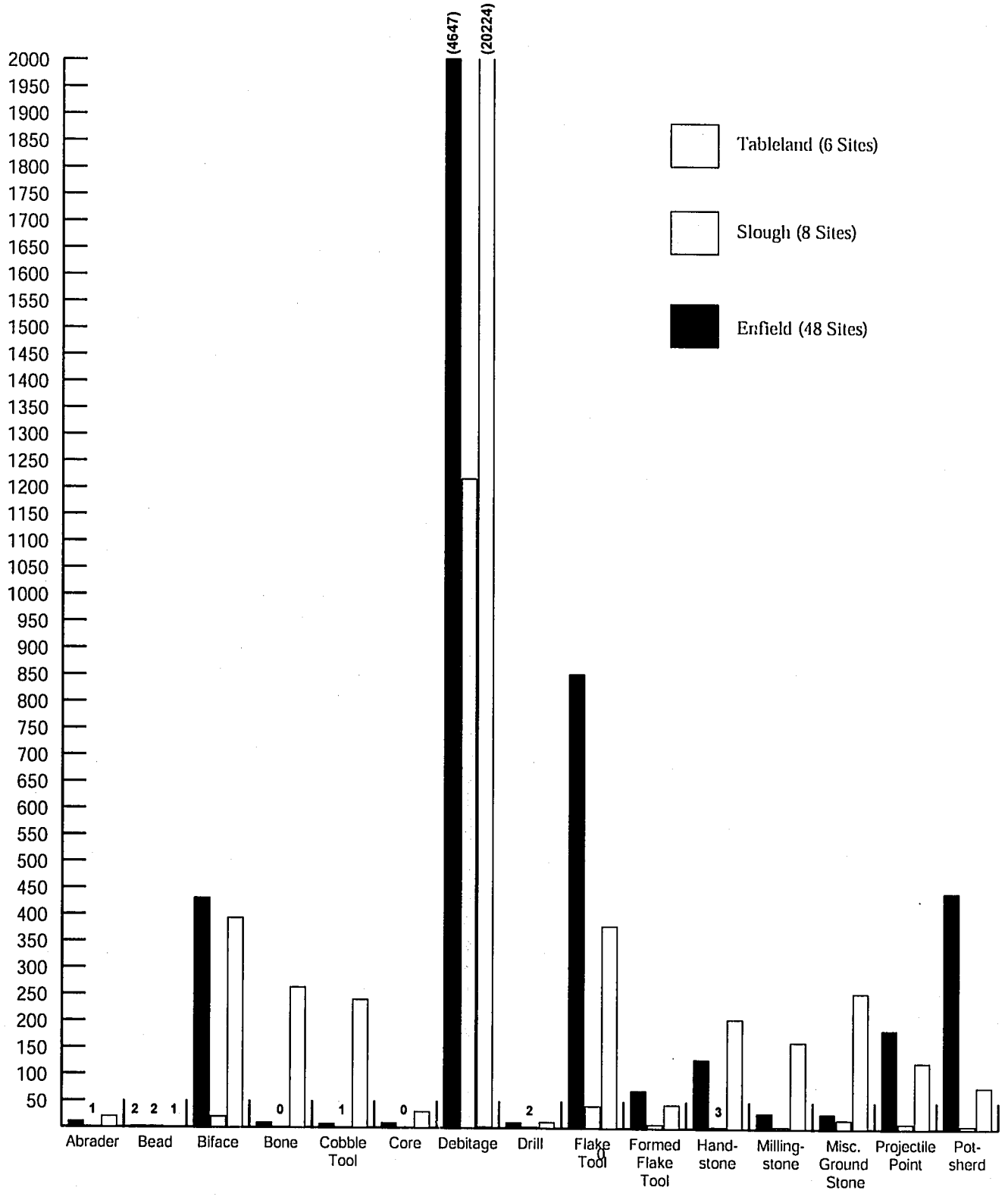

Figure 7.1. Tool Classes and Artifact Totals for Enfield, Slough, and Tableland Site Groups.

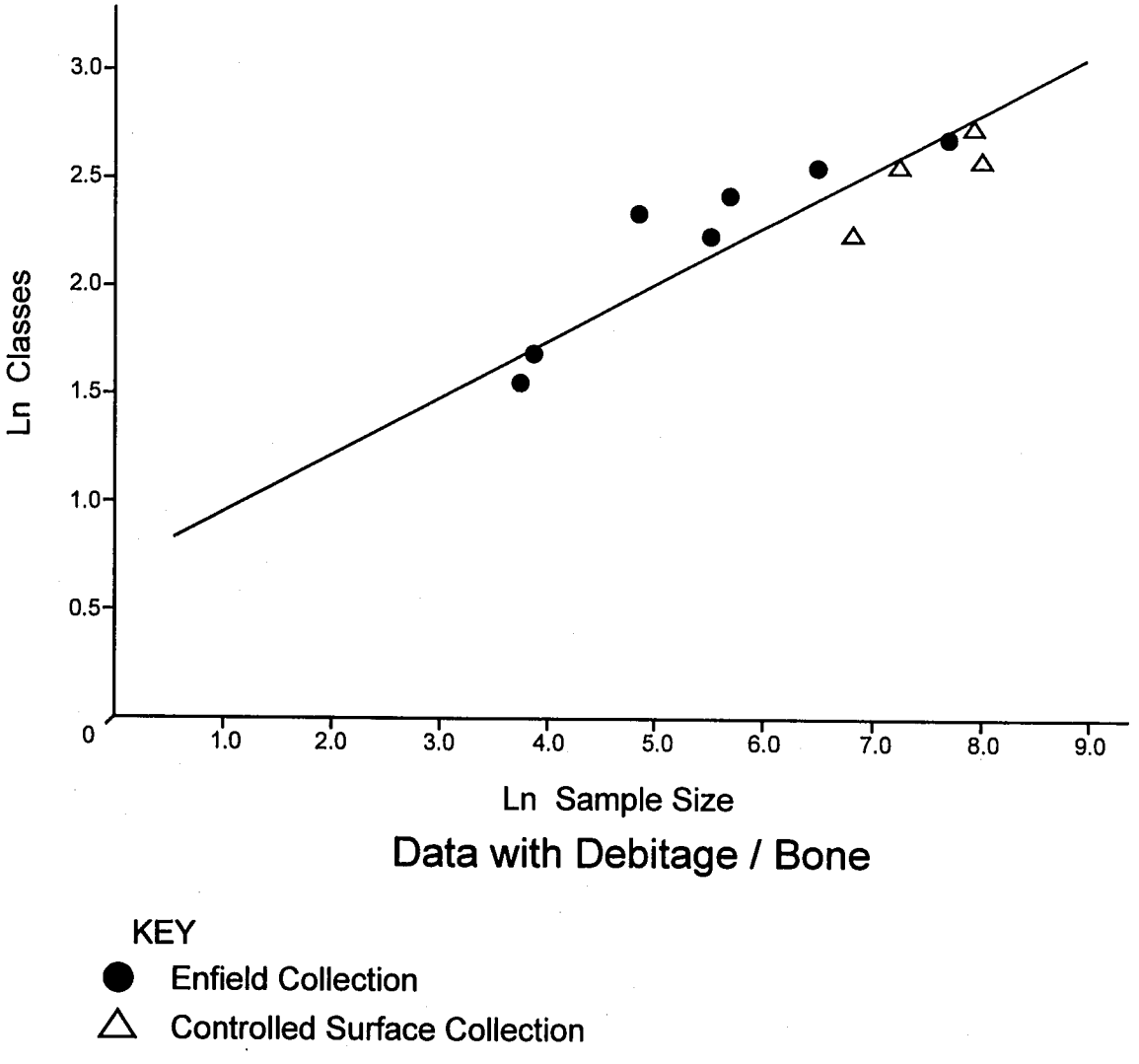

Figure 7.2. Enfield vs. Controlled Surface Collection with Debitage and Bone.

samples having a greater number of artifact classes. Enfield sites (represented by closed circles), Slough sites (open circles), and Tableland sites (triangles) all appear to cluster differently. Slough samples are the smallest and often contain the fewest classes. Tableland sites are the largest and richest, while Enfield sites again fall somewhere in the middle but are spread more widely along the richness/size continuum. The positions of Tableland and Slough sites in relation to the regression line indicate that both groups are generally larger than they are rich, a fact compounded by high quantities of debitage. Enfield sites are more closely aligned with the regression. A good number of them fall left of the line, indicating relatively small size and strong richness. This could relate to a scarcity of debitage, and/or to the Enfields trying to obtain samples of all artifact classes seen at survey sites.

If totals for debitage and bone are removed from calculations (Figure 7.3) site groups merge along the regression line. A couple of Slough sites with only one artifact class remaining are forced out of the comparison (18C-1, 20C-1), but the same basic pattern holds as in the previous figure. However, the amount of divergence between the site groups decreases radically. Particularly evident are the relative positions of Slough and Enfield sites, both groups spreading consistently along the regression line, and the movement of Tableland sites down into the overall data cluster. Site positions also return toward the middle, depicting a much stronger relationship between sample size and class richness. As a second test of this proposition, it is possible to compare five sites in the Tableland group that were visited by the Enfields and were surface collected in 1987-89: MNO-1992 ("5R-13A" in the Enfield system), MNO-2189 ("BE-233"), MNO-2190 ("5B-16"), MNO-2464 ("5B-6"), and MNO-2465 ("5S-13"). Figures 6.4 and 6.5 show logarithmic plots of sample size and class richness, calculated with and without debitage and bone totals, respectively. Debitage and bone counts continue to skew sample sizes for Tableland sites (Figure 7.4), but when these counts are removed (Figure 7.5) the distribution becomes much more integrated and individual sites match up fairly consistently. These tests indicate that sample size is the primary determinant of class richness, and it would appear

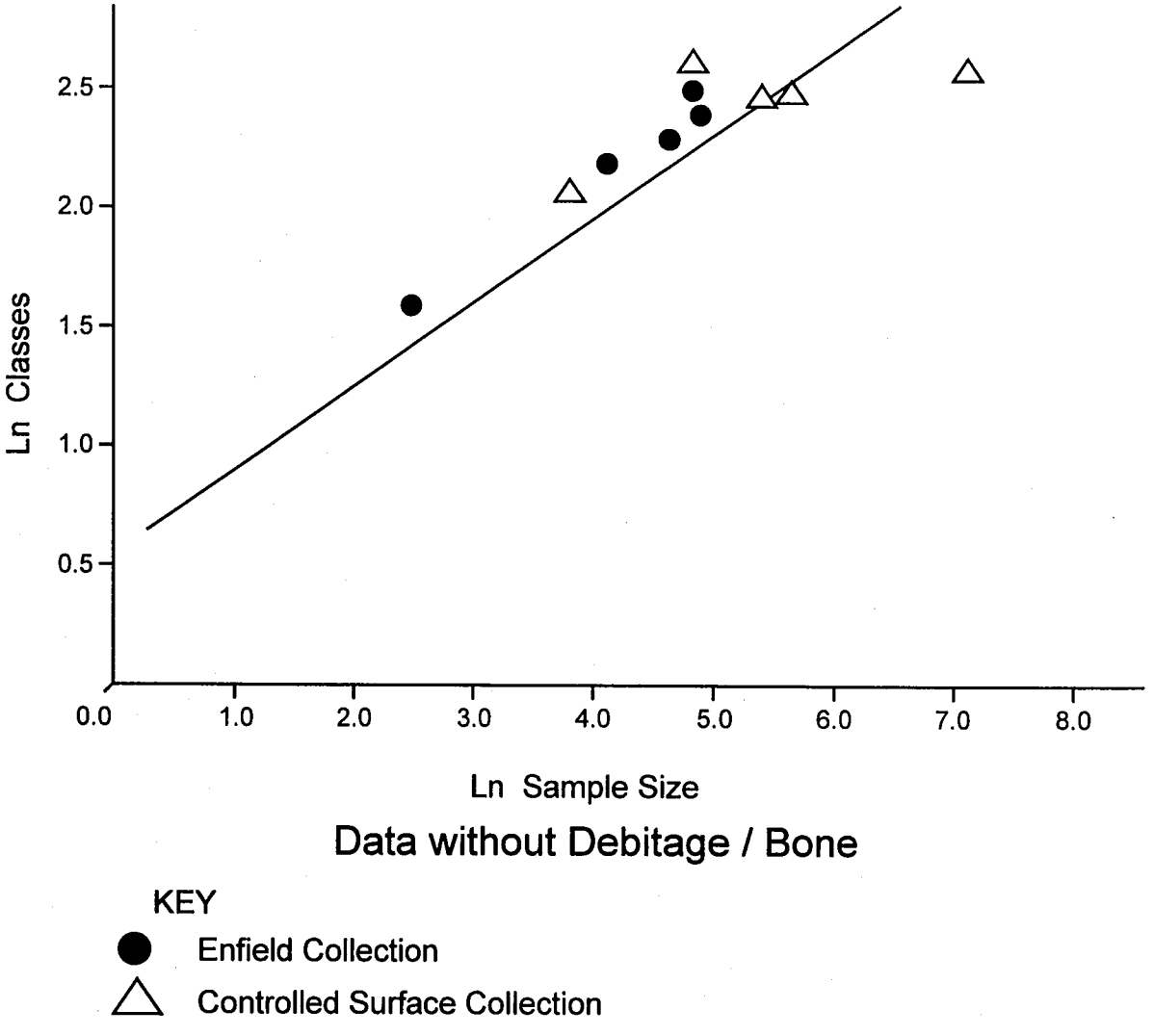

Figure 7.3. Enfield vs. Controlled Surface Collections without Debitage and Bone.

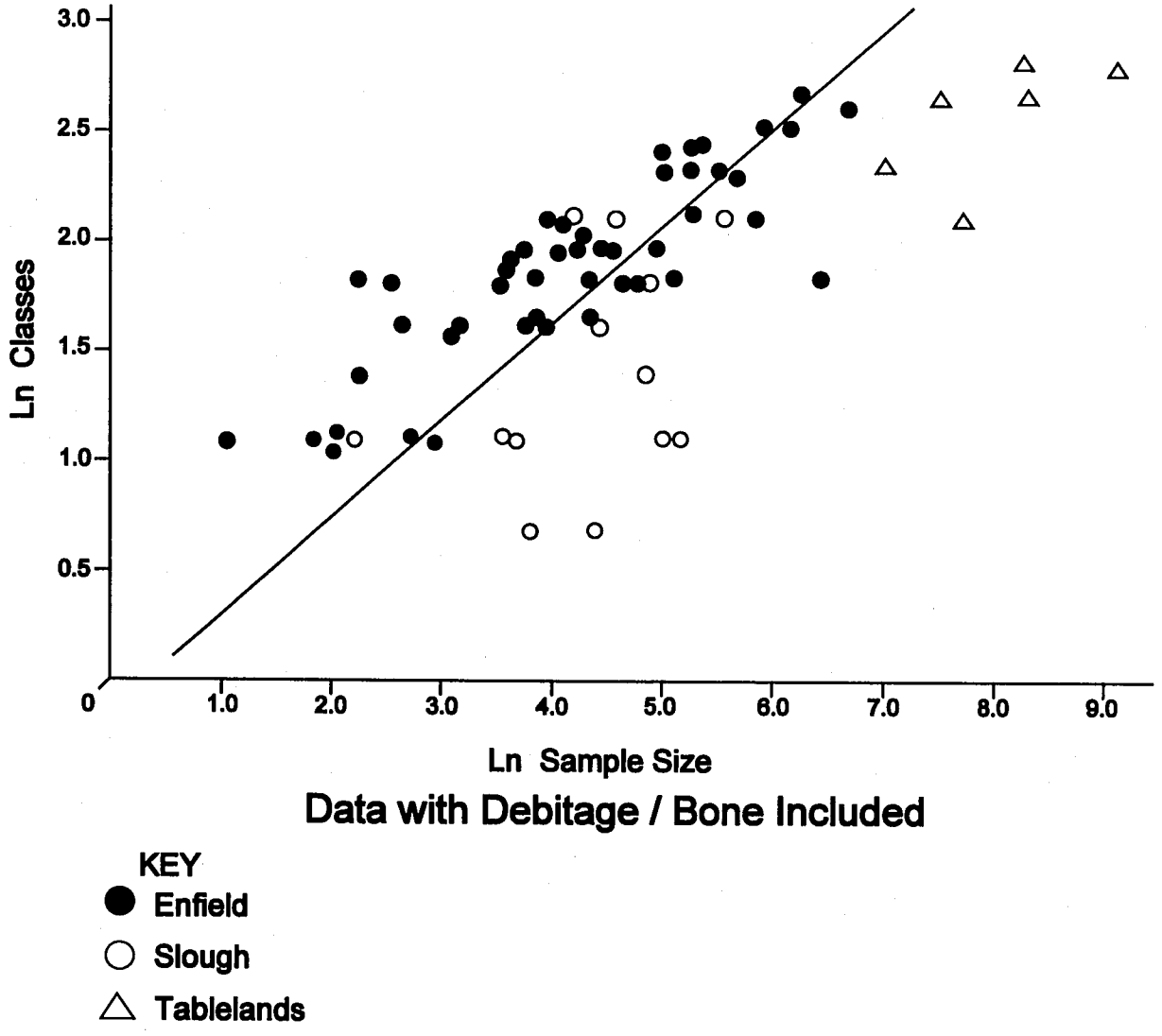

Figure 7.4. Log of Sample Size vs. Class Richness with Debitage and Bone.

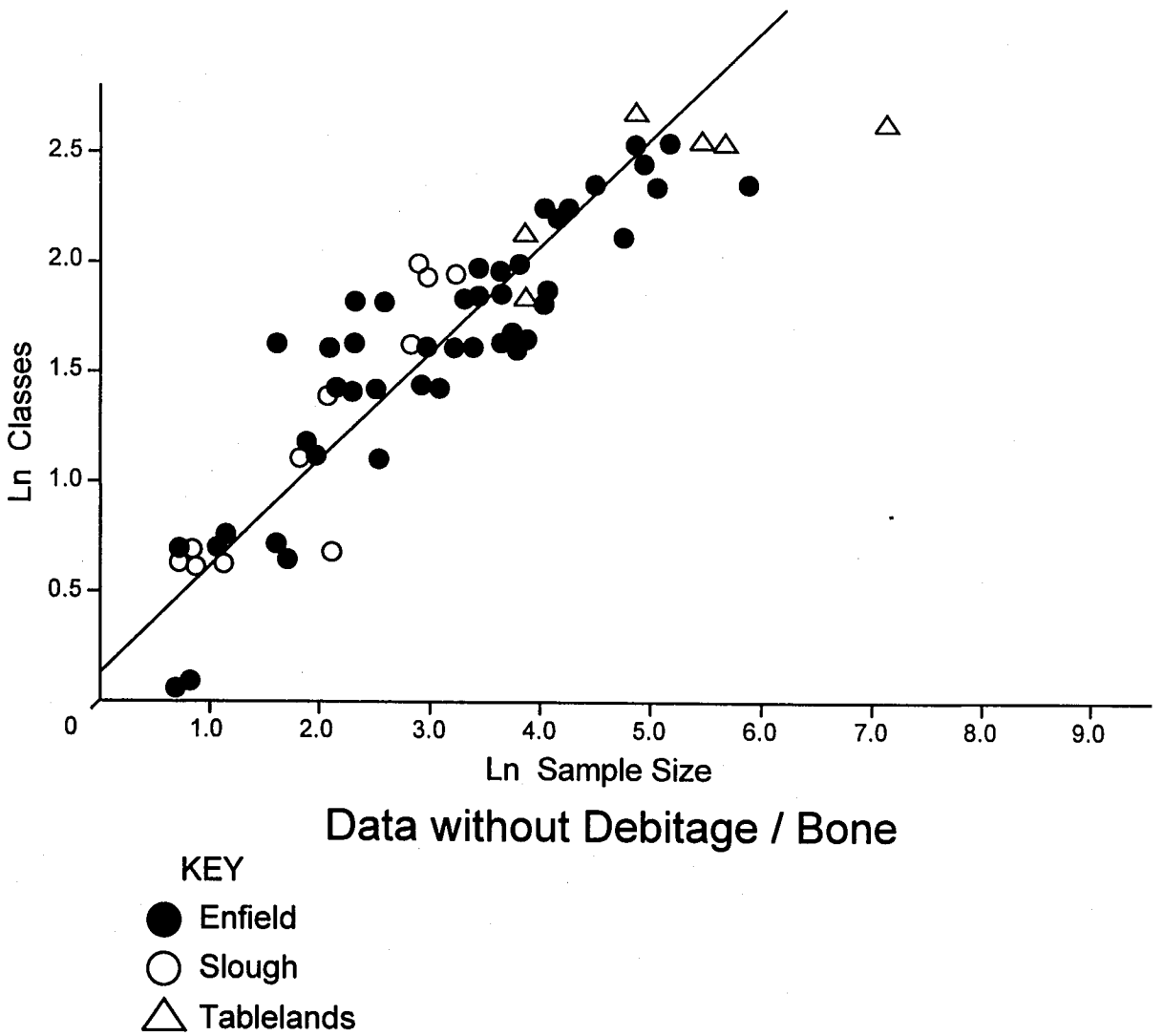

Figure 7.5. Log of Sample Size vs. Class Richness without Debitage and Bone.

that the amount of class richness is not drastically opposed between Enfield surface collections and those obtained more systematically. If these assertions are true, variations in class richness among Enfield collections should be related to sample size and not to any kind of serious recovery bias. It would seem, then, that the Enfields did not target any particular artifact classes, an activity that would lead to increased sample size at the expense of class richness.

It should be noted that classifications of Enfield sites fit well with other site classifications, indicating that sample size is not the only factor contributing to assemblage complexity (see Chapter Four). Still, other aspects of Enfield assemblages imply that Enfield recovery tactics were qualitatively different than those used in more recent systematic collections. To explore this possibility, data presented in Figure 7.1 (minus debitage and bone) were subjected to a chi-square analysis in order to illustrate specific discrepancies in the kinds of classes represented in collections from the three site groups. Residuals in Table 7.1 demonstrate how certain artifact classes are either less or more heavily weighted to Enfield, Slough, or Tableland sites. Statistically, the results of this test are highly significant (df=24, x^2 = 1034.75). Milling tools (cobble tools, handstones, millingstones, and miscellaneous ground stone) are clearly over-represented in Tableland collections relative to other groups, being especially rare in Enfield collections. Conversely, projectile points, flake tools, and pottery sherds are over-represented among Enfield materials and relatively rare in Tableland collections.

There is no doubt that some Enfield site collections witnessed major changes in inventory well after they were recovered (i.e., groundstone, points, and pottery sold or given to friends, other artifacts tossed out). Setting this problem aside, there are lines of evidence suggesting that variations in artifact representation are related to differences in recovery strategy and to the sequence of the two collection programs. First, given the prevalence of obsidian at sites on the Tableland it is unlikely that every non-obsidian rock would have received careful scrutiny, or that small bits of groundstone would have

TABLE 7.1. Artifact Totals and Adjusted Residuals for Enfield, Slough, and Tableland Sites (Without Bone and Debitage)

	Artifact Totals			Adjusted Residuals		
	Enfield	Slough	Tableland	Enfield	Slough	Tableland
Artifact Class						
Abrader	11	1	20	**-1.98**	0.16	1.93
Bead	2	2	1	-0.53	**5.17**	-1.15
Biface	431	20	393	-0.46	-0.61	0.66
Cobble Tool	7	1	240	**-15.90**	**-2.28**	**16.69**
Core	9	-	30	**-3.60**	-1.04	**3.95**
Drill	10	2	11	-0.80	1.79	0.22
Flake Tool	852	41	379	**12.96**	1.44	**-13.47**
Formed Flake Tool	70	7	44	1.36	**2.15**	**-2.06**
Handstone	129	3	205	**-5.16**	**-2.12**	**5.87**
Millingstone	29	4	162	**-10.55**	-0.55	**10.77**
Misc Ground Stone	28	17	254	**-15.22**	**3.34**	**14.19**
Projectile Point	185	10	124	**2.31**	0.53	**-2.49**
Potsherd	443	6	78	**15.85**	**-2.33**	**-15.14**

$X^2 = 1034.75 df = 24$

been deemed worthy of collection, both of which are standard practice in modern controlled surface collections. Groundstone is often cumbersome to collect, transport, and store, a fact that may have deterred the Enfields from collecting more than a few representative items from each site. In contrast, during the 1987-89 excavations all ground stone artifacts were rigorously collected from site surfaces. Not only were small groundstone fragments included, many large, heavy millingstones were also retrieved, some of which were extremely difficult to carry. Second, because the Enfields may have left pieces of groundstone at site locations, but removed points and other flaked stone tools, relatively more groundstone artifacts remained on the surface to be collected in 1987-89. These two explanations would easily account for the differences expressed in the residuals table and, considering

the aforementioned similarities in class richness, are the most logical alternatives. Moreover, had the Enfields tried to retrieve a representative sample of artifacts from each site, typological classifications of Enfield sites based on the presence/absence of artifact classes should be comparable to classifications of sites subjected to systematic surface collection. Unfortunately, because Enfield collections are slightly lacking in groundstone and are replete with projectile points and pottery, it is not possible to use Enfield materials for any intersite or intra-regional comparisons involving relative frequencies of artifact types, either across space or through time.

Despite the drawbacks noted above, what remains most useful about Enfield collections is the sheer number of sites represented and the prevalence of obsidian artifacts in them. The full magnitude of Enfield collections was realized in 1995 when I first investigated the use of these materials. As it turned out, hundreds of Enfield collections from all over Mono and Inyo counties had been donated to the INF, many more than had been thought to exist. Using available records, many of them crude and contradictory, it was eventually possible to extract from the dozens of boxes full of paper bags those collections which were made at sites on the Tableland. At first count, only 120 site collections were at the INF warehouse, though initially 153 had been taken from the Volcanic Tableland. Five collections had already been incorporated into materials recovered in 1987-89, dropping the total of existing Enfield collections to 115. Some of the missing collections were represented only by small paper bags marked with the words "Nothing found in shoebox; N. W.", followed by a year date. I took this to indicate that, upon preparing the collections for donation, Mr. Weller found labeled boxes devoid of contents, items that had been given away, lost, or discarded. Other sites had labeled bags with nothing in them, and still others were not represented at all. After thoroughly scouring the INF warehouse, it seems likely that the missing Enfield collections are lost for good.

Cursory inspections of the materials at INF showed that nearly every site collection held a variety of obsidian artifacts, most of them retaining some amount of debitage as well. Unfortunately,

none of the Enfield collections had been formally catalogued. Volunteers at the INF had processed some of the smaller collections in recent years for sites that lay on INF lands at the extreme western margin of the Tableland. Beyond these, artifacts in every site collection were in small paper envelopes, paper lunch bags, plastic produce bags, or old-style, twist-top closure plastic bags. Some artifact types were usually bagged separately in each collection (e.g., sherds were always separated) but flaked stone debris (tools and debitage) was usually confined to a single bag and in only a few cases were projectile points and bifaces bagged individually. For some collections, the Enfields had written numbers on formed artifacts with white-out and pen, using a numbering system that employed the site number followed by the consecutive catalog number (e.g, 3R-31-1, 3R-31-2, etc.). This helped me to trace items to sites during the initial sorting, but it quickly became evident that tools were often missing and that others had not been numbered at all.

Needless to say, it was obvious that every Enfield collection would require sorting and cataloguing, if they were to be standardized with other collections. Much of the basic sorting was accomplished at the INF warehouse on several trips to Bishop in 1995-96. In order to produce formal electronic catalogues and complete some basic analyses, arrangements were made for a loan of the collections by mail to Davis, 10 sites at a time, until completion of the project. Following instructions and using materials provided by the INF, artifacts were placed in 2-mil zip-loc bags with template paper tags filled out by hand; no numbers were to be written on any artifacts. Otherwise, cataloguing procedures paralleled those employed used for all other project collections. Cataloguing proceeded sporadically over the next year and half, and was finally finished in late 1998. The resulting catalogue of all 120 site collections contains 8803 items, including 1755 flaked stone tools, 6092 pieces of debitage, 265 pieces of milling equipment, 491 pottery sherds, a variety of other utilitarian tools, curios, bone, and *Anodonta* shell, as well as a few bits of historic debris.

Once the basic catalogue was in order, the next step was to perform basic technological analyses. All Enfield flaked stone tools were subjected to the same examinations as those recovered during other survey projects (excluding 87-89 and 1996 excavations). Metrics were obtained for all projectile points and bifaces, but not for simple flake tools, drills, or cores. Samples of debitage were selected and analyzed in the same manner as before, with preference again given to technologically diagnostic pieces. As it turned out, a very large fraction of the full Enfield collection is obsidian, some 7534 artifacts from 112 sites (Table 7.2). The complete obsidian inventory includes 190 projectile points, 41 point blanks, 416 bifaces, 915 simple flake tools, 74 formed flake tools, 13 drills, 8 cores, two assayed nodules and 61 raw nodules, and 5814 flakes. When it came time to re-organize these materials for sourcing and hydration, I found that several catalogued sites lay just outside the boundaries of current study area (2B-7, 3A-2, 3R-31, 5S-9, 5S-15, 5V-11, 5V-11B, 6B-14, 7S-16) and one was located in Chalfant Valley (E-17E) despite having a prefix in common with another site at Chidago Canyon (E-17, A/B). Except for the projectile points from site 2B-7 all obsidian from these sites was dropped from consideration. Site 2B-7 lay a few kilometers west of the study area boundary, but its collection included many projectile points (21), particularly Cottonwood and Desert Side-notched types which were scarce elsewhere. Ultimately, all points from this site were retained for sourcing and hydration in order to bolster sample numbers. These changes resulted in a loss of more than 1100 potential artifacts, primarily debitage. Also, in the course of moving Enfield materials back and forth from Bishop, a few small collections were misplaced after having been catalogued (5W-5A, 6L-1, 7P-4, 9M-9). Obsidian totals for potential analysis were thus further reduced, to some 1438 tools and 4762 flakes (see Table 7.5).

Without a doubt, the collection of Enfield materials provides an invaluable data set for the current research. Setting aside the minor qualitative and quantitative problems with Enfield recovery methods, the sheer number of site collections adds tremendously to the spatial coverage of obsidian

TABLE 7.2. Catalogued Enfield obsidian artifacts by site.

	PRJ	PTB	BIF	FLK	FRM	DRL	COR	ASN	DEB	NOD	Total
E-17, A/B	5	2	6	26	1	-	-	-	82	3	125
E-17E	1	-	-	1	-	-	-	-	1	-	3
G-32	1	-	21	7	1	-	-	-	38	1	69
G-25	1	1	2	8	-	-	-	-	11	1	24
H-3	-	-	-	2	-	-	-	-	12	-	14
H-3B	3	-	2	2	-	-	-	-	2	-	9
H-5	-	-	-	3	-	-	-	-	20	-	23
H-21	5	-	-	-	-	-	-	-	10	-	15
K-0	29	5	40	72	4	2	-	-	154	3	309
K-0B	1	-	-	-	-	-	-	-	-	-	1
L-14	-	-	10	12	2	-	-	-	9	-	33
L-14C	2	-	1	5	-	-	-	-	3	-	11
Y-1	1	-	4	17	-	-	-	-	66	2	90
1U-20	-	-	2	4	1	-	-	-	6	-	13
1W-3	1	-	9	22	-	-	-	-	92	5	129
1W-19	1	-	2	10	-	-	-	-	23	-	36
1Z-17	-	1	3	1	-	-	-	-	-	1	6
2A-1	3	-	2	4	-	-	1	-	1	-	11
2A-14	-	-	-	1	-	-	-	-	3	-	4
2B-7	21	2	12	39	5	2	-	-	36	-	117
2D-13	1	1	3	24	3	-	1	-	96	2	131
3A-2	-	-	-	3	-	-	-	-	15	-	18
3A-5	3	2	17	11	-	-	-	-	5	-	38
3R-31	-	-	1	7	-	-	-	-	101	-	109
4L-11	1	-	8	24	3	1	-	-	120	-	157
4L-13A	3	-	1	2	-	-	-	-	2	-	8
4T-17	-	-	-	5	-	-	-	-	2	-	7
5A-12	2	-	13	35	3	1	-	-	122	1	177
5A-12A*	2	-	1	1	4	-	-	-	22	-	30
5B-2	-	-	1	5	2	-	-	-	26	-	34
5B-5	5	-	7	14	-	1	-	-	121	-	148
5B-8	-	-	5	5	1	-	-	2	10	1	24
5B-14	-	-	-	1	-	-	-	-	4	2	7
5B-16A	1	-	3	2	-	-	-	-	13	-	19
5B-18	6	1	11	29	1	1	1	-	201	-	251
5B-18A	-	-	-	1	-	-	-	-	1	-	2
5B-18C	1	-	2	2	1	-	-	-	7	-	13
5C-6/7	1	-	1	1	-	-	-	-	10	-	12
5C-16**	-	-	11	28	4	1	-	-	235	2	281
5C-16A	1	-	-	2	-	-	-	-	89	-	92
5C-19	1	-	-	1	-	-	-	-	2	-	4
5C-20	2	-	1	-	-	-	-	-	8	-	11
5D-3	1	-	5	4	1	-	-	-	73	-	84
5G-17	1	-	-	-	-	-	-	-	-	-	1
5R-13A***	3	-	3	3	2	-	-	-	31	-	42
5R-13B	-	-	-	-	-	-	-	-	1	-	1
5R-19	-	1	-	1	-	-	-	-	3	2	7

TABLE 7.2. Catalogued Enfield obsidian artifacts by site (Cont...).

	PRJ	PTB	BIF	FLK	FRM	DRL	COR	ASN	DEB	NOD	Total
5S-4	2	1	-	-	-	-	-	-	7	-	10
5S-6	2	-	9	14	2	-	-	-	22	-	49
5S-9	5	4	7	15	1	-	1	-	312	2	347
5S-10	-	-	-	3	-	-	-	-	242	-	245
5S-11	5	2	14	7	-	-	-	-	151	-	179
5S-12	-	-	-	3	-	-	-	-	8	-	11
5S-14	-	-	-	6	-	-	-	-	54	5	65
5S-15	1	-	2	1	-	-	-	-	109	-	113
5T-16	2	-	1	4	1	-	-	-	78	-	86
5T-18	-	-	-	3	-	-	-	-	-	-	3
5T-19	11	6	19	87	1	1	1	-	360	-	486
5U-4	-	-	1	4	1	-	-	-	29	5	40
5U-4A	1	-	2	1	-	-	1	-	11	-	16
5U-4B	2	-	1	1	-	-	-	-	6	-	10
5U-4F	-	-	-	2	-	-	-	-	-	-	2
5U-4G	1	-	-	4	-	-	-	-	17	1	23
5U-5	-	-	-	1	-	-	-	-	1	-	2
5U-6	-	-	-	1	-	-	-	-	3	-	4
5U-8	3	-	3	1	-	-	-	-	61	-	68
5U-8A	1	-	-	1	3	-	-	-	28	-	33
5U-10	1	-	-	3	-	-	1	-	47	1	53
5U-11	-	-	2	-	-	-	-	-	-	-	2
5U-12	1	1	4	10	3	-	-	-	136	-	155
5U-13	1	-	1	3	-	-	-	-	77	3	85
5U-13A	-	-	2	8	2	-	-	-	22	2	36
5U-14	2	-	2	1	-	-	-	-	12	-	17
5U-15	-	-	4	14	-	-	-	-	61	2	81
5V-11	1	-	11	13	1	-	-	-	224	1	251
5V-15	4	2	7	12	-	-	-	-	607	-	632
5V-20	-	-	-	1	-	-	-	-	-	-	1
5V-21	-	-	2	1	-	-	-	-	-	-	3
5V-22	-	-	-	-	-	-	-	-	1	-	1
5V-25	-	-	1	-	-	-	-	-	-	-	1
5W-3	-	1	3	8	1	-	-	-	38	-	51
5W-5	-	-	2	9	-	-	-	-	10	-	21
5W-5A	-	-	1	1	-	-	-	-	1	-	3
5W-6	-	-	1	1	-	-	-	-	5	-	7
5W-6B	-	-	3	1	-	-	-	-	3	-	7
5W-8	3	1	10	20	-	-	-	-	107	-	141
5X-5	1	-	1	-	-	-	-	-	2	-	4
5X-9	-	-	-	-	-	-	-	-	3	-	3
5Y-7	-	-	-	-	2	-	-	-	6	1	9
6B-14	2	-	7	6	-	-	-	-	47	-	62
6D-8	1	-	2	5	2	-	-	-	29	-	39
6D-9	2	-	5	5	-	-	-	-	29	4	45
6E-16	2	-	12	20	4	-	-	-	59	-	97
6L-1	2	-	3	6	-	-	-	-	20	-	31
6Q-12	1	-	-	1	-	-	-	-	85	-	87

TABLE 7.2. Catalogued Enfield obsidian artifacts by site (Cont...).

	PRJ	PTB	BIF	FLK	FRM	DRL	COR	ASN	DEB	NOD	Total
6Q-9	4	1	9	6	2	-	-	-	97	-	119
6X-1	-	-	1	7	-	-	-	-	10	-	18
7P-4	3	1	10	24	3	-	-	-	80	-	121
7Q-10	-	-	1	-	-	1	-	-	3	-	5
7Q-19	-	-	2	5	-	-	-	-	36	-	43
7R-10	-	-	-	9	-	-	-	-	20	-	29
7S-16	1	-	3	7	-	-	-	-	91	-	102
7Y-12	-	1	2	12	2	-	1	-	21	1	40
7Z-2	2	-	-	-	-	-	-	-	3	-	5
8B-11	1	-	-	2	-	-	-	-	5	1	9
8B-15	2	-	1	2	-	-	-	-	6	-	11
8D-3	-	1	6	26	3	-	-	-	138	1	175
8D-4	1	3	8	21	-	-	-	-	65	1	99
8G-15	-	-	2	3	-	-	-	-	17	4	26
8H-11	1	-	11	18	-	-	-	-	95	-	125
9G-4	4	-	4	16	1	2	-	-	93	-	120
9M-9	1	-	1	2	-	-	-	-	15	-	19
TOTAL	190	41	416	915	74	13	8	2	5814	61	7534

Note: PRJ, projectile point; PTB, point blank; BIF, biface; FLK, simple flake tool; FRM, formed flake tool; DRL, drill; COR, core; ASN, assayed nodule; DEB, debitage; NOD, raw nodule. * Site eventually matched with CSUS survey site T2-A. **Site eventually matched with CSUS survey site T28-A. *** New collection discovered from site MNO-1992, not incorporated with 1987-89 project totals.

studies. Albeit survey methods were quite different, considering the time it took to complete the 1993 and 1997 surveys, recording 51 sites, and making collections at 32 sites, it might have required four or five more field seasons to achieve what the Enfields did. In fact, problems with Enfield recovery tactics really have no bearing on the current obsidian program at all. By treating the Tableland as a unit, sourcing and hydration studies do not require intrasite provenience information, nor do they rely on comparisons of artifact class frequencies. All that is needed from each site are artifacts to represent a point in space. Patterns are delineated through source characterizations and hydration profiles. So in a sense, using the Enfield materials was the best possible way to acquire artifacts given the aims and requirements of the present obsidian program. These collections may not be capable of answering

other kinds of archaeological questions, but they are perfectly suited to obsidian studies implemented on a regional level. Not only have the collections spared considerable costs in time and money, they provide an interesting example of how older museum collections can benefit modern research.

THE 1987-1989 CO-OP PROJECT

Between 1987 and 1989, three seasons of test excavation on the Volcanic Tableland were conducted by Mark Basgall from Far Western Anthropological Research Group, Inc., and Dr. Robert Bettinger from U.C. Davis (Basgall and Giambastiani 1995). This work focused on five sites in plateau locations (INY-399 [two adjacent rockshelters], MNO-2189, MNO-2190, MNO-2464, and MNO-2465) and two sites at Fish Slough, an open site (MNO-1992) and a small cave (MNO-2381). The results of testing at six of these locations were reported to the BLM (Basgall and Giambastiani 1992) and were later written as a full-length monograph (Basgall and Giambastiani 1995), while excavations at MNO-2381 (Fish Slough Cave) have been presented by Nelson (1999). The collection from Fish Slough Cave was not included in the current research. Methods used to catalogue and analyze collections from the 1987-89 project are comparable to those described in Chapter Four and for the Enfield materials (see above).

As shown in Table 7.3, the 1987-89 project recovered more than 1800 obsidian tools and over 50,000 pieces of obsidian debitage. Simple flake tools and bifaces were quite common and projectile points were also collected in large numbers. Two sites on the plateau, MNO-2189 and MNO-2190, together contributed more than 60% of the project obsidian assemblage. Site MNO-1992 was notable for Fish Slough Side-notched points for "keeled" formed flake tools (see Chapter Six); hydration data have shown both of these artifact types to be relatively ancient. Tested locations contained a variety of different occupations, which together were thought to span the last 8000 years and especially the

TABLE 7.3. Obsidian artifacts by site from the Far Western 1987-89 cooperative project.

	PRJ	PTB	BIF	FLK	FRM	DRL	COR	DEB	Total
INY-399i, ii	-	-	8	6	-	-	-	1360	1374
MNO-1992	51	5	126	132	24	5	4	7991	8338
MNO-2189	33	7	93	82	17	5	10	14882	15129
MNO-2190	109	17	343	253	21	9	20	15823	16595
MNO-2464	12	-	25	34	-	1	-	2233	2305
MNO-2465	45	7	104	240	13	6	-	8060	8475
Total	250	36	699	747	75	26	34	50349	52216

Note: PRJ, projectile point; PTB, point blank; BIF, biface; FLK, simple flake tool; FRM formed flake tool; DRL, drill; COR, core; DEB, debitage. Data from Basgall and Giambastiani 1995.

last three millennia (Basgall and Giambastiani 1995:262). Materials from the 1987-89 collection were used primarily as a back-up for collections obtained more recently. Most XRF sourcing and hydration analyses focused on other materials, but projectile points from the 1987-89 assemblages were of particular importance in delineating temporal trends in obsidian use and in evaluating the present hydration rate for Truman-Queen obsidian (see Chapter Nine). Visually sourced materials from this collection were also of great value, contributing much to the reconstruction of spatial distributions for different obsidians.

RECENT COLLECTIONS FROM SURVEYS AND TEST EXCAVATIONS

Archaeological testing at Fish Slough was implemented at 17 sites in 1993 and 1995-1996, this work producing some 703 obsidian tools and 63,824 obsidian flakes (Table 7.4). Much of the resulting collection was recovered by excavation (29% of all tools [n=201] and 68% of all debitage [n=43,688]; see Chapter Six) as opposed to systematic surface collection. This speaks to the generally

Table 7.4. Obsidian artifacts from investigated sites, 1993, 1995-96, and 1997 field programs.

	PRJ	PTB	BIF	FLK	FRM	DRL	COR	DEB	Total
1993-96									
MNO-1992	15	2	52	19	11	3	-	19764	19866
"533"	6	-	26	10	-	-	-	3990	4032
FS4C-1	-	-	1	1	-	-	-	8	10
FS10A-2	2	-	-	2	1	-	-	78	83
FS10B-2	56	2	73	82	2	-	-	16567	16782
FS12C-2	4	-	-	4	1	1	-	43	53
FS14C-1	18	2	43	25	5	1	-	3051	3145
FS14C-2	6	-	11	13	4	-	-	1079	1113
FS14D-1	27	2	54	39	2	2	1	15844	15971
FS18C-1	2	-	2	-	-	-	-	38	42
FS18C-2	1	-	3	2	-	-	-	172	178
FS18C-3	2	-	2	2	1	-	-	34	41
FS18D-1	-	-	4	8	-	-	-	1096	1108
FS20C-1	-	-	2	4	2	-	-	280	288
FS22B-1	1	-	-	6	1	-	-	140	148
FS22C-1	3	-	1	3	1	-	-	66	74
FS26B-1	4	-	3	4	-	-	-	1574	1585
Subtotal	147	8	277	224	31	7	1	63824	64519
1997									
T2-A	-	-	-	-	-	-	-	59	59
T2-B	-	-	-	-	-	-	-	214	214
T4-A	2	-	-	2	-	-	-	217	221
T4-B	-	-	-	1	-	-	-	40	41
T6-A	1	-	-	-	-	-	-	77	78
T8-A	3	-	-	-	-	-	-	36	39
T10-B	-	-	-	-	-	-	-	19	19
T16-A	1	-	-	-	2	-	-	41	44
T20-A	5	-	-	2	-	-	-	221	228
T23-A	-	-	-	-	-	-	-	62	62
T24-A	2	-	-	-	-	-	-	105	107
T24-B	-	-	-	2	-	-	-	174	176
T24-C	1	-	-	-	-	-	-	69	70
T28-A	-	-	1	2	-	-	-	188	191
T30-A	4	-	-	-	-	-	-	168	172
T30-B	8	-	-	-	-	-	-	238	246
Subtotal	27	-	1	9	2	-	-	1928	1967
GRAND TOTAL	174	8	278	233	33	7	1	65752	66486

Note: PRJ, projectile point; PTB, point blank; BIF, biface; FLK, simple flake tool; FRM, formed flake tool; DRL, drill; COR, core; DEB, debitage.

scant surface record at Fish Slough sites but also indicates the necessity of subsurface testing in order to obtain good samples of obsidian debitage. In particular, size discrepancies among unmodified flakes were obvious between surface and subsurface materials at all tested sites, larger items tending to remain on the surface and smaller pieces migrating downward even in shallow sediments. There were also practical considerations in recovering exceedingly small debitage like pressure flakes, it being more efficient to collect these in bulk through excavation (using 3-mm screen) than individually from loose, sandy surfaces. As a result, these collections are comprehensive representations of site assemblages, and given recovery tactics are directly comparable to collections obtained by excavation in 1987-89. Testing collections from Fish Slough provide the foundation for current obsidian studies, and many strategies used to select artifacts for analysis favor materials from Fish Slough sites.

Unlike work at Fish Slough, the 1997 survey and excavation program was directed specifically to obtaining samples of obsidian debitage (Table 7.4). The only formed artifacts intentionally collected were diagnostic projectile points, though a few tools were inadvertently recovered as they were mistaken for flakes in the field. Surface collections at survey sites targeted only larger, intact flakes that would be suitable for technological and obsidian analyses, so resulting samples are not directly comparable to those obtained from systematic surface grids during either the 1987-89 or 1993-1996 field programs. The survey effort did, however, provide debitage samples from buried contexts which are amenable to comparison with other excavation programs, as all items were collected with 3-mm mesh. In fact, pressure flakes obtained from 1997 survey sites have proven particularly useful to obsidian debitage analyses, as Enfield collections do not include small flakes. Projectile points from this survey were also important to increasing spatial coverage for both sourcing and hydration studies.

OBSIDIAN ARTIFACTS FOR POTENTIAL ANALYSIS

At the close of all fieldwork, and having removed from consideration all artifacts from Enfield sites not on the Tableland (save select projectile points), the combined archaeological collection includes some 4057 formal tools and more than 120,000 pieces of debitage (Table 7.5). In terms of available tools, the 1987-89 excavations contribute the largest portion (46%), though the Enfield collection is not far behind (35.1%). Investigations at Fish Slough produced relatively few tools (17.1%) despite an overall excavation volume comparable to Basgall's 1987-89 program (43.3 m^3 vs. 47.0 m^3, respectively). This difference reflects the sparse nature of Fish Slough sites (many Type 1 locations) and the heavy quantities of tools found at Type 3 sites on the plateau. In contrast, debitage is plentiful at Fish Slough sites, more than half of all flakes (52.8%) present among these materials. Collections from 1987-89 account for a near-equal amount of debitage (41.7% of the total), a fact consistent with the excavation volumes just mentioned, while the 1997 testing program contributed a limited share (just 1.6%). Again, low debitage production in 1997 relates directly to limited excavation volumes. However, the 1997 collection does provide nearly 7% of all projectile points, a sizable quantity considering the relatively small contribution it makes to the whole.

Obsidian projectile point classifications are presented by project in Table 7.6. Differences in typological systems used in the different projects are evident in several categories; "Little Lake" points occur primarily in 1987-89 materials, wholly "Untypable" forms found there exclusively. Categories like "Elko Side-notched", "Large Side-notched", and "Leaf" are classifications used subsequent to the 1987-89 project, but the restriction of Great Basin Concave-Base points to 1993-96 and 1997 collections indicates a true distribution. Criteria used in 1987-89 would probably have placed Elko Side-notched forms in with the "Elko Series" group, and Large Side-notched or Leaf points into the "Untypable Dart" class.

TABLE 7.5. Obsidian artifacts for potential analysis from all project collections.

	PRJ	PTB	BIF	FLK	FRM	DRL	COR	DEB	Total
Enfield Surveys	184	33	342	784	64	10	6	4762	6185
87-89 Excavations	257	36	699	747	76	25	35	50349	52224
93 Survey	8	-	-	-	-	-	-	-	8
93-96 Excavations	147	8	277	224	31	7	1	63824	64519
97 Survey/Excavations	44	-	1	9	2	-	-	1928	1984
Total	640	77	1319	1764	173	42	42	120863	124920

Note: PRJ, projectile point; PTB, point blank; BIF, biface; FLK, simple flake tool; FRM, formed flake tool; DRL, drill; COR, core, DEB, debitage.

The upshot of all this is that one-third (n=211) of the obsidian projectile points recovered on all of these projects is not temporally diagnostic for one reason or another. From a conservative stance, only 12 of 21 categories in Table 7.6 can actually be considered good time markers (bold in table). Points assigned to the Elko Side-notched and Elko Series categories cannot be reliably identified as corner-notched, eared, or contracting-stem variants. Humboldt forms are notoriously poor time markers in the Great Basin, occurring predominantly during the Newberry period but also well before Newberry and during the subsequent Haiwee interval. As indicated earlier, Large Side-notched forms could just as easily have been assigned to the Untypable Dart class. Leaf-shaped points, though often associated with Pinto forms in the southern deserts, are less consistently represented in eastern California, and there is also the possibility that they represent reworked variants of another dart point type or other bifacial tool. Finally, points subsumed in the untypable classes lack diagnostic attributes of any point class due to fragmentation, incomplete manufacture, or re-use.

TABLE 7.6. Classifications of obsidian projectile points by project.

	ENF	87-89 EXC	93 SUR	93-96 EXC	97 SUR/EXC	Total
Cottonwood	24	9	-	4	-	37
Desert Side-notched	15	19	-	7	1	42
Rose Spring	19	42	-	10	8	79
Eastgate	8	12	-	1	1	22
Elko Corner-notched	7	20	1	12	1	41
Elko Eared	22	22	-	49	5	98
Elko Contracting Stem	5	7	1	1	1	15
Elko Side-notched	-	-	1	1	1	3
Elko Series	9	16	-	1	2	28
Humboldt Basal-notched	10	11	1	5	1	28
Humboldt Concave-Base	1	2	-	-	-	3
Large Side-notched	-	-	-	-	2	2
Leaf	5	-	1	-	-	6
Little Lake	1	12	-	1	-	14
Fish Slough Side-notched	9	25	-	7	-	41
Pinto	5	-	1	12	4	22
Great Basin Stemmed	8	2	-	-	4	14
Great Basin Concave-Base	-	-	-	1	2	3
Untypable Arrow	8	14	-	2	-	24
Untypable Dart	28	34	2	33	11	108
Untypable	-	10		-	-	10
Total	184	257	8	147	44	640
Total Diagnostic	**123**	**170**	**3**	**105**	**28**	**429**

Note: ENF, Enfield; SUR, survey; EXC, excavation. Temporally diagnostic styles in bold.

As for other tool forms, some 13% of all obsidian bifaces were of indeterminate reduction stage, due mainly to fragmentation (Table 7.7, above). Less than 4% of all Enfield bifaces could not be staged, as compared to about 15% from 1987-89 collections and 19% from the 1993-96 materials. Setting aside indeterminates, more than half of all Enfield and 1993-96 bifaces are late-stage forms while only

TABLE 7.7. Obsidian bifaces by reduction stage group and project.

	Reduction Stage Group				
	Early (1-2)	Middle (3)	Late (4-5)	Indeterminate	Total
Enfield Surveys	45	97	187	13	342
1987-89 Excavations	172	230	195	102	699
1993-96 Excavations	34	73	117	53	277
1997 Survey/Excavations	-	1	-	-	1
Total	251	401	499	168	1319

about 32% of 1987-89 bifaces were late-stage. Conversely, 29% of all 1987-89 bifaces are early-stage as compared to about 15% for both Enfield and 1993-96 collections. Middle-stage bifaces are more abundant in the 1987-89 collection. The Enfields may have preferred to collect more refined bifaces, but stage apportionments in other samples probably reflect real technological patterns. Recall that most sites examined in 1987-89 are in plateau situations while those tested in 1993-96 are all at Fish Slough. As indicated by Basgall and Giambastiani (1995), the prevalence of early- and middle-stage bifaces at 1987-89 sites reflects a biface manufacturing profile, particularly in Newberry-age deposits at residential sites like MNO-2189, MNO-2190, and MNO-2464. A similar profile is also evident in the pre-Little Lake component at MNO-1992 at Fish Slough. An opposite pattern is manifest at Fish Slough sites (most of which are Type 1 lithic scatters) where late-stage bifaces are dominant. This discrepancy probably arises from variation in stoneworking activities conducted at different kinds of sites - biface manufacturing at residential locations, tool repair and discard of late-stage fragments at Type 1 locations.

Comparable trends are also evident in samples of flake tools from the three subject projects (Table 7.8). Again ignoring indeterminates, biface thinning flakes account for more than 70% of all Enfield and 93-96 simple flake tools as opposed to only about 55% in the 1987-89 collection. More

TABLE 7.8. Obsidian flake tools by technological group and project.

	Cortical	Interior	Bifacing	Bipolar	Pressure	Indet.	Total
Simple Flake Tools							
Enfield Surveys	96	56	422	7	-	203	784
87-89 Excavations	16	228	310	-	1	192	747
93-96 Excavations	18	17	95	-	-	94	224
97 Survey/Excavations	2	-	3	-	-	4	9
Total	132	301	830	7	1	493	1764
Formed Flake Tools							
Enfield Surveys	12	2	8	-	-	42	64
87-89 Excavations	3	32	19	-	-	22	76
93-96 Excavations	3	8	4	-	-	16	31
97 Survey/Excavations	-	1	-	-	-	1	2
Total	18	43	31	-	-	81	173

than 40% of all 1987-89 flake tools are made from interior blanks but only 10-15% of flake tools from other projects are so manufactured. If simple flake tools derive from on-site debitage, these data could signify a greater amount of early-stage core reduction at plateau sites and an emphasis on the production of flake blanks from already shaped bifaces at Fish Slough. Formed flake tools do not demonstrate the same allotments. In fact, relatively few of them are made from biface thinning flakes. Formed flake tool metrics (see Chapter Six) suggest that larger flake blanks were usually selected, either cortical or simple interior flakes. Because formed flake tools were often curated, flakes used to make them were probably not culled from bifacing debris at sites where the tools were discarded but originated from other locations.

Finally, the sheer volume of debitage from all Tableland projects precluded analysis of the entire collection. Given the various recovery methods used on Enfield projects, it seemed unlikely

TABLE 7.9. Analyzed obsidian debitage by technological group and project.

	Cortical	Interior	Bifacing	Pressure	Indet.	Total
Enfield Surveys	121	77	252	-	-	450
87-89 Excavations	29	317	703	2931	2772	6754
93-96 Excavations	59	31	459	104	2	655
97 Survey/Excavations	48	34	213	85	-	380
Total	257	459	1627	3120	2774	8239

that resulting debitage collections would accurately portray reduction profiles (see Chapter Four). Pressure flakes were not even present in Enfield materials, and really only existed in large enough quantities within excavated debitage samples from a few Fish Slough sites. All of these discrepancies can be easily observed in Table 7.9. Because various sampling schemes were used to collect debitage, flakes used for source and hydration study are really only amenable to assessing general trends in technology through time and cannot provide measures of inter- or intra-site variability in obsidian stoneworking. This is acceptable because site-specific reduction patterns are not important to this research, but it means that even larger-scale comparisons of reduction technology, such as those between the Slough and Plateau, must rest primarily in debitage samples from the 1987-89 program (MNO-1992 vs. other sites) and in patterns expressed in other tool classes.

Summary and Implications

Despite a few significant differences in recovery tactics, and minor discrepancies in analytical treatments, all of the collections used in this study must be considered essentially equal in order to construct certain comparisons in the following chapters. Sampling strategies and methods used in obsidian studies have accounted for these variations (see Chapter Four), and it has been shown that

Enfield collections are not altogether different from those obtained by systematic surface collection. In terms of measuring spatial and temporal trends in obsidian source use, the above differences are more or less meaningless. Given that there is no real bias in their field recovery, samples of artifacts from all project sites should be generally indicative of source profiles, showing expected source disjunctions between transported tools and on-site debitage. Chronological estimates of project-wide trends in land-use and technology should also be unbiased, as projectile point distributions and hydration analyses interpret each artifact as an isolate in space without considering its depositional context. In a sense this is a non-site, artifact-based approach like those described by Ebert (1992), one that sacrifices the potential to make by-site assessments of source use, occupational age, and lithic production in favor of discerning broader spatial and temporal patterning.

Chapter Eight

OBSIDIAN USE ON THE VOLCANIC TABLELAND

This chapter focuses on the data from obsidian sourcing and hydration studies. The mass of data accumulated during the study precludes the presentation of every trend or trajectory, particularly the myriad of patterns describing intra- and inter-site source relationships. Instead, I offer only information that can serve in the interpretation of spatio-temporal source distributions across the Volcanic Tableland and in speculation about region-wide lithic acquisition and settlement modes. Full data appendices are provided at the rear of this document.

The approach taken in this chapter is as follows. First, it is necessary to layout separately the basics of all three obsidian programs (visual sourcing, XRF, and hydration) so that pertinent datasets can be presented (see Appendix C). Second, visual and XRF sourcing data will be combined in order to facilitate source comparisons. Finally, raw hydration data will be provided that relates to chronological and technological patterns discussed in subsequent chapters. All data necessarily have a local focus, with an emphasis on synchronic spatial distributions, as more far-reaching trends and their implications are examined in the next chapter.

VISUAL SOURCING

A total of 11,685 artifacts was subjected to visual source examination, the full collection deriving from 136 different sites and including 24 survey isolates (Table 8.1); this includes 3631 tools and 8054 unmodified flakes (Table 8.2). Tools derive from 132 sites, some 1449 specimens from sites excavated in 1987-1989 (Basgall and Giambastiani 1995), eight from sites recorded during the 1993 Slough survey, 695 tools from the 1993-1996 excavations at Fish Slough, 56 tools collected during

Table 8.1. Visual source assignments by site and isolate locations.

	Casa Diablo	Truman-Queen	Fish Springs	Indeterminate	Total
1987-89 Excavations					
MNO-1992	190	698	8	654	1550
MNO-2189	40	787	15	499	1341
MNO-2190	234	1020	6	932	2192
MNO-2464	22	334	5	216	577
MNO-2465	296	455	3	1226	1980
INY-399i, ii	21	341	2	199	563
Subtotal	803	3635	39	3726	8203
1993 Survey					
FS24A-1	-	-	-	1	1
ISOLATE	1	5	-	1	7
Subtotal	1	5	-	2	8
1993 Excavations					
MNO-1992	21	68	-	66	152
"533"	10	37	-	44	91
Subtotal	31	105	-	110	246
1995-96 Program					
FS4C-1	-	2	-	8	10
FS10A-2	1	9	1	9	20
FS10B-2	47	120	-	107	274
FS12C-2	4	11	-	14	29
FS14C-1	18	62	1	46	127
FS14C-2	11	26	-	16	53
FS14D-1	29	78	-	80	187
FS18C-1	2	8	-	11	21
FS18C-2	3	14	-	18	35
FS18C-3	-	16	-	4	20
FS18D-1	7	18	-	36	61
FS20C-1	6	18	1	17	42
FS22B-1	7	16	-	14	37
FS22C-1	2	15	1	10	28
FS26B-1	10	25	1	24	60
Subtotal	147	438	5	414	1004
1997 Survey					
T2-A	-	14	-	1	15
T2-B	1	10	-	4	15
T4-A	5	7	-	22	34
T4-B	4	-	-	12	16
T6-A	-	13	-	3	16
T8-A	1	4	-	13	18
T10-B	3	-	-	7	10

Table 8.1. Visual source assignments by site and isolate locations (Cont...).

	Casa Diablo	Truman-Queen	Fish Springs	Indeterminate	Total
1997 Survey (Cont...)					
T16-A	2	14	-	2	18
T20-A	13	2	-	22	37
T23-A	-	6	-	9	15
T24-A	4	6	-	7	17
T24-B	2	9	-	6	17
T24-C	1	8	-	7	16
T28-A	7	2	-	9	18
T30-A	5	15	-	14	34
T30-B	3	7	7	21	38
ISOLATE	3	4	1	9	17
Subtotal	54	121	8	168	351
Enfield Collections					
1U-20	1	2	-	4	7
1W-3	10	11	-	26	47
1W-19	4	2	-	7	13
1Z-17	1	3	-	1	5
2A-1	1	3	-	6	10
2A-14	-	-	-	1	1
2B-7 *	5	1	-	15	21
2D-13	6	11	-	31	48
3A-5	7	9	-	17	33
4L-11	12	4	-	36	52
4L-13A	3	1	-	2	6
5A-12	14	22	-	33	69
5A-12A (same as 2-A)	2	2	-	4	8
5B-2	3	3	-	2	8
5B-5	3	33	-	6	42
5B-8	-	2	-	9	11
5B-14	-	-	-	1	1
5B-16A	1	2	-	3	6
5B-18	16	19	2	28	65
5B-18A	-	-	-	1	1
5B-18C	1	1	-	4	6
5C-6,7	1	2	-	-	3
5C-16 (same as 28-A)	14	4	-	29	47
5C-19	-	1	-	1	2
5C-20	1	-	-	2	3
5D-3	8	2	-	16	26
5G-17	-	1	-	-	1
5R-13A (MNO-1992)	2	6	-	3	11
5R-19	1	1	-	-	2
5S-4	-	1	-	2	3
5S-6	10	3	-	14	27
5S-9	3	-	-	2	5
5S-11	9	14	-	20	43
5S-12	1	2	-	-	3
5S-14	-	-	-	6	6
5S-15	-	-	-	1	1

Table 8.1. Visual source assignments by site and isolate locations (Cont...).

	Casa Diablo	Truman-Queen	Fish Springs	Indeterminate	Total
Enfield (Cont...)					
5T-16	7	9	-	7	23
5T-18	-	2	-	1	3
5T-19	33	44	-	64	141
5U-4	3	3	-	-	6
5U-4A	3	2	-	-	5
5U-4B	1	1	-	2	4
5U-4F	-	1	-	1	2
5U-4G	1	-	-	4	5
5U-5	1	-	-	-	1
5U-6	-	-	-	1	1
5U-8	-	1	1	5	7
5U-8A	2	1	-	2	5
5U-10	-	12	-	8	20
5U-11	1	1	-	-	2
5U-12	8	5	-	21	34
5U-13	-	18	-	3	21
5U-13A	1	7	-	6	14
5U-14	-	3	-	2	5
5U-15	2	22	-	9	33
5V-11	-	-	-	1	1
5V-15	2	11	-	27	40
5V-20	-	-	-	1	1
5V-21	-	2	-	1	3
5V-25	-	1	-	-	1
5W-3	5	8	-	15	28
5W-5	4	4	-	3	11
5W-6	-	1	-	1	2
5W-6B	3	-	-	1	4
5W-8	10	22	1	16	49
5X-5	-	1	-	1	2
5Y-7	-	1	-	1	2
6B-14	1	-	-	1	2
6D-8	7	5	1	12	25
6D-9	4	2	-	6	12
6E-16	14	10	1	28	53
6Q-9	15	2	-	20	37
6Q-12	1	-	-	1	2
6X-1	1	4	-	3	8
7Q-10	1	-	-	-	1
7Q-19	9	-	1	12	22
7S-16	-	1	-	-	1
7Y-12	5	6	-	7	18
7Z-2	1	1	-	-	2
8B-11	1	-	-	2	3
8B-15	-	2	-	3	5
8D-3	13	8	5	25	51
8D-4	7	25	-	18	50
8G-15	3	1	-	1	5
8H-11	7	12	-	26	45

Table 8.1. Visual source assignments by site and isolate locations (Cont...).

	Casa Diablo	Truman-Queen	Fish Springs	Indeterminate	Total
Enfield (Cont...)					
9G-4	13	7	-	23	43
E-17	5	7	-	2	14
E-17A	3	7	-	14	24
E-17B	2	23	-	7	32
G-25	3	4	-	4	11
G-32	13	6	-	11	30
H-21	1	3	-	1	5
H-3	-	-	-	2	2
H-3B	3	4	-	-	7
H-5	1	-	-	2	3
K-0	33	69	1	68	171
K-0B	-	1	-	-	1
L-14	2	16	-	6	24
L-14C	1	4	-	3	8
Y-1	7	6	2	22	37
Subtotal	415	591	15	867	1873
GRAND TOTAL	1440	4891	67	5287	11685

Note: * Site lies just outside study area boundaries; was included to bolster projectile point samples.

1997 Plateau survey, and 1423 obsidian tools from Enfield collections. From all these projects a total of 4057 obsidian tools was ultimately available for sourcing (see Chapter Seven, Table 7.5), and only 190 bifaces, 230 simple flake tools, and six point blanks were left unexamined by either visual or XRF methods. Debitage was selected from 68 site locations. Most of it derives from sites excavated in 1987-89 (6754 pieces, 83.9%), the remainder taken from many other locations. With few exceptions, survey sites contributed 15-60 pieces of debitage apiece.

As shown in Table 8.2, visual sourcing was able to assign more than half of all scrutinized artifacts to specific obsidian types (54.8%), 6398 items attributed to either the Truman-Queen (4891), Casa Diablo (1440), or Fish Springs (67) sources with all others indeterminate (5287 pieces). Fractions of indeterminates vary slightly, differing from 35-51% between artifact classes. Bifaces and

formed flake tools were easiest to source, while point blanks and unmodified flakes were the most difficult. This is logical given that success is somewhat dependent upon artifact size and thickness; bifaces and formed flake tools have greater dimensions than do small, gracile flake tools and debitage. The fact that success rates were fairly comparable between tool classes implies that artifact size does not significantly affect visual sourcing of tools. However, considering that more than 70% of all indeterminate items are flakes, it would seem that visual sourcing of debitage was hampered by artifact thickness. Because of this problem, visual and XRF sourcing efforts generally ignored small flakes, those less than 2.0 cm in diameter and less than 1.0 mm in thickness.

X-RAY FLUORESCENCE SOURCING

A total of 2198 artifacts was subjected to XRF analysis, including 244 projectile points, 436 bifaces, 36 point blanks, 64 formed flake tools, 633 simple flake tools, five drills, 17 cores, and 763 unmodified flakes (Table 8.2). The main goal of XRF work was to source artifacts (especially tools) that could not be sourced visually. Thus, the vast majority of items subjected to XRF comprises visually indeterminate pieces (2112, or 96.1%), which account for all indeterminate tools save 14 points, 30 simple flake tools, and 14 drills. Beyond visual indeterminates, a sample of 86 artifacts that had been visually assigned to Truman-Queen (54), Casa Diablo (16), and Fish Springs (16) sources was also examined by XRF. Most were tools (29 projectile points, 36 bifaces, three formed flake tools, and a single core) analyzed to round out several site obsidian samples and to bolster source samples for pre-Newberry projectile point types. Of the remaining 17 unmodified flakes, fifteen had been sourced to Truman-Queen and the other two to Fish Springs. All of these were sourced by XRF as a test of visual methods (see below) and are incorporated into project totals. In all, 18.8% of all visually sourced artifacts were examined by the XRF method.

Table 8.2. Visual source assignments by artifact type.

	Casa Diablo	Truman-Queen	Fish Springs	Indeterminate	Total
Projectile Point	114	253	17	256	640
Point Blank	9	26	-	36	71
Biface	274	436	8	411	1129
Formed Flake Tool	55	55	2	61	173
Simple Flake Tool	317	552	2	663	1534
Drill	9	13	1	19	42
Core	6	20	-	16	42
Debitage	656	3536	37	3825	8054
Total	1440	4891	67	5287	11685

Patterns in XRF assignments have immediate relevance for evaluating current visual sourcing methods. Chapter Four already showed the high degree of accuracy in visual methods, achieving an overall success rate of nearly 90%. Results of XRF sourcing tend to corroborate the conservative nature of the visual program (in Table 8.4). Because visual assignments were made only when confidence was high, there is an abundance of Truman-Queen, Casa Diablo, and Fish Springs glasses among visually indeterminate items subjected to XRF. Excluding 175 pieces that could not be classified by XRF, Casa Diablo makes up 21%, Truman-Queen 15%, and Fish Springs about 4% of the remaining visual indeterminates, the combined sum (789 pieces) accounting for 41% of the total subjected to XRF. In retrospect, some examples might have been correctly identified visually had criteria for classification been less stringent. However, this would have resulted in a much lower overall accuracy rate, which runs counter to the main goal of visual sourcing - reliability. Visual indeterminates traced by XRF to Casa Diablo, Truman-Queen, and Fish Springs sources occur in near-equal proportions between artifact classes, a fact that supports the consistency of the visual method (Table 8.4). For example, items in all XRF source classes sort with surprising regularity into several

Table 8.3. Artifacts subjected to XRF sourcing by artifact class.

	PRJ	BIF	PTB	FLK	FRM	DRL	COR	DEB	Total
Visual Indeterminates	256	411	36	663	61	19	16	3825	5287
XRF Attempts	244	436	36	633	64	5	17	763	2198
XRF Indeterminates	16	48	3	61	9	-	2	42	181
Total XRF Assignments	228	388	33	572	55	5	15	721	2017

Note: PRJ, projectile point; BIF, biface; PTB, point blank; FLK, simple flake tool; FRM, formed flake tool; DRL, drill; COR, core; DEB, debitage.

artifact groups. Differences in the relative amount of items in each artifact group vary by no more than 16% between any two sources, most variations restricted to within 1-3%. The only notable anomaly is among Casa Diablo materials where the fraction of debitage is slightly elevated and the portion of projectile points is lower than expected. This lone discrepancy could signify that Casa Diablo projectile points were a bit more easily recognized than Casa Diablo flakes by visual means, but the overall pattern shows little if any bias in the kinds of artifacts found visually indeterminate. Again, it would seem that artifacts were rejected during visual assessment based primarily on size and thickness limitations, no obsidian being more easily recognized among any particular artifact type. Artifacts examined by XRF derive from 124 sites and include 12 isolates as well (Table 8.5). As a result of the various sampling strategies used to select items for analysis, the largest share of the XRF sample consists of Enfield materials (38%), followed by the 1987-89 collections (29%), the 1993-96 collections (24%), and the 1997 survey materials (9%). At face value this spread seems pretty consistent, but in terms of the relative portion each obsidian collection makes up in the overall project assemblage greater fractions of Enfield (14%) and 1997 survey (10%) collections figured into XRF study than either the 1987-89 or 1993-96 materials (about 1% each). This difference results mainly

TABLE 8.4. Visually examined obsidian artifacts by XRF source assignment.

	XRF Classification													
	BH	CD	CO	FS	MC	MG	MO	MH	PG	QI	SV	TQ	IN	Total
Visual														
TQ	-	-	-	1	-	1	3	2	-	-	-	44	3	54
CD	-	11	-	-	-	1	-	-	-	1	-	-	3	16
FS	-	1	-	15	-	-	-	-	-	-	-	-	-	16
IN	14	415	9	75	26	418	136	278	9	27	231	299	175	2112
Total	14	427	9	91	26	420	139	280	9	28	231	343	181	2198

Note: BH, Bodie Hills; CD, Casa Diablo; CO, Coso; FS, Fish Springs; MC, Mono Craters; MG, Mono Glass Mountain; MO, Mono Craters/Mono Glass Mountain; MH, Mount Hicks; PG, Pine Grove Hills; QI, Queen Impostor; SV, Saline Valley; TQ, Truman-Queen; IN, Indeterminate.

from the use of debitage samples from Enfield and 1997 survey sites in order to expand the spatial coverage afforded by source analyses.

Although the intent of this chapter is to focus on source trends pertaining to the Tableland as a whole, there are a few site-specific patterns deserving of quick mention. First, it is evident that MNO-1992 contains 10 of 23 artifacts (43%) assigned to either Bodie Hills or Pine Grove Hills sources. Another eight specimens (four each) derive from four sites at Fish Slough ("533", FS14C-1, FS14D-1, and FS18D-1); thus, nearly 80% of all Bodie and Pine Grove Hills artifacts come from only five sites at the slough. These data show that Bodie and Pine Grove Hills obsidians are even rarer than their already low numbers would suggest. A similar pattern occurs for Coso obsidian, five of nine pieces (56%) hailing from three sites at Fish Slough (FS18D-1, FS26B-1, T24-A). The fact that these three obsidians are the most distant of all potential glasses implies, among other things, that Fish Slough (and especially MNO-1992) was a regular target for groups moving extremely long distances throughout eastern California. Second, the distribution of Queen Impostor obsidian is limited to nine sites and primarily to a single location, Enfield site 5V-15 providing 16 of 28 artifacts (57%) assigned

TABLE 8.5. Visual indeterminates traced by XRF to Casa Diablo, Truman-Queen, and Fish Springs.

	Projectile Point	Biface	Simple Flake Tool	Debitage	Other	Total
Casa Diablo	27 (7%)	45 (11%)	89 (21%)	248 (60%)	6 (1%)	415 (100%)
Truman-Queen	43 (15%)	47 (16%)	65 (22%)	132 (44%)	9 (3%)	299 (100%)
Fish Springs	12 (16%)	11 (14%)	14 (19%)	36 (48%)	2 (3%)	75 (100%)

to that source. In contrast, Saline Valley obsidian is spread throughout the XRF source sample, occurring at over 50 different sites, and there seems to be no correlation between the two glasses at any particular places. As with other distant obsidians, the pattern demonstrated by Queen Impostor glass appears to be location-specific, its prevalence at 5V-15 perhaps representing a single event of toolstone importation and use. The Saline Valley distribution is suggestive of more regular or frequent importation to a large number of locations across the Volcanic Tableland.

Moving on to other XRF patterns, a broad array of obsidians is manifest in the sample of chemically sourced visual indeterminates (see Table 8.5). Leaving aside for the moment all Casa Diablo, Queen, Fish Springs, and XRF indeterminates, the remaining 1148 pieces account for no less than eight other distinct obsidians. Material from Mono Glass Mountain makes up the largest share (36.4%), followed by Mt. Hicks (24.2%), Saline Valley (20.1%), Queen Impostor (2.4%), Mono Craters (2.3%), Bodie Hills (1.2%), Pine Grove Hills and Coso (0.8% each). Undifferentiated Mono Craters/Mono Glass Mountain obsidians make up another 11.8%, the majority of this group probably attributed to Mono Glass Mountain (see Chapter Four). These apportionments are consistent with the relative distances of subject obsidians, Mono Glass Mountain being the nearest source, Pine Grove Hills and Bodie Hills the most removed to the north, and Coso the farthest to the south.

TABLE 8.6. XRF source assignments by site and isolate locations.

	BH	CD	CO	FS	MC	MG	MO	MH	PG	QI	SV	TQ	IN	Total
1987-89 Program														
MNO-1992	6	13	-	4	1	15	6	15	2	-	6	21	9	98
MNO-2189	-	5	-	-	-	5	7	10	-	1	1	45	7	81
MNO-2190	3	42	-	3	-	35	18	36	-	3	39	60	24	265
MNO-2464	-	9	-	2	1	3	7	2	-	-	1	15	3	43
MNO-2465	-	34	-	3	-	25	13	24	-	1	30	6	10	146
INY-399i, ii	-	1	-	1	-	2	-	-	-	-	-	2	-	6
Subtotal	9	104	-	13	2	85	51	87	2	5	77	149	53	639
1993-96 Programs														
MNO-1992	-	9	-	-	-	9	2	12	2	-	4	16	9	63
"533"	1	13	-	1	-	7	2	2	2	1	4	5	5	43
FS4C-1	-	1	-	-	-	2	1	-	-	-	-	2	-	6
FS10A-2	-	2	-	2	-	1	1	1	-	-	1	2	-	10
FS10B-2	-	17	-	-	-	31	3	30	-	-	12	6	8	107
FS12C-2	-	3	-	-	-	3	1	1	-	-	1	3	1	13
FS14C-1	-	6	-	3	-	13	1	6	1	-	3	8	5	46
FS14C-2	-	1	-	-	-	5	2	3	-	-	2	1	2	16
FS14D-1	1	12	-	1	-	26	3	12	-	-	10	9	6	80
FS18C-1	-	5	-	-	-	1	-	-	-	-	-	3	2	11
FS18C-2	-	4	-	-	-	5	2	2	-	-	1	4	-	18
FS18C-3	-	-	-	1	-	1	2	-	-	-	-	-	-	4
FS18D-1	2	16	2	1	-	5	1	1	1	1	1	3	2	36
FS20C-1	-	8	-	1	-	2	-	1	-	-	3	2	-	17
FS22B-1	-	3	-	1	-	5	1	2	-	1	-	-	1	14
FS22C-1	-	2	-	1	-	1	2	1	-	-	1	1	1	10
FS26B-1	-	2	2	7	-	7	1	2	-	-	-	2	2	25
ISOLATE	-	1	-	1	-	-	-	-	-	-	-	-	-	2
Subtotal	4	105	4	20	-	124	25	76	6	3	43	67	44	521
1997 Survey														
T2-A	-	-	-	-	-	1	-	1	-	-	-	-	4	6
T2-B	-	-	-	-	-	-	-	1	-	-	1	1	1	4
T4-A	-	7	-	-	-	4	1	1	-	-	7	-	2	22
T4-B	-	-	-	-	-	5	2	4	-	-	-	-	1	12
T6-A	-	-	-	-	-	1	-	1	-	-	-	1	-	3
T8-A	-	3	-	-	-	3	-	3	-	-	-	3	1	13
T10-B	-	6	-	-	-	1	-	-	-	-	-	-	-	7
T16-A	-	-	-	-	1	-	-	-	-	-	-	1	-	2
T20-A	-	17	-	-	1	2	2	-	-	-	-	-	-	22
T23-A	-	6	-	-	-	-	1	-	-	1	-	1	-	9
T24-A	-	1	1	2	1	-	-	1	-	-	-	1	-	7
T24-B	-	3	-	-	-	-	-	1	-	-	1	1	-	6
T24-C	-	3	-	-	1	1	1	-	-	-	-	1	-	7
T28-A	-	8	-	1	1	11	4	7	1	-	3	-	2	38
T30-A	-	2	-	1	1	-	2	-	-	-	-	5	3	14
T30-B	-	1	1	1	7	1	6	1	-	-	-	2	1	21
ISOLATE	-	-	-	3	1	1	-	-	-	-	-	3	2	10
Subtotal	-	57	2	8	14	31	19	21	1	1	12	20	17	203

TABLE 8.6. XRF source assignments by site and isolate locations (Cont...)

	BH	CD	CO	FS	MC	MG	MO	MH	PG	QI	SV	TQ	I	Total
Enfield Surveys														
1U-20	-	2	-	-	-	2	-	-	-	-	-	-	-	4
1W-3	-	6	-	-	-	8	1	-	-	-	-	4	2	21
1Z-17	-	-	-	-	-	-	-	-	-	-	-	1	-	1
2A-1	-	-	-	1	-	1	-	2	-	-	1	1	-	6
2A-14	-	-	-	-	-	1	-	-	-	-	-	-	-	1
2B-7	-	1	-	-	-	1	-	5	-	-	5	-	3	15
2D-13	-	5	-	2	-	8	1	3	-	-	5	6	1	31
3A-5	-	-	-	2	-	3	1	3	-	-	3	4	2	18
4L-11	-	7	-	2	1	4	-	6	-	-	14	1	2	37
4L-13A	-	2	-	-	-	-	-	-	-	-	1	-	-	3
5A-12	1	8	-	-	-	4	3	3	-	-	3	11	1	34
5B-2	-	-	-	-	-	-	-	-	-	-	2	-	-	2
5B-5	-	3	-	-	-	-	-	-	-	-	1	3	-	7
5B-8	-	1	-	-	-	1	2	-	-	-	1	2	2	9
5B-14	-	-	-	-	-	1	-	-	-	-	-	-	-	1
5B-16A	-	-	-	-	-	1	1	-	-	-	-	1	-	3
5B-18	-	5	-	-	-	9	2	5	-	-	3	5	-	29
5B-18A	-	-	-	-	1	-	-	-	-	-	-	-	-	1
5B-18C	-	-	-	-	1	-	-	1	-	-	1	-	1	4
5C-6,7	-	-	-	-	-	-	-	-	-	-	-	1	-	1
5C-19	-	1	-	-	-	-	-	-	-	-	-	-	-	1
5C-20	-	-	-	-	-	-	-	1	-	-	-	-	1	2
5D-3	-	5	-	4	-	4	-	-	-	-	-	1	1	15
5R-13A*	-	-	-	-	1	-	1	1	-	-	-	-	-	3
5S-4	-	-	-	-	-	-	1	-	-	-	-	-	1	2
5S-6	-	3	-	1	1	2	1	-	-	-	5	1	1	15
5S-9	-	1	-	-	-	-	-	-	-	-	1	-	-	2
5S-11	-	8	-	-	-	5	-	3	-	-	2	2	1	21
5S-14	-	2	-	-	-	-	1	-	-	-	1	-	2	6
5S-15	-	1	-	-	-	-	-	-	-	-	-	-	-	1
5T-16	-	3	-	-	-	-	-	1	-	-	1	2	-	7
5T-18	-	-	-	-	-	-	-	-	-	-	-	-	1	1
5T-19	-	12	-	1	1	24	9	4	-	-	4	7	4	66
5U-4A	-	1	-	-	-	-	-	-	-	-	-	-	-	1
5U-4B	-	-	1	-	-	-	-	-	-	-	-	-	1	2
5U-4F	-	-	-	-	-	-	1	-	-	-	-	-	-	1
5U-4G	-	1	-	-	-	-	-	-	-	-	1	2	-	4
5U-6	-	-	-	-	-	-	-	-	-	-	1	-	-	1
5U-8	-	2	-	1	-	1	-	-	-	-	1	1	-	6
5U-8A	-	-	-	-	-	2	-	-	-	-	-	-	-	2
5U-10	-	2	-	1	-	1	1	1	-	-	-	2	-	8
5U-12	-	9	-	2	-	3	-	2	-	1	2	1	1	21
5U-13	-	-	-	-	-	-	-	1	-	-	1	1	-	3
5U-13A	-	-	-	-	-	-	-	1	-	-	1	3	3	8
5U-14	-	-	-	1	-	-	-	-	-	-	-	1	-	2
5U-15	-	1	-	-	-	2	2	-	-	-	1	3	-	9
5V-11	-	-	-	-	-	-	1	-	-	-	-	-	-	1
5V-15	-	-	-	2	-	-	-	6	-	16	1	-	3	28
5V-20	-	-	-	-	-	-	-	-	-	-	-	-	1	1
5V-21	-	-	-	-	-	1	-	-	-	-	-	-	-	1

TABLE 8.6. XRF source assignments by site and isolate locations (Cont...)

	BH	CD	CO	FS	MC	MG	MO	MH	PG	QI	SV	TQ	I	Total
Enfield (Cont...)														
5V-25	-	-	-	-	-	-	-	-	-	-	-	1	-	1
5W-3	-	4	-	-	-	7	-	1	-	-	2	1	-	15
5W-5	-	-	-	-	-	1	-	1	-	-	1	-	-	3
5W-6	-	-	-	-	-	1	-	-	-	-	-	-	-	1
5W-6B	-	1	-	-	-	-	-	-	-	-	-	-	-	1
5W-8	-	3	-	2	1	3	2	3	-	-	-	3	1	18
5X-5	-	-	1	-	-	-	-	-	-	-	-	-	-	1
5Y-7	-	-	-	-	-	1	-	-	-	-	-	-	-	1
6B-14	-	-	-	-	-	-	-	1	-	-	-	-	-	1
6D-8	-	6	-	-	-	4	2	-	-	-	1	-	-	13
6D-9	-	1	-	2	-	2	-	-	-	-	-	2	-	7
6E-16	-	7	-	6	-	1	-	8	-	-	3	2	2	29
6Q-9	-	10	-	-	-	2	-	1	-	-	4	-	3	20
6Q-12	-	1	-	-	-	-	-	-	-	-	-	-	-	1
6X-1	-	1	-	-	-	-	-	1	-	-	-	1	-	3
7Q-19	-	2	-	1	-	5	1	-	-	-	1	1	1	12
7Y-12	-	2	-	-	-	2	-	-	-	-	1	2	-	7
8B-11	-	-	-	-	1	1	-	-	-	-	-	-	-	2
8B-15	-	1	-	-	-	1	-	-	-	-	-	1	-	3
8D-3	-	4	1	2	1	8	-	3	-	-	6	-	3	28
8D-4	-	1	-	2	-	3	4	2	-	-	-	4	1	17
8H-11	-	2	-	-	-	4	1	3	-	-	-	1	2	13
9G-4	-	7	-	-	-	5	-	1	-	-	5	2	3	23
E-17	-	1	-	-	-	1	-	-	-	-	-	-	-	2
E-17A	-	5	-	-	-	5	-	-	-	-	-	2	2	14
E-17B	-	1	-	-	-	2	1	1	-	-	-	2	-	7
G-25	-	-	-	-	1	2	-	1	-	-	-	-	-	4
G-32	-	2	-	5	-	3	-	1	-	-	-	-	-	11
H-3	-	-	-	-	-	2	-	-	-	-	-	-	-	2
H-3B	-	1	-	-	-	-	-	-	-	-	-	-	-	1
H-5	-	2	-	-	-	-	-	-	-	-	-	-	-	2
H-21	-	-	-	-	-	1	-	-	-	-	-	-	-	1
K-0	-	3	-	7	-	16	2	16	-	-	8	8	11	71
L-14	-	-	-	1	-	-	-	-	-	2	-	3	-	6
L-14C	-	-	-	-	-	1	-	1	-	-	-	1	-	3
Y-1	-	2	-	2	-	7	2	2	-	-	4	3	-	22
Subtotal	1	162	3	50	10	180	43	96	-	19	99	107	65	835
TOTAL	14	427	9	91	26	420	139	280	9	28	231	343	181	2198

Note: BH, Bodie Hills; CD, Casa Diablo; CO, Coso; FS, Fish Springs; MC, Mono Craters; MG, Mono Glass Mountain; MO, undifferentiated Mono; MH, Mount Hicks; PG, Pine Grove Hills; QI, Queen Impostor; SV, Saline Valley; TQ, Truman-Queen; I, indeterminate. * Site is same as MNO-1992.

Somewhat surprising given their distant locations are quantities of Mt. Hicks and Saline Valley obsidians, the former seeming particularly abundant next to the limited amounts of Pine Grove Hills and Bodie Hills glasses and the latter being unexpectedly common as compared to Queen Impostor. Mt. Hicks is actually a bit closer to the Volcanic Tableland than Bodie Hills or Pine Grove Hills, by about 10 and 30 km, respectively, adding some support to a simple distance drop-off explanation. The scarcity of Pine Grove Hills is also somewhat understandable given the relatively limited quantity and sizes of obsidian nodules available at that source as compared to Mt. Hicks or Bodie. Still, the difference between Pine Grove Hills and Mt.Hicks is quite large (9 vs. 280 pieces), indicating a more drastic falloff than might be anticipated if simply due to some additional distance. And, unlike Pine Grove Hills, the rarity of Bodie Hills cannot be explained due to inadequacies of its source deposits, as substantial amounts of raw material are available there in fairly large packages.

The other notable discrepancy, between Saline Valley and Queen Impostor, is also not easily explained. These two obsidians are essentially equidistant from the Tableland, both occurring in the Saline Range which separates Saline Valley from Eureka Valley (Johnson 1999). Of three chemical types yet identified in this source area, Variety 1 ("Queen Impostor") occurs on both west and east flanks of the Saline Range but is the only type found on the west. Obsidian-bearing units on the west offer pebble- to boulder-sized packages of Queen Impostor glass (Johnson 1999, 2002). On the east, Variety 1, Variety 2 (an unknown), and Variety 3 ("Saline Valley") all occur in various depositional units, often in close proximity to each other. At present, primary outcrops of Saline Valley obsidian are only known on the east side of the Saline Range, but it is likely that aboriginal consumers got nodules from alluvial fans extending far out from the eastern edge of the mountains (Johnson et al. 1999). So far, Queen Impostor has been identified with some frequency in Owens Valley, but Saline Valley is scarce (Delacorte et al. 1995; Delacorte and McGuire 1993; Richman and Basgall 1998; but see Gilreath and Nelson 1999). This could imply that Saline Valley obsidian has a primarily eastward

affiliation, being used more by Nevada populations than by eastern California groups. Unfortunately, the presence of Saline Valley obsidian has only recently been documented (Johnson 1999) and no major archaeological studies have been conducted near the source to help verify its distribution or to isolate previously "unknown" glasses to which it may correspond.

Source Distributions Between Artifact Classes and Site Types

As shown above, trends unique to both visual and XRF data indicate that mere distance-to-source explanations are insufficient to account for observed variability in the proportions of different obsidians on the Volcanic Tableland. In order to explore other possibilities, and to demonstrate spatial patterns in source presence, we can combine the results of both sourcing programs to create a master obsidian source profile for the study area (Table 8.7). In this tabulation all indeterminate classifications are removed, and all Mono Craters, Mono Glass Mountain, and undifferentiated Mono Craters/Glass Mountains assignments have been lumped into a single Mono Craters/Glass Mountain category. It should also be noted that the proportion of Truman-Queen debitage is a bit exaggerated relative to other obsidians, this being due to variations in sampling methodologies of the two sourcing programs. For example, as shown earlier in Table 8.3, the visual source sample contained 5827 indeterminates that included 1462 tools and 3825 pieces of debitage. The same table indicates that nearly all visually indeterminate tools were examined by XRF but only one-fifth of all flakes was chemically sourced. Given the high rates of accuracy in visual sourcing, it is likely that nearly all non-XRF debitage derives from sources *other* than Truman-Queen, Casa Diablo, or Fish Springs. This is particularly relevant to Truman-Queen, as this source comprises a much larger portion of the overall visual sample (42%) than it does in the XRF sample of visual indeterminates (14%) in Table 8.4; differences along these lines for Casa Diablo and Fish Springs are less drastic, the former dropping from 22% to 19% in the XRF sample and the latter increasing from 0.6% to nearly 4%. While

TABLE 8.7. Obsidian source assignments by artifact class on the Volcanic Tableland.

	Pine Grove Hills	Bodie Hills	Mt. Hicks	Truman-Queen	Mono Craters/ Glass Mtn	Casa Diablo	Fish Springs	Saline Valley	Queen Impostor	Coso	Total
Projectile Point	-	5	50	293	38	141	29	23	2	2	583
Point Blank	1	-	8	27	12	11	1	6	2	-	68
Biface	1	2	101	484	97	327	19	49	4	-	1084
Formed Flake Tool	-	-	8	63	22	58	3	8	2	-	164
Simple Flake Tool	3	2	89	617	193	406	16	114	2	1	1443
Core	-	-	1	22	8	6	-	2	1	-	40
Drill	-	-	3	13	1	9	1	1	-	-	28
Debitage	4	5	20	3664	214	904	73	28	15	6	4933
Total	9	14	280	5183	585	1862	142	231	28	9	8343

relative amounts of the three glasses are comparable between visual and XRF tools, the amount of Truman-Queen as debitage in the full source sample (74%) is much greater than its ration among visual debitage (44%) because the XRF analysis of visually indeterminate flakes was incomplete. Be this as it may, there is no evidence that the enhanced portion of Truman-Queen debitage in the overall sample has changed or compromised any major source patterns (Table 8.7). The dominance of Truman-Queen in both tools and debitage is unmistakable, accounting for 38-55% of items in all tool classes and more than 70% of all debitage. Even if the proportion of Truman-Queen in the debitage class was dropped to match its fraction among tools, say to about 45% (2200 flakes or so), the only glass that would even approach in terms of overall numbers is Casa Diablo, and it would really only do so in the tool classes. The fact that Truman-Queen is so prevalent in all artifact categories shows it was the most recently exploited source at sites in the project area, and also implies it was imported to the Tableland in greater quantities than other glasses. As for other obsidians, their profiles are generally indicative of greater distance from the study area. Most obsidians from quite far away, like Queen Impostor, Saline Valley, Bodie Hills, and Mt. Hicks, occur primarily as tools, bifacial forms (projectile points and bifaces) being more common relative to unifacial ones (flake tools). Other glasses are more balanced as tools and debitage (Mono, Fish Springs, Casa Diablo), thus conforming to expectations of "local" sources which arrived in larger quantities on the Tableland.

There is also some variation in the distribution of obsidian sources across site types, though patterns are less forceful due to sample size limitations. In Table 8.8, sources are compared by site type and arranged by artifact groups, with totals in percentages (indexed to 1.0); note that in the "All Tools" and "Bifacial Tools" categories, some 50 projectile points from sites outside the Tableland are omitted (see hydration sampling, Chapter Four). The group All Artifacts shows that most sources are heavily weighted, between about 70-80%, to Type 3 (residential) sites. Exceptions are Coso and Queen Impostor, these having much smaller portions in the Type 3 category (22% and 32% each).

TABLE 8.8. Relative proportions of obsidian sources by site types and artifact groups.

	PG	BO	MH	TQ	MO	CD	FS	SV	QI	CO	Total
All Artifacts											
n (=1.0)	9	14	274	5169	580	1845	139	225	28	9	8292
Type 1	.11	.14	.07	.04	.09	.06	.07	.04	.11	.33	.05
Type 2	-	.07	.10	.11	.17	.10	.28	.10	.57	.45	.12
Type 3	.89	.79	.82	.84	.73	.83	.69	.85	.32	.22	.82
Type 4	-	-	<.01	<.01	<.01	<.01	-	<.01	-	-	<.01
Type 5	-	-	-	<.01	-	<.01	-	-	-	-	<.01
All Tools											
n (=1.0)	5	9	254	1505	377	941	66	197	13	3	3370
Type 1	-	-	.04	.03	.06	.03	.05	.04	.08	.33	.04
Type 2	-	.11	.10	.12	.18	.15	.18	.11	.31	-	.13
Type 3	1.0	.88	.86	.84	.75	.81	.77	.84	.61	.67	.82
Type 4	-	-	<.01	<.01	<.01	<.01	-	<.01	-	-	<.01
Type 5	-	-	-	<.01	-	<.01	-	-	-	-	<.01
All Debitage											
n (=1.0)	4	5	20	3664	214	904	73	28	15	6	4933
Type 1	.25	.40	.50	.04	.18	.10	.10	.07	.13	.33	.07
Type 2	-	-	.15	.11	.15	.05	.34	.04	.80	.67	.11
Type 3	.75	.60	.35	.84	.66	.85	.56	.89	.07	-	.82
Type 4	-	-	-	<.01	.01	-	-	-	-	-	<.01
Type 5	-	-	-	-	-	-	-	-	-	-	-
Bifacial Tools											
n (=1.0)	1	7	145	763	131	451	45	66	6	2	1617
Type 1	-	-	.05	.03	.03	.03	.05	.01	.17	-	.03
Type 2	-	.14	.05	.10	.11	.13	.22	.08	.50	-	.11
Type 3	1.0	.86	.89	.86	.85	.83	.73	.91	.33	1.0	.85
Type 4	-	-	<.01	<.01	<.01	<.01	-	-	-	-	<.01
Type 5	-	-	-	<.01	-	<.01	-	-	-	-	<.01
Unifacial Tools											
n (=1.0)	3	2	97	680	215	464	19	122	4	1	1607
Type 1	-	-	.02	.03	.03	<.01	.05	.05	-	1.0	.04
Type 2	-	-	.19	.14	.22	.17	.11	.13	-	-	.16
Type 3	1.0	1.0	.79	.81	.74	.78	.84	.81	1.0	-	.79
Type 4	-	-	-	.01	<.01	<.01	-	<.01	-	-	<.01
Type 5	-	-	-	<.01	-	<.01	-	-	-	-	<.01

Note: PG, Pine Grove Hills; BH, Bodie Hills; MH, Mt. Hicks; TQ, Truman-Queen; MO, undifferentiated Mono; Cd, Casa Diablo; FS, Fish Springs; QI, Queen Impostor; SV, Saline Valley; CO, Coso. Bifacial tools include points and bifaces; Unifacial tools include simple and formed flake tools.

In the All Tools group, every source sample is strongly aligned with Type 3 sites, but in the All Debitage there is a moderate shift toward other site types. The reversal is most pronounced in the Bodie Hills, Mt. Hicks, Fish Springs, Queen Impostor, and Coso samples. In particular, Mt. Hicks debitage is abundant at Type 1 sites, Queen Impostor is biased to Type 2 sites, and Coso is restricted to Type 1 and Type 2 sites. It is possible this trend simply relates to small sample sizes, but more likely it is the essence of the pattern that is most telling: on the Tableland, distant obsidians are partial to temporary camps (Type 1-2 sites), while nearby sources occur more often at residential sites (Type 3). Saline Valley is the exception among distant sources, following the pattern of a local obsidian.

The last two groupings in Table 8.8 clearly show that tools of all sources are strongly biased to Type 3 sites, irrespective of manufacturing type. Indeed, the only glass that deviates from the norm is Queen Impostor, for which bifacial tools are fairly evenly distributed between Type 1, Type 2, and Type 3 sites. A more interesting and pervasive pattern can be seen in the relative distributions of sources between bifacial and unifacial tool groups. From the perspective that bifacial implements are more often curated and transportable, and that unifacial tools (especially simple flake tools) are more often made, used, and discarded in one place, it stands to reason that distant obsidians should be represented mainly among bifacial tools while local glasses should be prevalent as unifacial forms. These scenarios play out when comparing source sample totals (the "n" rows) in bifacial and unifacial tool groups. In general, distant obsidians are more strongly represented among bifacial tools (Bodie Hills, 7 of 9 [78%]; Mt. Hicks, 145 of 242 [60%]; Queen Impostor, 6 of 10 [60%]; Coso, 2 of 3 [67%]), though Fish Springs behaves like a distant obsidian in this regard (70% in the bifacial group). Local obsidians (Truman-Queen, Mono, Casa Diablo) show an opposite trend, being weighted toward unifacial tools or evenly represented as both tool forms. As it did in the debitage group, Saline Valley again behaves like a local obsidian, with a stronger representation as unifacial tools (65%).

At the very least, these trends support notions developed by Basgall (1989) and others about the effects of curation and tool use-life variability on obsidian source profiles. They suggest that obsidians from distant locations were usually deposited in temporary camps on the Tableland, while nearby glasses were more often used at residential sites. Notions about the kinds of stoneworking practices associated with different site types are also consistent with these conclusions, temporary camps seeing mainly tool repair and discard and residential sites witnessing full-scale manufacturing. Local obsidians should figure more prominently in tool manufacture, as larger stores of raw stone, recently obtained, would be used more intensively in tool production.

A couple of exceptions to these patterns are compelling, those involving Fish Springs and Saline Valley obsidians. In many ways, Fish Springs behaves like a non-local obsidian despite its proximity to the study area. It is found most often at temporary camps and mainly as bifacial tools. As noted elsewhere (Basgall and Giambastiani 1995), this probably indicates that Fish Springs obsidian was rarely imported to the Tableland and never in large amounts, perhaps always being one or two source visits removed. This is consistent with hypotheses by Bettinger (1982a, 1982b, 1989a), which suppose that native Owens Valley people controlled the distribution of Fish Springs obsidian, restricting its distribution to areas north of the source (near Big Pine) and south of the Tableland. However, it conflicts with ethnographic data that place the Tableland within the boundaries of Owens Valley (Bishop) Paiute territory (Steward 1933, 1938), which imply that Fish Springs glass should be common on the Tableland, especially during more recent times. Further implications of the Fish Springs profile, and its contradictory nature, will be examined later in this chapter as they pertain largely to temporal differences in the deployment of Fish Springs obsidian. Presaging upcoming discussions, hydration data indicate that Fish Springs obsidian was more often imported to the Tableland during pre-Newberry population shifts, occurring rarely after that except at sites along Fish Slough.

As for Saline Valley, it shows an opposite trend to Fish Springs, occurring mainly at residential sites and primarily as unifacial tools despite originating some 100 km distant. Equally curious is the fact that its neighbor source, Queen Impostor, behaves like a distant source. This distinction could relate to the site-specific bias of Queen Impostor glass, recalling that most of it (16 pieces, or 42%) comes from a single Type 2 site (Enfield 5V-15). If this site sample is excluded from consideration, the remaining Queen Impostor debris (12 pieces) does act more like a local obsidian in some respects, though sample size becomes quite limited. It is possible that the Queen Impostor debris at 5V-15 could relate to a single occupational episode, but given the variety of items present (one Leaf-shaped projectile point, one point blank, two bifaces, and 12 flakes) and the occurrence of other dart-points, arrow-points, and obsidians at the site (Casa Diablo, Fish Springs, Mt. Hicks, Saline Valley, Truman-Queen) this seems unlikely. Therefore, it may be that the original Queen Impostor pattern is correct and that the Saline Valley profile is anomalous.

Considering Saline Valley, then, there are three reasonable ways to explain its "local" profile and broad distribution: (a) Saline Valley obsidian was frequently acquired through trade or another type of indirect access; (b) its presence is the result of direct moves from the source to the Tableland, with few if any other sources visited along the way; or (c) early-period use of Saline glass results from direct procurement, while late-period use is mainly an outcome of scavenging. The first hypothesis is feasible if one considers ethnographic data that indicate regular interactions between Saline Valley and Owens Valley (Steward 1933, 1934, 1938). Though there is no specific mention of obsidian trade, people from Saline Valley did provide salt to Owens Valley groups (Steward 1938:78), and there was some intermarriage between the two populations (Steward 1933:237). Steward also suggests that family ownership of pine nut plots by Saline Valley Shoshone may have been borrowed from Owens Valley Paiute (1938:73). However, there are two important facts which do not support trade as the force which placed Saline Valley obsidian on the Tableland. First, Saline Valley obsidian

is present at over 50 sites in the study area (see Table 8.6). Available hydration data also show that Saline obsidian has a broad temporal spread, extending from pre-Newberry to Marana times (see Chapter Nine). Unless Saline glass was imported via numerous trade events throughout prehistory, it seems unlikely that trade is responsible for its local spatio-temporal distribution. The second hypothesis is most attractive in explaining the early presence of Saline Valley, as it is fairly well established that obsidian was procured through wide-ranging settlement movements between Owens Valley-Long Valley during Newberry and earlier temporal intervals (Basgall 1989; Delacorte et al. 1995; Delacorte and McGuire 1993). In this context it is not hard to envision the direct acquisition and transport of Saline Valley obsidian to the Tableland. Still, this hypothesis is less able to explain the more recent presence of Saline glass, if it is true that populations throughout the Inyo-Mono region (and especially Owens Valley) became more centralized following the Newberry period. A general decline in settlement mobility would imply that Owens Valley groups had less frequent access to Saline obsidian, a material that may have already been difficult to obtain due to its out-of-the-way location (the east flank of the Saline Range).

Considering the problems with the two previous hypotheses, the last scenario appears to have the most merit. In particular, it is difficult to explain how Saline obsidian might have arrived on the Tableland via exchange rather than by direct access. Bettinger (1982a, 1982b) has speculated that Fish Springs glass was controlled by Owens Valley people during the last few millennia, restricting direct access only to groups residing within 15-25 km north and west of the source and requiring exchange from all other consumers. However, given the differences between Steward's (1938) estimates of ethnohistoric population densities in Owens Valley (one person/2.1 sq miles) and Saline Valley (one/16.6 sq miles), it is unlikely that this kind of territoriality could have been exerted by Saline Valley residents over their local obsidian. Bettinger (1982a, 1982b, 1989a) has also suggested that little inter-regional obsidian trade was practiced by eastern California groups, and it seems

unlikely that Owens Valley groups would have any real need for Saline obsidian. Considering also that the demand for Saline glass was probably never extreme, because of its isolated location and given the abundance of other sources, these facts likely preclude the development of formal exchange directed to moving Saline Valley obsidian into Owens Valley. Direct exploitation thus appears responsible at least for the early appearance of Saline glass on the Tableland, though its route of entry remains unknown (see Chapter Nine).

There is also much regional and local evidence for an increase in obsidian scavenging during the terminal prehistoric period. At INY-30, Basgall and McGuire (1988) noted the effects of scavenging on Marana period hydration profiles, many broken items in firmly dated feature contexts having primary or secondary hydration rims that were much larger than expected. North of Lone Pine, Delacorte et al. (1995) discuss a late-period increase in the presence of distant obsidians, particularly those which are normally rare in the local vicinity. The fact that all obsidians occur in consistent relative proportions between tool classes and debitage is also viewed as representative of scavenging; no glass looks to have been obtained by direct access or exchange, and the disjunctions between tools and debitage expected of obsidians imported from long distances are absent. Even near the Fish Springs obsidian source, Bettinger (1989a) depicts late-period hydration anomalies similar to those demonstrated at INY-30, particularly at Two Eagles where tool supplies were relatively low. On the Tableland, Basgall and Giambastiani (1995) concluded that the late-period persistence of bifaces (of all reduction stages) and the use of biface thinning flakes as blanks for flake tools were both partly due to scavenging, with still-serviceable bifacial tools being procured from older (Newberry) contexts on-site or elsewhere. This fits with the contention that bifacial reduction debris is well-suited to flake-based technologies, particularly for the production of arrow-points (Basgall and McGuire 1988:360).

In this study, there is some evidence of late-period scavenging of Saline Valley obsidian from a few key sites. Though samples are small, and exact parameters of the Saline hydration rate are not

known, means for Saline Valley artifacts from established Haiwee/Marana components (six) and all others less than 4.0 microns thick (seven) include a considerable number of anomalies and secondary hydration rims (54% of all specimens). Among the former group, three (50%) are unexpectedly large (between 4.7-5.7 microns) and one has a larger, diffuse rim (not cortical); among the latter, three (43%) have larger secondary rims (2.3/3.9, 2.9/3.8, and 3.3/5.0). These phenomena are not observed in hydration samples of Queen Impostor, Mt. Hicks, or other distant obsidians, but they do occur among local glasses that are more plentiful at project sites. Thus, for reasons which I cannot fully explain it appears that Saline Valley obsidian was subject to more frequent scavenging than is predicted simply by chance. It is a fact, though, that the seven anomalies derive from only five sites which together account for 35% of all Saline Valley obsidian (MNO-2190, 39 pieces; MNO-2465, 30 pieces; K-0, 8 pieces; 6Q-9, 4 pieces, 5U-4G, 1 piece). If tool scavenging was especially frequent at these sites, especially MNO-2190 and MNO-2465, these activities may have biased the profile of Saline Valley obsidian to resemble a "local" raw material by producing debitage in greater than expected quantities. It has been suggested that a high portion of Truman-Queen glass in late contexts at MNO-2190 could actually relate to the scavenging of Newberry deposits at the site rather than an incursion of raw material (Basgall and Giambastiani 1995:128), and there is evidence of scavenging in hydration profiles for Haiwee/Marana contexts at MNO-2465 (Basgall and Giambastiani 1995:Table A.1).

Moving to some final assessments, there are minor differences in the diversity and ranges of sources present at various site types. Table 8.9 shows the relative proportions of obsidian sources as percentages (indexed to 1.0) for three datasets. First, it is easy to see the regularity of source diversity in the All Artifacts group. Looking strictly to Type 1-3 sites, where samples are large enough to be meaningful, source profiles are dominated by local obsidians (Truman-Queen, Casa Diablo, Mono). The relative proportions of these sources in each site type are comparable as well; Truman-Queen

TABLE 8.9. Artifact groups and site types with relative proportions of obsidian sources.

	PG	BO	MH	TQ	MO	CD	FS	SV	QI	CO	n (=1.0)
All Artifacts											
Type 1	<.01	<.01	.05	.50	.12	.27	.02	.02	<.01	<.01	439
Type 2	-	<.01	.03	.60	.10	.19	.04	.02	.01	<.01	993
Type 3	<.01	<.01	.03	.63	.06	.22	.01	.03	<.01	<.01	6831
Type 4	-	-	.04	.50	.18	.23	-	.04	-	-	22
Type 5	-	-	-	.57	-	.43	-	-	-	-	7
Total	<.01	<.01	.03	.62	.07	.22	.02	.03	<.01	<.01	8292
All Tools											
Type 1	-	-	.08	.39	.18	.26	.02	.06	<.01	<.01	128
Type 2	-	<.01	.06	.39	.15	.31	.03	.05	<.01	-	444
Type 3	<.01	<.01	.08	.46	.10	.27	.02	.06	<.01	<.01	2774
Type 4	-	-	.06	.47	.12	.29	-	.06	-	-	17
Type 5	-	-	-	.57	-	.43	-	-	-	-	7
Total	<.01	<.01	.08	.47	.11	.28	.02	.06	<.01	<.01	3370
All Debitage											
Type 1	<.01	<.01	.03	.53	.12	.27	.02	<.01	<.01	<.01	321
Type 2	-	-	<.01	.77	.06	.09	.05	<.01	.02	<.01	549
Type 3	<.01	<.01	<.01	.76	.03	.19	.01	<.01	<.01	-	4057
Type 4	-	-	-	.50	.50	-	-	-	-	-	6
Type 5	-	-	-	-	-	-	-	-	-	-	-
Total	<.01	<.01	<.01	.74	.04	.18	.01	<.01	<.01	<.01	4933

Note: PG, Pine Grove Hills; BH, Bodie Hills; MH, Mt. Hicks; TQ, Truman-Queen; MO, undifferentiated Mono; CD, Casa Diablo; FS, Fish Springs; QI, Queen Impostor; SV, Saline Valley; CO, Coso.

accounts for between 50-63%, Casa Diablo for 19-27%, and Mono for 6-12%. The same patterns are seen in the All Debitage grouping, with Truman-Queen being even more dominant. Relative source distributions even out somewhat in the All Tools dataset. There, Truman-Queen makes a lesser contribution (between 39-46%), while Mt. Hicks, Mono, Casa Diablo, and Saline Valley show slightly amplified proportions. Of course, one might expect this assuming that some quantity of tools was

imported from distant locales, producing a source profile that reflects non-local sources more strongly. In terms of source range, or "richness", Type 3 sites (residences) generally have a greater number of sources present than do other sites. These profiles, however, are probably as much a function of overprinting from multiple occupation events as they are an outcome of the more varied stoneworking that characterizes residences, activities such as maintenance, production, and wholesale discard.

Source Distributions Across the Volcanic Tableland

Broader conclusions regarding obsidian source use and regional settlement patterns can be inferred based on data from the Volcanic Tableland. The spatial distributions, relative frequencies, and forms of obsidian artifacts made of different source materials all contribute to an understanding of land-use patterns in the study area and to the hypothetical reconstruction of the Tableland's place within settlement systems based in outer areas. Data and trends presented in this section will include some examination of obsidian hydration data, as they provide a temporal framework for source patterning and will have ramifications for discussions of regional focus contained in Chapter Nine.

Going back to the spatial quadrants delineated in Chapter Five, we begin by looking at the gross distributions of obsidian sources across the Tableland. Table 8.10 lists the sources in two groups, either north or south in relation to the study area, by spatial Quad. Except for Pine Grove and Bodie Hills, sources north of the Tableland are well represented in all Quads, those to the south being generally scarce. The largest share of South obsidians is in Quad 4, which combined makes up only 12% (59 of 492 total pieces) of the source profile. To better illustrate spatial differences in source distributions, the relative proportions of sources in each Quad are shown as pie graphs in Figures 8.1-8.4. In Quad 1 (Figure 8.1), Truman-Queen is dominant (57.8%) with Casa Diablo making up a significant share as well (28.7%), among eight sources represented. Quad 2 (Figure 8.2) is overwhelmingly dominated by Truman-Queen (74.3%), its strongest representation in any area.

TABLE 8.10. Obsidian sources by spatial quadrant and direction from study area.

	Q1 (NW)	Q2 (NE)	Q3 (SE)	Q4 (SW)	Total
North					
Pine Grove Hills	-	-	8	1	9
Bodie Hills	1	3	10	-	14
Mt. Hicks	45	64	135	30	274
Truman-Queen	979	2129	1977	96	5181
Mono	115	133	270	65	583
Casa Diablo	487	438	684	241	1850
North Total	1627	2767	3084	433	7911
South					
Fish Springs	12	34	73	23	142
Saline Valley	54	58	78	35	225
Queen Impostor	1	6	20	1	28
Coso	-	-	9	-	9
South Total	67	98	180	59	404
GRAND TOTAL	1694	2865	3264	492	8315

Proportions of Truman-Queen (60.6%) and Casa Diablo (21.0%) in Quad 3 (Figure 8.3) are similar to those in Quad 1, but there are ten sources represented with the addition of Coso and Pine Grove Hills; this is the only Quad in which Coso glass occurs. In Quad 4 (Figure 8.4) a much different picture emerges, with Casa Diablo assuming dominance (49.0%) and Truman-Queen (19.5%) and Mono glasses (13.2%) being more evenly matched. Saline Valley obsidian also makes its strongest showing here, due to the fact that Enfield site 5V-15 lies in this quadrant. In general, Quad source profiles are dominated by the nearest major obsidian: Quad 2 (northeast) and Quad 3 (southeast) are dominated by Truman-Queen, which probably arrived via Hammil/Chalfant Valley; Quad 1 (northwest) and Quad 4 (southwest) have amplified portions of Casa Diablo and Mono glasses, which

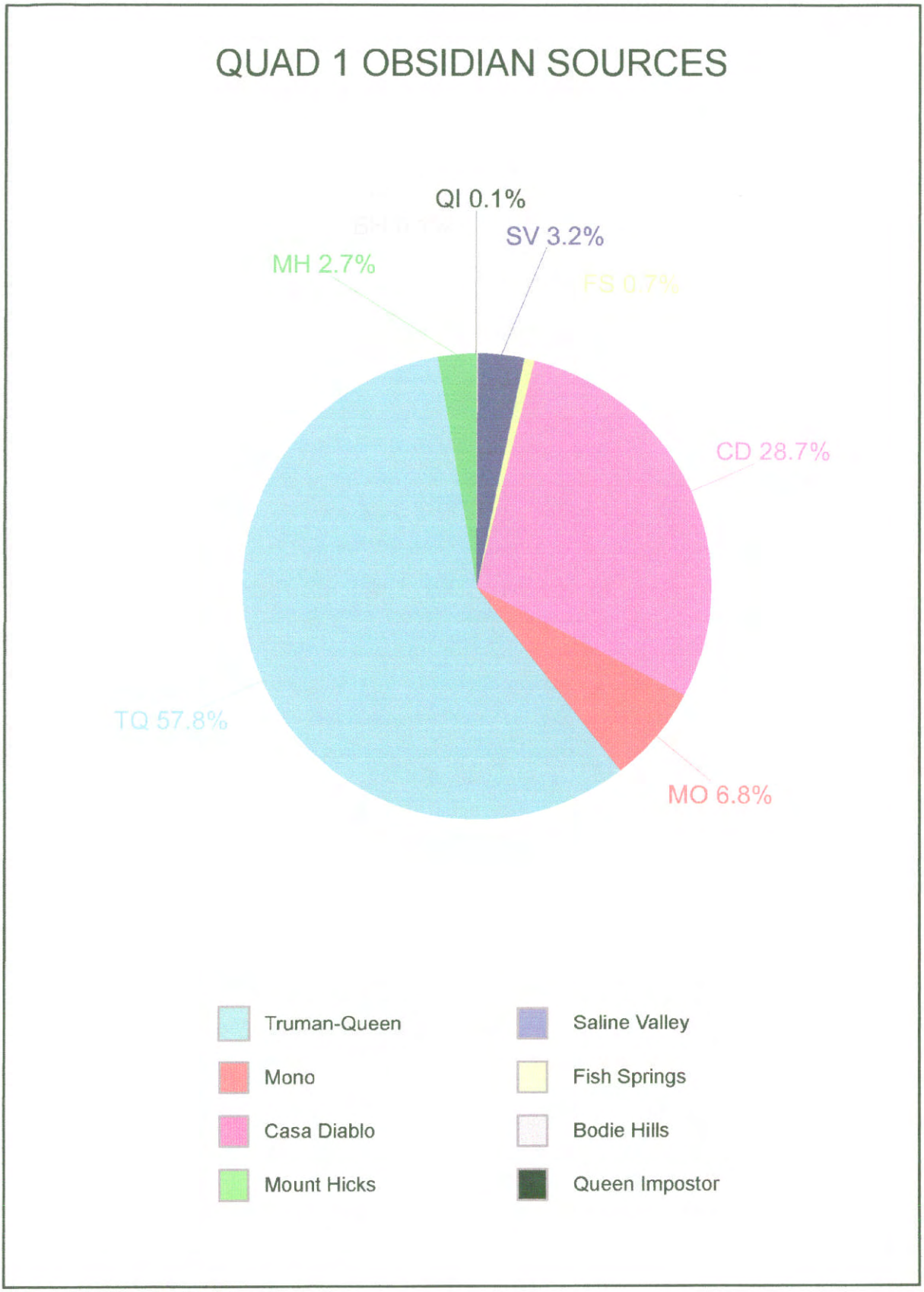

Figure 8.1. Quad 1 Obsidian Sources.

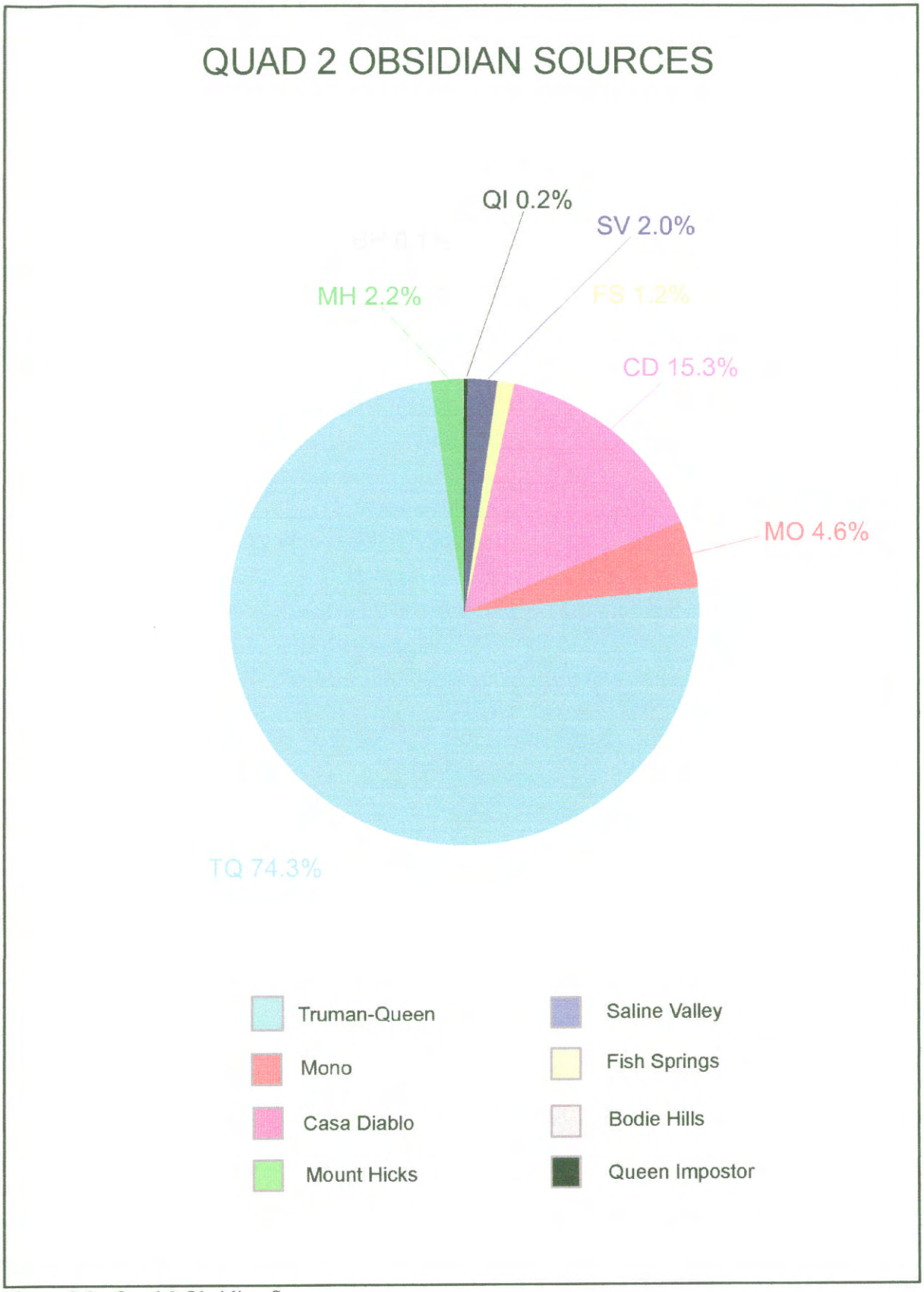

Figure 8.2. Quad 2 Obsidian Sources.

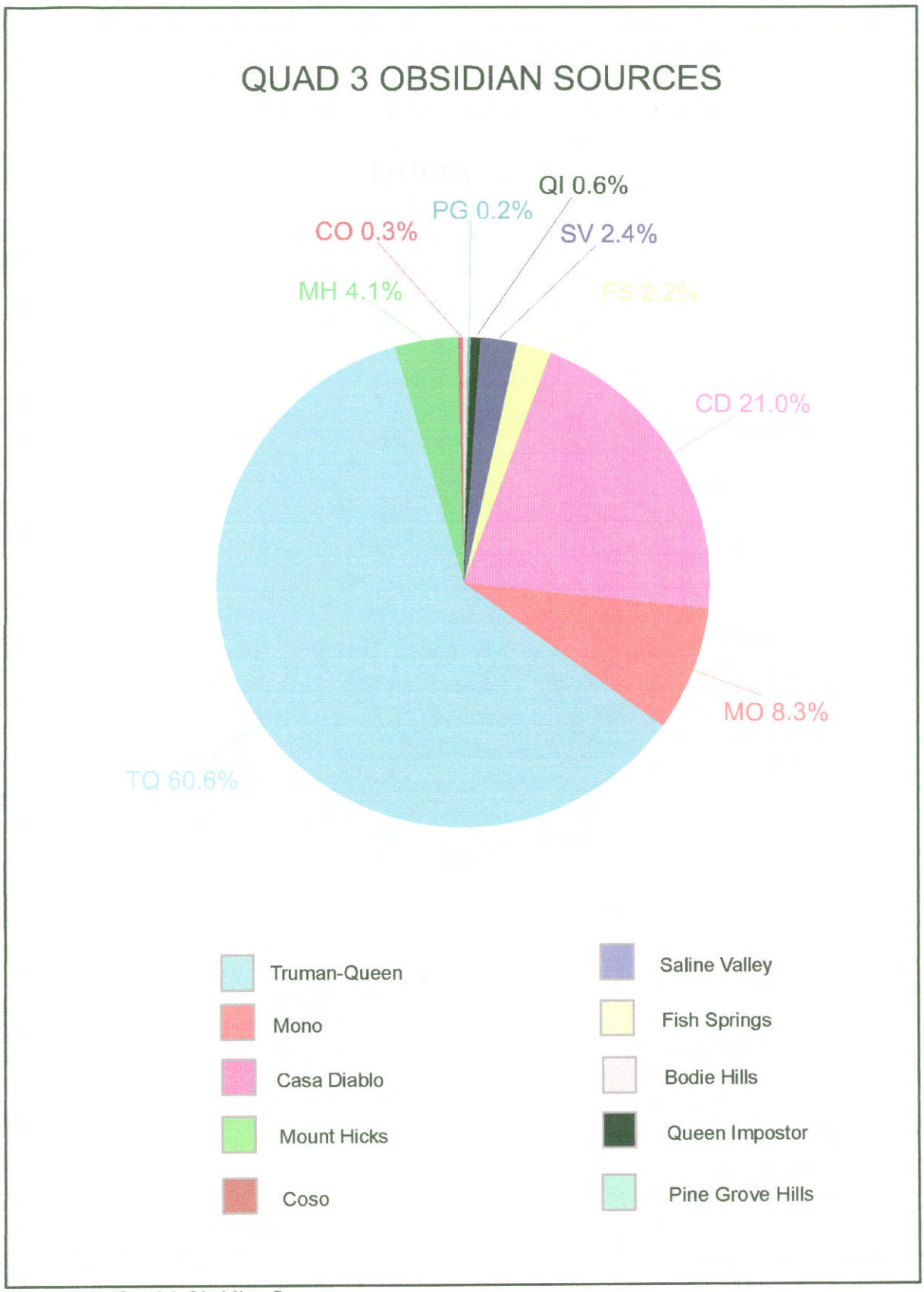

Figure 8.3. Quad 3 Obsidian Sources.

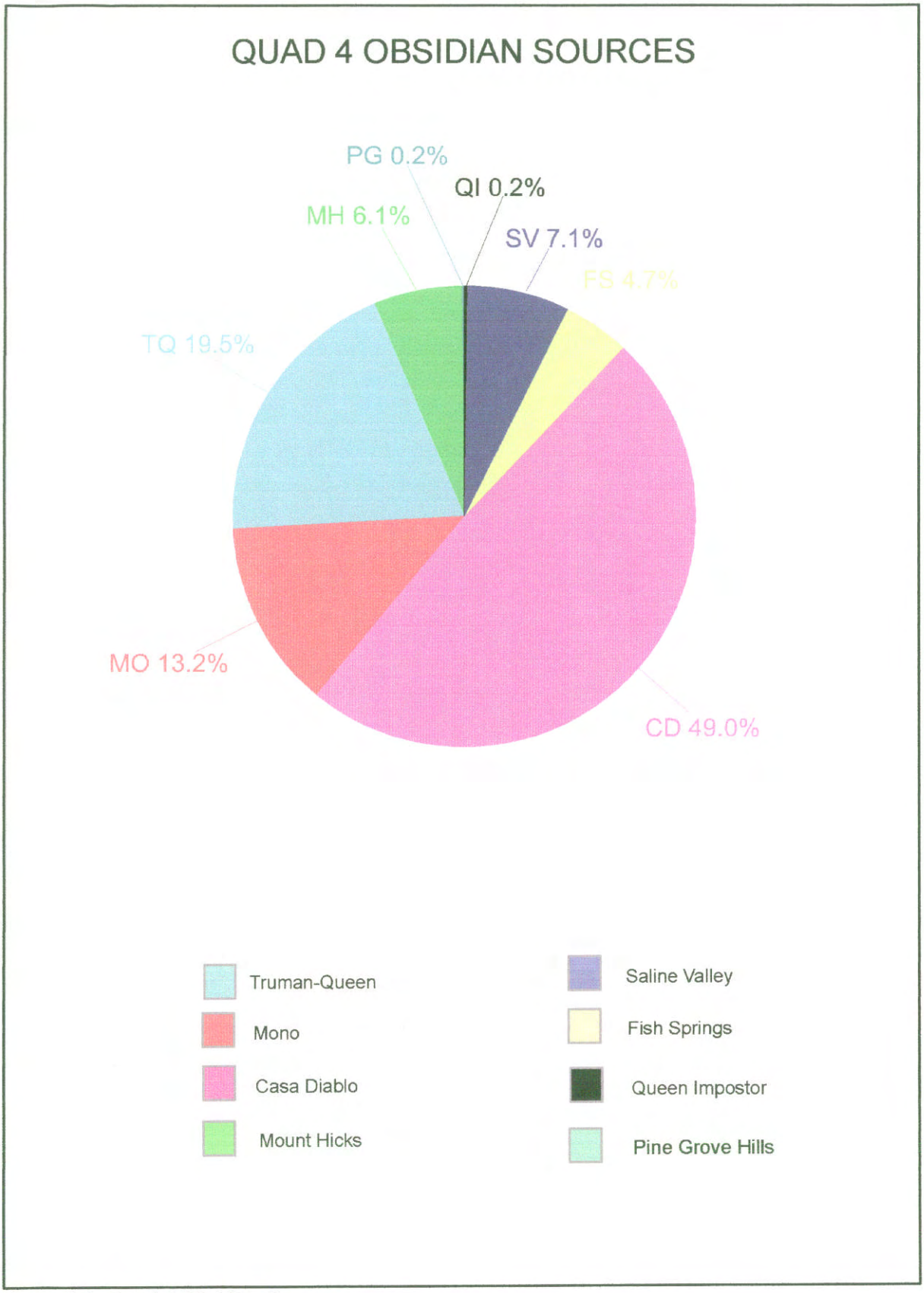

Figure 8.4. Quad 4 Obsidian Sources.

likely were brought in via Long Valley, Chidago Canyon, or the Owens River Gorge; and Quad 3 is the only one that has Coso glass, being relatively closer to Coso than other quadrants. Overall, though, Tableland sites were mainly supplied with northern glasses; as noted earlier, this runs counter to ethnographic Owens Valley Paiute territory and land-use patterns (Steward 1933, 1938).

It is also possible to gauge whether sources "behave" like local or extralocal obsidians by examining tool:debitage ratios in each spatial Quad (Table 8.11). This is based on two assumptions: (1) that sources occurring mainly as debitage are likely to be local in origin, having been imported and reduced at project sites in large quantities; and (2) that sources present largely as tools are more likely to have extralocal origins, arriving primarily at study sites as finished implements (like projectile points and bifaces) that may have been maintained and transported over long distances. As for interpreting tool:debitage ratios in Table 8.11, those at or greater than 1.0 indicate overabundances of tools, while those below 1.0 signify the opposite. Numbers in parentheses denote artifact totals that could not be used to generate ratios. All that said, a few sources look like local glasses. The most obvious are Truman-Queen, in Quads 1-3, and Casa Diablo in all areas. An exception here is the ratio of Truman-Queen in Quad 4, where it is represented more strongly as tools (2.31 ratio). In contrast, Mt. Hicks, Mono, and Saline Valley sources are obviously extralocal, although ratios for Mono in each Quad are less forceful than for the other glasses. Fish Springs is anomalous, behaving as a local source in Quads 2 and 4 but an extralocal source in Quads 1 and 3. Samples for other obsidians are too small for meaningful comparison, though it is noteworthy that overall ratios for Pine Grove Hills and Bodie Hills (both distant obsidians) are consistent with extralocal origin. It also look as if Quad 4 has an overabundance of tools (ratio 1.73), but this is due largely to the relatively high Saline Valley ratio in that Quad.

TABLE 8.11. Tool:debitage ratios for obsidian sources by quadrant.

	Quad 1	Quad 2	Quad 3	Quad 4	Overall Source
Pine Grove Hills	ns	ns	1.00	(1/0)	1.25
Bodie Hills	(1/0)	(3/0)	1.00	ns	1.80
Mt. Hicks	6.50	31.00	10.25	(30/0)	12.70
Truman-Queen	0.36	0.36	0.47	2.31	0.41
Mono	2.97	2.24	1.31	2.44	1.72
Casa Diablo	0.90	0.98	1.16	1.17	1.05
Fish Springs	3.00	0.89	1.03	0.43	0.95
Queen Impostor	(1/0)	(6/0)	0.33	(1/0)	0.87
Saline Valley	5.00	28.00	6.80	4.00	7.03
Coso	ns	ns	0.50	ns	0.50
Overall Quad	0.66	0.55	0.75	1.73	0.69

Note: ns, no sample.

To further explore the implications of these distributions, obsidian sources can be collapsed into seven categories that are differentiated by their general direction and relative distance from the Tableland (refer to Figure 2.3 for regional layout):

Far North - Pine Grove Hills, Bodie Hills, Mt. Hicks
Northwest - Mono Obsidians
Northeast - Truman-Queen
West - Casa Diablo
South - Fish Springs
Southeast - Saline Valley, Queen Impostor
Far South - Coso Volcanic Field

These categories can then be arrayed against Quads to show the relative spatial distributions of the different source groups. This is best done graphically, with artifact totals for source groups in each Quad converted into relative percentages (represented by bar length) of the total items in each unit.

Looking strictly at debitage in Figure 8.5, it appears that Quads 1-3 are dominated by Northeast obsidian (Truman-Queen), which accounts for at least 60% of all sourced obsidian in those areas. In these same Quads, West obsidian (Casa Diablo) makes up the second largest share, particularly in Quad 1 where it comprises 29% of the total sample. A different situation emerges in Quad 4, where West obsidian increases to about 50%; a change in the relative importance of Truman-Queen to Casa Diablo, from east to west on the Tableland, was originally surmised by Basgall and Giambastiani (1995). Also in Quad 4, Northeast, Northwest (Mono), and South (Fish Springs) glasses adopt more even proportions, which Southeast obsidian (Saline Valley, Queen Impostor) makes its greatest contribution in any quadrant (7%). Quad 3 contains the only pieces obsidian from the Far South (Coso) and the only real noticeable amount of glass from the Far North (Bodie Hills, Pine Grove Hills, Mt. Hicks). These patterns demonstrate even more clearly how source location is a factor in conditioning the spatial distribution of obsidians on the Tableland. More so than any other part of the study area, it seems that Quad 3 attracted human occupants from far-flung locations in all directions, resulting in the deposition of a wide range of obsidian sources. Other sectors of the Tableland were more often visited by groups having obtained obsidian from the nearest source.

Comparable trends emerge if source groups are divided between tool type and debitage classes and their relative portions in each Quad listed as fractions of 1.0 (Table 8.12). In the Debitage class, we see the same major pattern as before: Northeast obsidian dominates everywhere except in Quad 4, where West obsidian is more abundant. Beyond this, however, there are small but compelling differences in source proportions between tool and debitage classes that merit brief discussion. In the classes containing only tools (All Tools, Projectile Points, Bifaces, and Unifacial Tools), the relative contribution of Northeast obsidian in any Quad ranges from 17-61%, with overall proportions in each class between 42-52%. Conversely, the amount of Northeast obsidian in the Debitage class rises to 70-85% except in Quad 4, where it falls sharply to 15% with an increase in West glass. This clearly

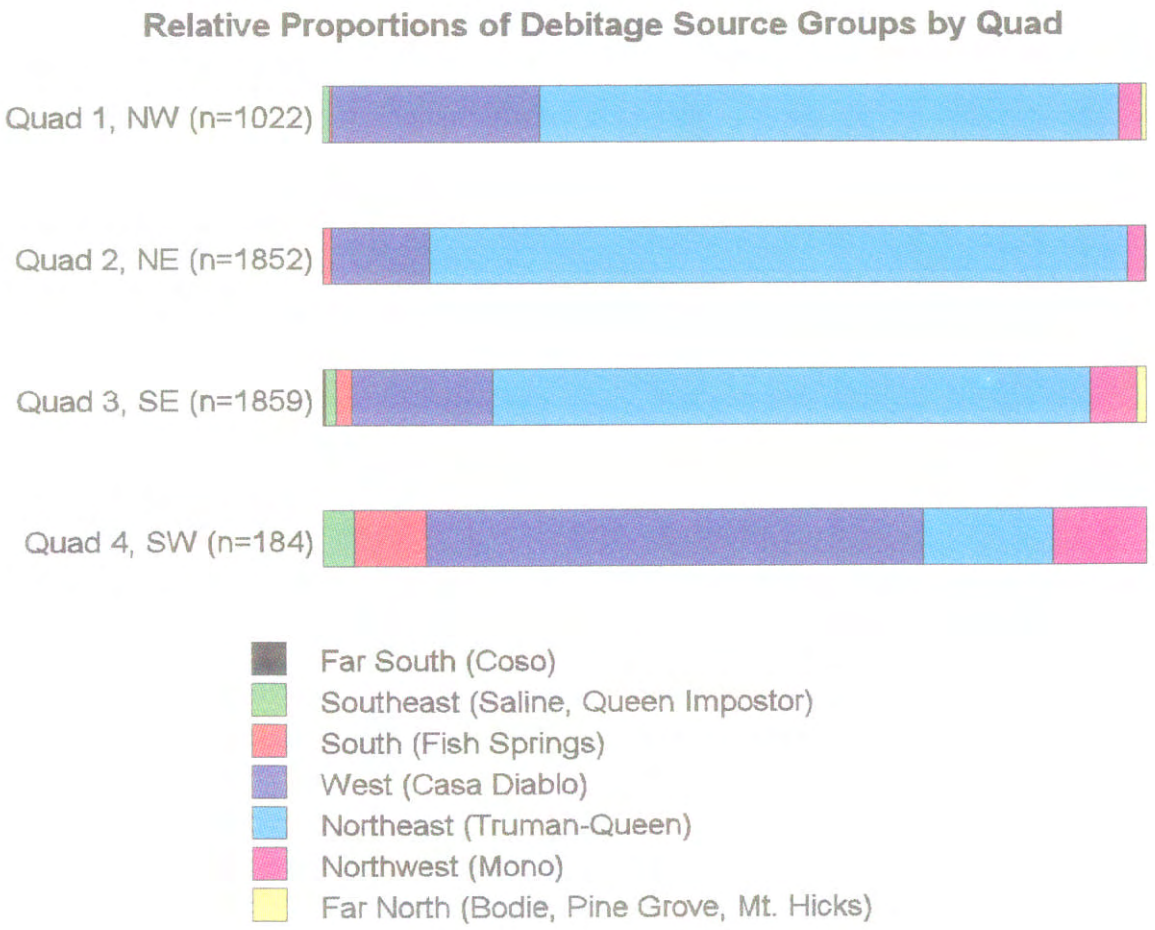

Figure 8.5. Debitage source groups by spatial quadrant.

TABLE 8.12. Proportions of obsidian source groups by spatial Quad and select artifact categories.

		Q1 (NW)	Q2 (NE)	Q3 (SE)	Q4 (SW)	TOTAL
All Tools	Far North	.06	.07	.09	.10	.08
	Northwest	.13	.09	.11	.13	.11
	Northeast	.39	.55	.45	.22	.45
	West	.34	.21	.26	.43	.28
	South	.01	.02	.03	.02	.02
	Southeast	.07	.06	.05	.10	.06
	Far South	-	-	<.01	-	<.01
	n (=1.0)	672	1013	1395	302	3382
Debitage	Far North	<.01	<.01	.01	-	.01
	Northwest	.03	.02	.06	.14	.04
	Northeast	.70	.85	.72	.15	.74
	West	.25	.12	.17	.59	.18
	South	<.01	<.01	.02	.08	.02
	Southeast	<.01	<.01	.01	.04	<.01
	Far South	-	-	<.01	-	<.01
	n (=1.0)	1022	1852	1869	190	4933
Points	Far North	.08	.04	.11	.10	.09
	Northwest	.05	.08	.05	.16	.07
	Northeast	.47	.61	.51	.32	.52
	West	.32	.21	.21	.32	.23
	South	.08	.04	.06	.02	.05
	Southeast	-	.02	.05	.08	.03
	Far South	-	-	<.01	-	<.01
	n (=1.0)	77	170	270	38	555
Bifaces	Far North	.07	.10	.11	.05	.09
	Northwest	.07	.07	.11	.11	.09
	Northeast	.44	.50	.44	.28	.45
	West	.36	.24	.29	.48	.30
	South	.01	.02	.02	.01	.02
	Southeast	.05	.07	.03	.07	.05
	Far South	-	-	-	-	-
	n (=1.0)	181	347	469	86	1084
Unifacial	Far North	.04	.05	.08	.12	.06
	Northwest	.16	.12	.13	.12	.13
	Northeast	.35	.56	.44	.17	.42
	West	.35	.21	.26	.44	.29
	South	<.01	<.01	.02	.03	.01
	Southeast	.09	.07	.06	.12	.08
	Far South	-	-	<.01	-	<.01
	n (=1.0)	390	435	611	171	1607

Note: Unifacial includes simple and formed flake tools only.

shows that Truman-Queen obsidian was most often imported to and reduced at sites on the Tableland, except in its southwest quarter where Casa Diablo was more frequently in supply. The other thing evident in Table 8.11 is that the relative contributions of Northeast glass in each Quad are greater among Projectile Points than among Bifaces or Unifacial Tools. While differences are minor, they are consistent and may be indicative of obsidian re-use at study sites. All else equal, if projectile points were more often maintained and carried for extended periods of time than other tool types, it is expected that these should demonstrate greater diversity in overall source profiles. The fact that they do not could indicate that projectile points made at Tableland sites, more often than not, were produced with Truman-Queen obsidian, with points made elsewhere and discarded at study sites in the context of retooling accounting for the other obsidian sources represented.

Differences Between Slough and Plateau Domains

To conclude this section, one more set of comparisons is made to identify source discrepancies between Slough and Plateau sites. As demonstrated in Chapter Five, Six, and Seven, there are considerable differences between the kinds of sites and assemblages present at Fish Slough and those in other landscape situations. Most Slough sites are small lithic scatters, while many Plateau sites are residential camps with discrete middens and/or rock features (e.g., houses and threshing floors). Previous data have already shown that distant obsidians have a greater representation in Quad 3, which contains the Fish Slough drainage. It is curious, then, that source profiles for Slough sites and for sites elsewhere on the Plateau are remarkably similar in terms of source diversity (Table 8.13). No source group makes a significantly larger contribution to either the Slough or Plateau profile, and more specific breakdowns by tool type and debitage (not shown) also fail to show significant differences. In spite of major discrepancies in occupational trajectories, a synchronic perspective finds that basic patterns of obsidian use were pretty consistent across the Tableland province.

TABLE 8.13. Source group profiles for Slough and Plateau sites.

	SLOUGH		PLATEAU	
	Number	Percent	Number	Percent
Far North	129	5.2%	168	2.9%
Northwest	206	8.4%	376	6.4%
Northeast	1458	59.4%	3722	63.5%
West	555	22.6%	1294	22.1%
South	42	1.7%	100	1.7%
Southeast	59	2.4%	194	3.3%
Far South	5	0.2%	4	<0.1%
Total	2454		5858	

Nonetheless, slight variations in obsidian use emerge when comparing source profiles by site type for Slough and Plateau regions (Table 8.14). Returning to the use of individual obsidian sources, most noticeable are differences in source richness between Type 1 and 2 sites in the two areas. Type 1 sites at the Slough include the full range of sources, as opposed to Type 1 sites on the Plateau which contain only seven; the most distant obsidians (Bodie Hills, Pine Grove Hills, and Coso) occur only at Type 1 Slough sites. The opposite goes for Type 2 sites, those at the Slough with only six sources represented and those on the Plateau with eight. These differences are not drastic, but they give an impression of greater source richness at Slough Type 1 and Plateau Type 2 sites. Also evident is the directional, relative increase in Truman-Queen obsidian at the Slough and Plateau, from Type 1 to Type 3 sites. These site types have slightly greater amounts of Truman-Queen in the Plateau group, but it is the direction rather than the magnitude of the increase that is important, a trajectory that presumably marks a slightly stronger role of Truman-Queen obsidian at residential sites. Finally, source diversity at Slough and Plateau sites is fairly consistent within each site type class. Comparisons made using the Simpson Diversity Index (λ) = Pi^2, which is the inverse of the sum of

TABLE 8.14. Relative percentages of obsidian sources by major site type for Slough and Plateau areas.

	BH	PG	MH	MO	TQ	CD	FS	QI	SV	CO	n (100%)
SLOUGH											
Type 1	0.6%	0.3%	3.9%	11.4%	49.7%	27.9%	2.3%	0.6%	2.3%	1.0%	308
Type 2	-	-	2.4%	13.3%	53.0%	18.1%	10.8%	-	-	2.4%	83
Type 3	0.4%	0.3%	4.7%	7.8%	61.1%	22.0%	1.3%	<.01%	2.4%	-	2057
PLATEAU											
Type 1	-	-	6.1%	13.0%	51.1%	25.2%	2.3%	0.8%	1.5%	-	131
Type 2	0.1%	-	2.9%	9.7%	61.0%	18.8%	3.1%	1.7%	2.5%	0.2%	910
Type 3	.06%	.02%	0.7%	5.5%	64.5%	22.6%	1.4%	0.2%	3.0%	.02%	4771

Note: BH, Bodie Hills, PG, Pine Grove Hills; MH, Mt. Hicks; MO, undifferentiated Mono Craters/Mono Glass Mountain; TQ, Truman-Queen; CD, Casa Diablo; FS, Fish Springs; QI, Queen Impostor; SV, Saline Valley; CO, Coso.

the squared proportions (%) of each source group, indicate that Type 1 sites are the most diverse (Slough 2.93, Plateau 2.89), followed by Type 2 (Slough 2.91, Plateau 2.38) and Type 3 sites (Slough 2.32, Plateau 2.12). However, sites at the slough are consistently more diverse than those on the plateau, the greatest difference seen between Type 2 sites at the two localities. Again, the significance here is in directionality, not fortitude. Taking all these trends together, Slough sites clearly have more diverse source profiles than Plateau sites. As seen earlier, the presence of distant obsidians in Quad 3, and especially at Fish Slough, is largely responsible for increased source richness and diversity.

Temporal Patterns in Source Data

Having already demonstrated that certain obsidians have more or less importance in different Tableland quadrants, it remains to provide a chronological framework for the spatial distributions of

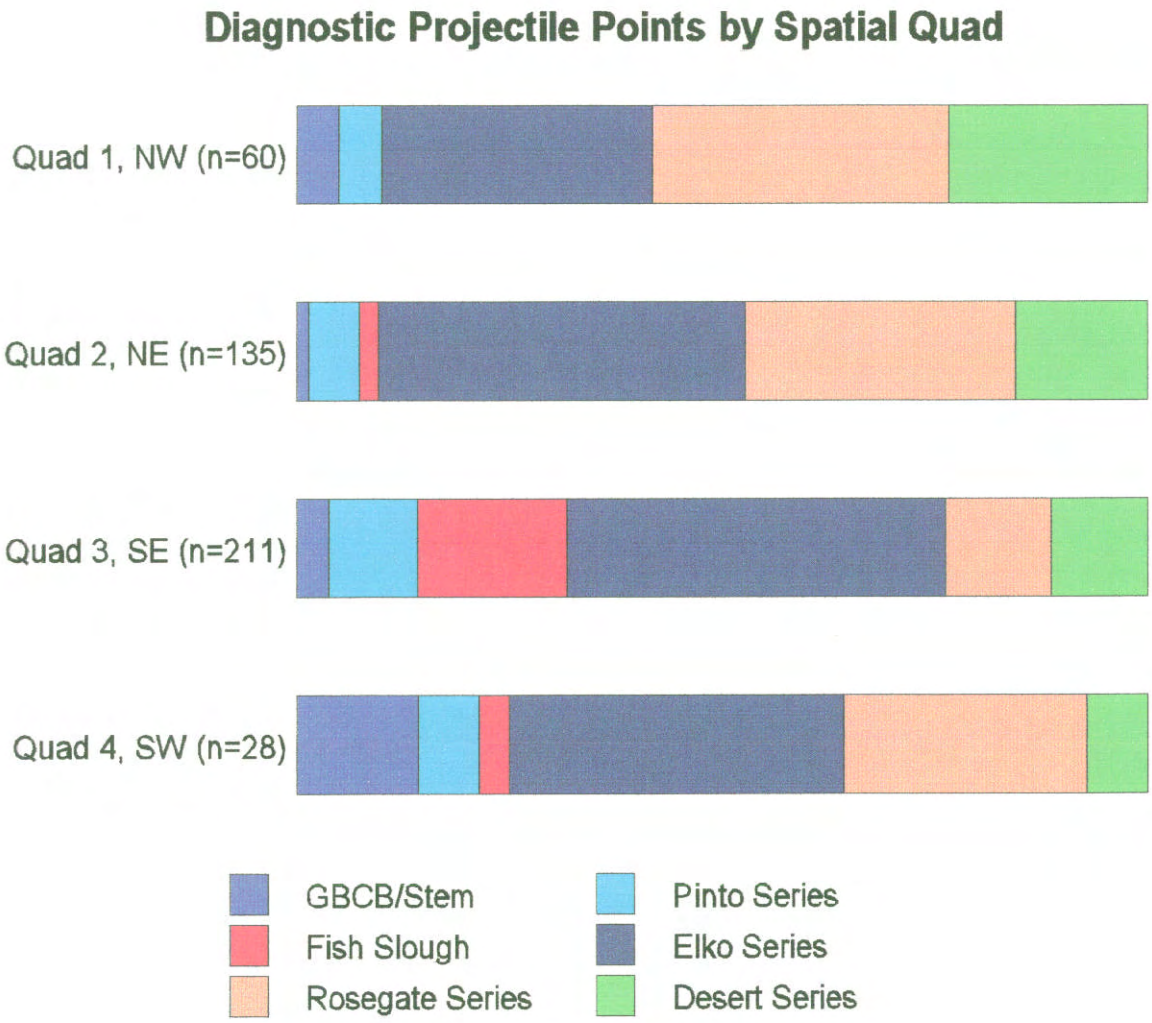

Figure 8.6. Relative proportions of diagnostic projectile points by spatial quadrant.

obsidian sources. This can be approached first by looking at the spatial allotments of diagnostic projectile points by Quad as a proxy measure of temporal variation. In Figure 8.6, time-sensitive projectile points (including a few chert items) are presented in relative proportions within Quads 1-4. Starting with individual point styles, Great Basin Concave-Base/Stemmed Points have their greatest presence in Quad 4 (14% of all points there). Pinto Series forms are most common among points in Quad 3 (10%), Fish Slough Side-notched points are prevalent only in Quad 3 (18%), and Elko Series forms comprise nearly half of all points in Quad 2 (43%) and Quad 3 (45%). Rosegate and Desert Series points are apportioned much differently, being common in all Quads but making their best showings in Quad 2 (32%) and Quad 1 (23%), respectively. In combination, the weights of these distributions form a pattern in which pre-Newberry point types are more prevalent in the south (Quads 3-4) and post-Newberry types more abundant in the north (Quads 1-2). Elko points are more evenly spread between the four Quads, making up no less than 32% of all points in any of them and being slightly more common in the east (Quads 2 and 3). At the very least, we can infer that occupations in the southern half of the Tableland, especially in Quad 3, are relatively ancient compared to habitations in the north. Also notable is the near-exclusion of Fish Slough Side-notched points to Quad 3, a good majority of them (31 of 41, or 76%) recovered from site MNO-1992 at Fish Slough and nearly all of them found within the Slough area (88%). Clearly, these points must represent a unique occupational pattern at Fish Slough, one that has a pre-Newberry temporal signature (Basgall and Giambastiani 1995; Basgall et al. 1995).

If these trends portray a general shift in occupation through time, from south to north, it stands to reason that there should be temporal patterns in obsidian source use as well. Basgall and Giambastiani (1995) have already noted a dominance of Truman-Queen throughout occupational sequences at several sites. Also noted, however, were increases in Casa Diablo and Mono glasses following the Newberry/Haiwee interface. These conclusions were based on a small XRF sample, but

TABLE 8.15. Source assignments for obsidian projectile points from the Volcanic Tableland.

	Bodie Hills	Mt. Hicks	Truman-Queen	Mono Craters/ Glass Mtn	Casa Diablo	Fish Springs	Saline Valley	Queen Impostor	Coso	Indeterminate	Total
Diagnostic Points											
Cottonwood	-	5	13	1	10	-	5	-	-	3	37
Desert Side-notched	-	8	18	4	6	-	2	-	-	4	42
Rose Spring	1	4	37	5	16	5	3	-	-	8	79
Eastgate	1	-	8	1	7	1	1	-	-	-	22
Elko Corner-notched	1	2	17	1	12	5	-	-	1	2	41
Elko Eared	-	14	51	7	17	3	3	-	-	3	98
Elko Contracting Stem	-	-	9	1	4	1	-	-	-	-	15
Fish Slough Side-notched	1	2	21	4	9	1	-	-	-	3	41
Pinto	-	4	6	2	7	2	-	-	-	2	22
Great Basin Stemmed	-	-	4	2	5	1	-	-	-	2	14
Great Basin Concave Base	-	-	2	-	-	-	-	1	-	-	3
Non-diagnostic											
Untypable Arrow	-	1	10	-	5	3	2	-	-	3	24
Humboldt Basal-notched	-	-	16	2	7	1	1	-	-	1	28
Humboldt Concave Base	1	-	-	1	-	-	-	-	-	1	3
Elko Side-notched	-	-	1	-	1	-	-	-	-	-	2
Elko (undifferentiated)	-	-	15	-	6	1	-	-	-	6	29
Little Lake	-	1	7	-	4	2	-	-	-	-	14
Large Side-notched	-	-	1	-	1	-	-	-	-	-	2
Leaf-Shaped	-	-	2	1	1	-	-	1	-	1	6
Untypable Dart	-	7	51	5	22	3	6	-	1	13	108
Untypable	-	-	4	-	1	-	-	-	-	5	10
Total	5	50	293	38	141	29	23	2	2	57	640

they receive support from trends in current databases. To begin, source assignments for all projectile point classifications used in the study, diagnostic or not, are presented in Table 8.15. In order to interpret source patterns, raw data for 387 diagnostic points (Cottonwood, Desert Side-notched, Rose Spring, Eastgate, Elko Corner-notched, Elko Eared, Elko Contracting Stem, Fish Slough Side-notched, Pinto, Great Basin Stemmed, and Great Basin Concave Base) are arranged by type against the source groupings listed earlier in this chapter (Figure 8.7). Among the oldest point types, GBCB/Stemmed and Pinto, relative fractions of Northeast and West glasses are similar, the former holding only a slight edge over the latter in each case (about 6%). Northwest obsidians also account for many GBCB/Stemmed points, while South and Far North obsidians are more prevalent among Pinto points. Both of these point groups have considerable source diversity relative to later styles. Source patterns shift radically with Fish Slough Side-notched forms. Northeast glass becomes dominant, accounting for more than half of all points, this occurring mainly at the expense of obsidian from the West. The dominance of Northeast glass continues in Elko, Rosegate, and Desert Series profiles, though it seems to lessen slightly through time as West, Southeast, and Far North obsidians gain favor. Obsidian in the South group drops out altogether among Desert Series points, giving way to relative increases in the Northwest and Far North groups. As indicated by the distributions of point styles by Quad, and of obsidian sources by point type, post-Pinto times saw increased use of the upper half of the Tableland and of obsidians from northern sources.

This same basic patterns emerge more forcefully in the sample of sourced debitage subjected to hydration analysis. Setting aside for the moment differences in various hydration rates, debitage rim readings are divided into broad micron classes in order to reveal temporal trends in obsidian use. In Table 8.16, rim readings for 502 flakes are sorted into five classes that broadly represent the major time periods or point types relevant to this study: $\geq$ 10.0 microns (Pinto and earlier); 9.9-7.0 microns (Fish Slough); 6.9-5.0 microns (Little Lake/Newberry); 4.9-3.0 microns (Haiwee); <3.0 microns

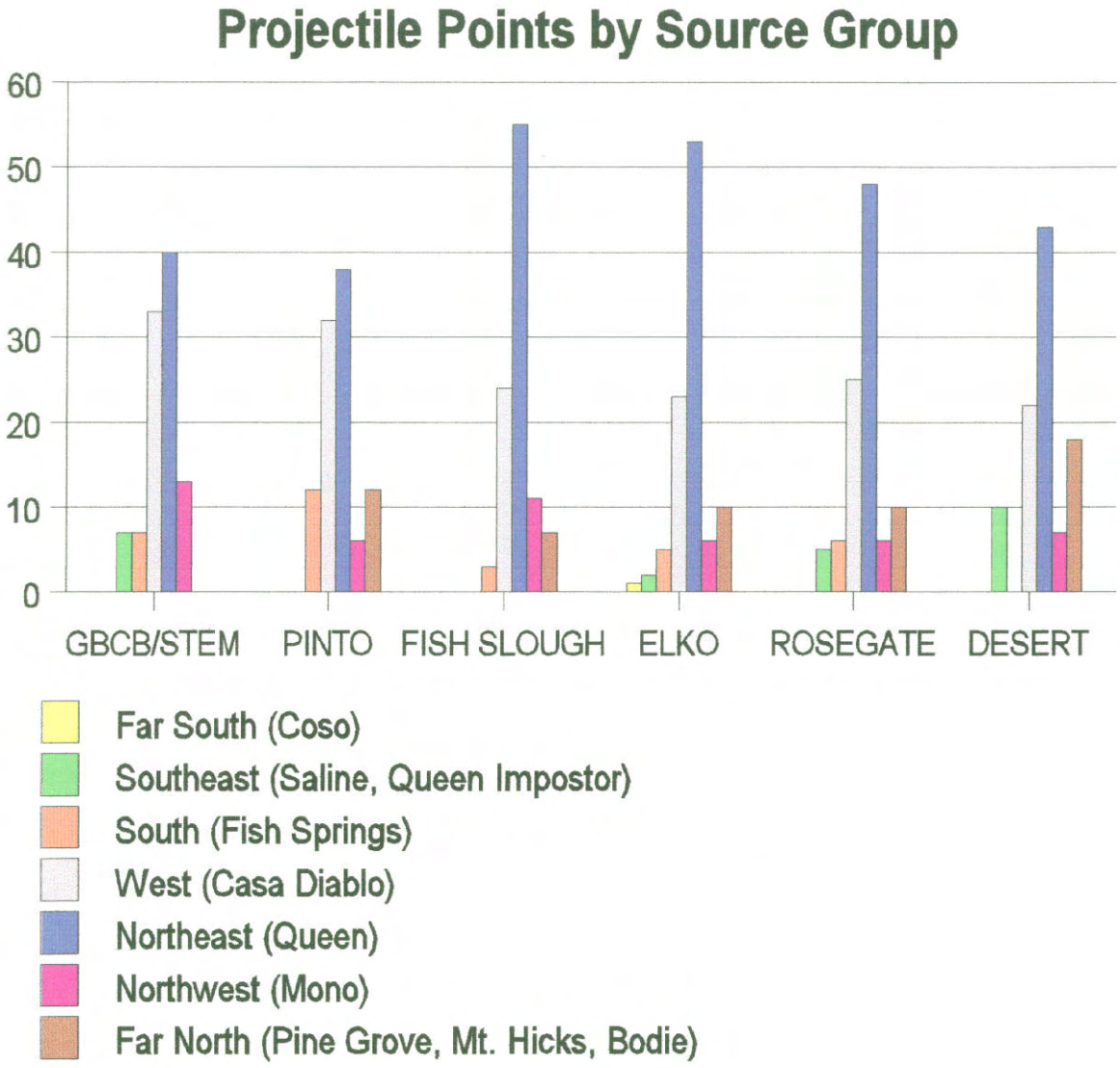

Figure 8.7. Relative proportions of diagnostic projectile points by obsidian source group.

TABLE 8.16. Proportions of hydration rim readings for sourced debitage in obsidian source groups.

	Micron Groups					
	≥10.0	9.9-7.0	6.9-5.0	4.9-3.0	<3.0	n (=1.0)
Far North	.33	.17	.17	.08	.25	12
Northwest	.30	.12	.17	.13	.28	90
Northeast	.15	.23	.22	.23	.18	271
West	.28	.13	.21	.18	.20	98
South	.04	.58	.04	.17	.17	23
Southeast	-	-	.17	.66	.17	6
Far South	-	1.0	-	-	-	2

(Marana). Totals in these classes are then converted to relative percentages (indexed to 1.0) and compared against obsidian source groups. No doubt some temporal overlap exists between micron groups - there are Fish Slough Side-notched points with hydration rims thicker than ten microns, just as there are Pinto points with rims smaller than ten microns and Desert Series points with rims thicker than three microns - but they serve well in showing long-term changes in source use. First, rim readings on Far North and Northwest obsidian sources show a sort of bimodal distribution, roughly a third of each present in the largest (≥10.0 micron) and smallest (<3.0 micron) classes. Northeast glass is the most evenly distributed over time, followed closely by West obsidian, while the remaining source groups are largely represented by the 9.9-7.0 micron class (South and Far South) or the 4.9-4.0 micron class (Southeast). The most prominent trend, considering sample sizes, is the even spread of Northeast glass over time. This indicates a strong affiliation between the Tableland and the Truman Meadows/Queen Canyon area over the last eight or nine thousand years. Presumably, these patterns are better indicators than those for projectile points, given that debitage was usually imported as unfinished masses, reduced on-site, and abandoned with less potential for reuse and scavenging.

Summary

All of the above sourcing data have demonstrated some general spatial and temporal patterns in obsidian use on the Volcanic Tableland. At their most basic level, obsidian profiles follow expectations based on source distance and direction. Faraway sources are present in small quantities and occur mainly as points and bifaces rather than unifacial tools, while obsidians that are closer to the Tableland occur in larger amounts and more evenly as both tools and debitage. The only real exceptions are Fish Springs and Saline Valley, the former being scarce and having the profile of a distant source and the latter being the direct opposite. The paucity and profile of Fish Springs glass may relate to the limited size of its source deposit and to a late-period decline in importation. Saline Valley obsidian probably has an exaggerated presence as debitage due to tool scavenging efforts at a couple of sites (MNO-2190, MNO-2465).

Most obsidians also manifest spatial distributions consistent with their location from and orientation to the study area. Setting aside Quad 3, which contains good quantities of all obsidians, all other Quads contain a large share of the nearest local obsidian (Casa Diablo, Mono, Truman-Queen), the prevalent source depending on its orientation relative to the Tableland. In contrast, Quad 3 has the largest relative portions of more distant obsidians, particularly those to the Far North (Pine Grove Hills, Bodie Hills, Mt. Hicks) and Far South (Coso), these being restricted primarily to sites along the Fish Slough drainage. The lone exception is Saline Valley glass, which is spread between the four Quads but is slightly more common in the north (Quads 1-2). Again, however, this may be attributable to its strong presence at MNO-2190 (Quad 1) and MNO-2465 (Quad 2); if these sites are ignored, a stronger southern affiliation emerges. Comparisons between Slough and Plateau source profiles also shows that each subject obsidian is represented in more or less the same proportions at both localities. In a way this demonstrates overall consistency in source use, but there is other evidence of source variation between site types and through time. In general, Fish Slough sites of all

major types have somewhat richer and more diverse source profiles than sites on the plateau. This is due to the bias of several distant glasses to Fish Slough (Pine Grove Hills, Bodie Hills, Coso) and to a relatively stronger presence of Truman-Queen obsidian across the plateau.

Finally, spatial distributions of projectile points imply that occupations in the south half of the Tableland may be generally more ancient than in the north, Quad 3 in particular containing the vast majority of pre-Elko points. Obsidian artifacts brought to and made at Quad 1-2 sites may have later temporal signatures than those in Quads 3-4. Support is found in source profiles for projectile points and in hydration readings for debitage. Older point types have greater source diversity, and a stronger presence of distant sources, while Fish Slough Side-notched and later types are dominated by Northeast (Truman-Queen) obsidian. Portions of North, Northwest, and West glasses rise in Newberry and post-Newberry micron groups, these sources also having firm affiliations to Quads 1-2.

OBSIDIAN HYDRATION

Given that the previous discussions have focused on the relative timing of obsidian source use on the Volcanic Tableland, the primary emphasis of this section is to outline a temporal profile for local patterns of flaked stone use. One of the major goals of the present research is to identify technological shifts that may have accompanied the replacement of the atlatl-and-dart with the bow-and-arrow in eastern California. To accomplish this, aspects of artifact analysis and obsidian hydration programs were designed to produce complementary data that could testify to long-term changes in flaked stone tool use and might reveal any specific temporal breaks pertaining to the late-period transition in hunting weaponry. As few site deposits or components were reliably dated as part of this study, an overall outline for technological change on the Tableland rests largely on trends recognized by Basgall and Giambastiani (1995). Current research supports all of the previous

conclusions, but provides a slightly different examination of technological shifts related to the introduction of the bow-and-arrow, through the combined use of artifact attribute and hydration data.

Indices of Technological Change on the Volcanic Tableland

Reporting on excavations at six sites, five on the Tableland proper (MNO-2189, MNO-2190, MNO-2464, MNO-2465, INY-399) and one at Fish Slough (MNO-1992), Basgall and Giambastiani (1995) identified an inclusive history of occupation spanning more than eight millennia, from about 8500 B.P. until the beginning of the protohistoric era (ca. 150 years ago). The earliest cultural component was identified at site MNO-1992, where a flaked stone assemblage pre-dating 6500 B.P. contained unique dart points (Fish Slough Side-notched) and formally shaped, heavily used unifaces. Evidence of Little Lake occupation (5000-3500 B.P.) was scant but present at several sites (MNO-1992, MNO-2189, MNO-2190, MNO-2464), while Newberry-age (3200-1400 B.P.) components were found at all six sites and were substantial at most (MNO-1992, MNO-2189, MNO-2190, MNO-2464). More recent components were also common but proved more difficult to tease out, due to patterns of site re-use and depositional mixing. Haiwee-period (1400-700 B.P.) material was identified at all sites, with a discrete component found at just one (MNO-2190) and mixed Newberry-Haiwee or Haiwee-Marana components present at all others, the last represented most strongly at MNO-2190 and MNO-2465. Domestic structures and their interior surface deposits at four sites (MNO-1992, MNO-2189, MNO-2190, MNO-2465) were attributed to Marana occupation (700-150 B.P.), with Marana-age middens being restricted to MNO-1992 and MNO-2190. The effects of scavenging behavior were most obvious at MNO-2465, where many older artifacts lay within otherwise recent deposits (Basgall and Giambastiani 1995:239), and evidence of tool reworking was seen at most sites, particularly MNO-2190 (Basgall and Giambastiani 1995:116).

From this rough chronology, the authors developed three composites of temporal components (Pre-Little Lake, Little Lake/Newberry, and Haiwee/Marana) for which technological profiles were prepared and examined. To summarize briefly, comparisons showed that projectile points and formed flake tools (often "keeled" in shape [see below]) were weighted heavily to the Pre-Little Lake group. Cores, bifaces (mainly early-stage forms), and large volumes of debitage (primarily bifacing wastes) were aligned with Little Lake/Newberry components, together indicating an increase in raw material importation and bifacial tool manufacturing. The average debitage:tool ratio also peaked in this group (77.1:1) as compared to Pre-Little Lake (36.0:1) or Haiwee/Marana groups (18.9:1), indicating a height of stoneworking intensity during Little Lake/Newberry times (Basgall and Giambastiani 1995:244). Finally, simple flake tools were common to all component groups but dominated Haiwee/Marana deposits. This pattern was interpreted as reflecting a shift from the use of percussion-thinned bifaces to small flake blanks in manufacturing projectile points, a transition that could be attributed to differences in requirements for dart-point and arrow-point preforms (see below).

In examining prehistoric technological change, the present research was designed to evaluate the events noted above and to build a stronger chronological framework around them. Admittedly, temporal assignments made for site components during the original Tablelands project were often provisional at best, given the scarcity of time-sensitive artifacts and limitations of project funds for obsidian hydration and radiocarbon analyses. The disturbed and ephemeral nature of many components also effectively negated the utility of re-visiting examined sites for the purpose of recovering additional, meaningful temporal data in the form of diagnostic artifacts or feature constituents. The only exception to this was MNO-1992, which contained an unexplored midden of presumably late-period age at Locus B that was excavated in 1993 (see Chapter Six). Nonetheless, from most sites only obsidian samples could be used to establish chronological estimates, via hydration analysis. Through this line of inquiry it would be possible to overlay the time frame of

artifact use atop the existing occupational template, in order to determine how different patterns of production and use correlated with the supposed timing of major technological changes.

As mentioned in Chapter Four, hydration analyses identified measurable rims on 1658 artifacts, including 361 diagnostic projectile points, 70 point blanks, 222 bifaces, 166 formed flake tools, 40 cores, and 799 unmodified flakes. Samples were chosen from each artifact category in slightly different ways, but specifically for the purpose of measuring technological change. Projectile points were selected to provide consistent samples of each good temporal type. Bifaces in all three major reduction groups (Early-, Middle- and Late-stage) were selected without preference to obtain a fixed total (about 75 pieces each). All point blanks, formed flake tools, and cores were examined, but simple flake tools were ignored assuming they would simply track debitage patterns. Unmodified flakes (debitage) were culled from discrete components at previously examined sites (see Basgall and Giambastiani 1995:43), from surface collections at Enfield and other survey sites, and from excavated matrix within apparently discrete deposits at Slough and Plateau locations. Because of these sampling differences some artifact types are less able to measure technological change across space through hydration analysis (projectile points, bifaces), but all are amenable to examining change over time.

Even without the benefit of source-specific hydration rates for all subject obsidians (see next section), temporal trends in artifact use can still be outlined using hydration rim measurements. In Table 8.17, micron readings are placed into the same broad micron groups used earlier in this chapter: $\geq$10.0 microns (Pinto and earlier); 9.9-7.0 microns (Fish Slough); 6.9-5.0 microns (Little Lake/Newberry); 4.9-3.0 microns (Haiwee); <3.0 microns (Marana). Totals are provided but are also converted to relative percentages and indexed to 1.0 (in parentheses). While accepting some temporal overlap within and between each group, there is no doubt that major patterns in hydration data represent long-term changes in flaked stone use. First, the sample of projectile points is divided into two classes, dart-points and arrow-points. Darts include a number of large point styles (Great Basin

TABLE 8.17. Totals and proportions of hydration rim readings for tool classes in micron groups.

	Projectile Points		Point Blanks	Bifaces	Formed Flake Tools	Cores	Total
	Dart	Arrow					
≥10.0 μm	31 (.14)	1 (<.01)	1 (.01)	13 (.06)	14 (.08)	1 (.02)	61
9.9-7.0 μm	62 (.27)	1 (<.01)	2 (.03)	32 (.14)	52 (.31)	7 (.18)	156
6.9-5.0 μm	100 (.44)	1 (<.01)	8 (.11)	69 (.31)	29 (.18)	8 (.20)	215
4.9-3.0 μm	32 (.14)	59 (.44)	34 (.49)	97 (.44)	54 (.33)	14 (.35)	290
<3.0 μm	2 (.01)	72 (.54)	25 (.36)	11 (.05)	17 (.10)	10 (.25)	137
n (=1.0)	227	134	70	222	166	40	859

Concave-Base, Stemmed points, Pinto, Fish Slough Side-notched, Leaf-shaped points, Large Side-notched, Humboldt Basal-notched, Little Lake, and all Elko Series forms as well as a handful of untypable "dart-size" pieces cut during previous analyses [Basgall and Giambastiani 1995]). Arrow points include all Rosegate and Desert Series forms, as well as a few untypable "arrow-size" items. As expected, distributions in these classes are dramatically opposed. Dart-points are all but absent in the <3.0 micron group and scarce in the 3.0-4.9 micron group, 85% of all items having readings greater than that. Arrow points are restricted almost entirely to the two smallest groups, most occurring in the <3.0 micron set (54%) and only a few specimens (3) having measurements larger than 4.9 microns. These basic distributions indicate that the shift from dart points to arrow points happened during the 3.0-4.9 micron interval. Actually, that the cleanest break between dart- and arrow-points is pinpointed between 4.0-4.5 microns, with temporally undiagnostic forms (Humboldt Basal-notched and untypable dart fragments) accounting for five of seven dart-size items with hydration rims smaller than 4.0 microns. The relative ages of dart- and arrow-points, as implied by these data, are certainly nothing new to California archaeology. The hydration data, however, do provide provide a ballpark

estimate for the timing of the dart- to arrow-point transition on the Volcanic Tableland. Using the Truman-Queen hydration rate proposed by Basgall and Giambastiani (1995), the 4.0-4.5 micron spread equates to about 1400-1800 years B.P., the recent end of this span corresponding directly with the supposed timing of the Newberry/Haiwee (dart-arrow) transition (see Chapter Nine).

In addition, the distribution of point blanks clearly tracks that of arrow-size projectile points, some 84% of all point blanks having hydration rims measuring less than 5.0 microns and 96% coming in at less than 7.0 microns. This clearly implies that most point blanks were intended as arrow-points preforms, being initially shaped and/or partially reduced but never completed. Their small size (averaging <30 mm in length and <4 mm in thickness) and roughly triangular shapes are also consistent with arrow points, though some larger blanks were probably intended as dart points. It is also noteworthy that nearly all point blanks in project collections (including a few chert ones) were manufactured from small percussion flakes, a fact in line with the premise that small flake blanks figured prominently in the manufacturing of arrow-points but not dart-points. Bettinger (1989a:71-72) has described some of the difficulties in attempting to identify point blanks from used flakes, many of which were considered during initial classifications of subject artifacts (see Chapter Four). The distribution of point blank hydration readings clearly supports the approach used herein to distinguish these artifacts from damaged flakes or simple flake tools.

Moving on to other tool classes, bifaces and formed flake tools have somewhat curious hydration distributions. For bifaces, this is due partly to functional variation; as shown later, some bifaces probably served as cores or tool preforms and others simply constitute fragments of finished projectile points. Nonetheless, bifaces generally trend away from the smallest micron group (95% ≥3.0 μm) and more than half (51%) have hydration rims of 5.0 microns or more. It would seem that Newberry and earlier intervals have priority on bifaces, but a large portion of readings (44%) do fall between 4.9-3.0 microns (Haiwee period), signaling pretty substantial biface use during that time.

TABLE 8.18. Technological data for select tool classes by hydration rim groups.

	BIFACES			FORMED FLAKE TOOLS			CORES		
	Early	Middle	Late	Amorphous	Keeled	Other	Bifacial	Bipolar	Other
≥10.0μm	3	9	1	12	1	1	-	1	-
9.9-7.0μm	14	10	8	40	10	2	3	2	1
6.9-5.0 μm	24	20	25	26	3	-	4	2	-
4.9-3.0 μm	26	30	41	51	1	2	5	5	1
<3.0 μm	3	8	-	16	-	1	3	5	1
Total	70	77	75	145	15	6	15	15	3

However, differences in rim readings between biface reduction stages emphasize observed temporal shifts in biface use, and also have further implications for technological change (Table 8.18). For bifaces of all reduction stages, most hydration measurements are within the 6.9-5.0 and 4.9-3.0 micron groups (Early-stage bifaces, 71%; Middle-stage, 65%; Late-stage, 88%), which together correspond largely to the Newberry interval. Looking at the 4.9-3.0 micron group though, measurements for more than half of all Early- and Middle-stage bifaces fall near the larger end of the range (59% and 51%) while Late-stage bifaces (45%) are weighted more heavily in the opposite direction. In fact, while no Late-stage bifaces have measurements under 3.0 microns, 55% of them places in the 3.0-4.9 micron group. It is also the case that most (73%) of the bifaces in the <3.0 micron category are Middle-stage forms. Taking all this together, if dart-point technology is represented by hydration rims larger than 4.9 microns, and assuming that Early-stage bifaces were regularly discarded in the course of bifacial tool production, the fact that rim measurements for Early-stage bifaces are weighted to larger micron groups implies an importance of biface manufacture in dart-point production. The persistence of some Early-stage bifaces in smaller micron groups implies that bifaces were still in use during the tenure of bow-and-arrow technology. Basgall and Giambastiani (1995:244-245) observed this same trend

and suggested it was due to the use of bifaces as cores in late-period flake production and as crude processing tools. For lack of contrary evidence the same conclusion must be reached, but it is possible that many of the Early-stage bifaces with small hydration rims represent pieces scavenged from older lithic deposits and reworked to meet immediate demands for toolstone.

Along these same lines, 73% of all bifaces with hydration rims smaller than 5.0 microns are either Middle- or Late-stage forms. Again, the late presence of these items could testify to some limited production or use as processing implements, but the fact that most (58%) are essentially finished items implies a separate, late-period pattern resulting from arrow-point manufacture. This makes more sense if we recall that most Late-stage bifaces are probably fragments of projectile points. Biface size data then appear complementary, given that 28 of 41 (68%) Late-stage forms in the 4.9-3.0 micron group are of arrow-point size while Late-stage bifaces in larger micron groups are predominantly dart-size (at least 63% in each group above 4.9 microns). Thus, it would appear that most Late-stage bifaces with arrow-point hydration rims are indeed fragments of arrow points, while others with a similar degree of reduction but with larger hydration rims are probably pieces of dart points. However, it is also evident that *no* late-stage bifaces are found in the <3.0 micron group. This insinuates that the link between arrow-points and late-stage bifaces may involve only Rosegate points, a premise consistent with evidence from all over eastern California showing that Desert Series point forms (both Desert Side-notched and Cottonwood) were fashioned strictly from small flake blanks and that many were not even fully pressure-flaked across the body. This may reveal an important distinction between Rosegate and Desert Series point forms, many of the former being manufactured from small bifacial preforms and the latter made primarily from small flake blanks.

The distribution of rim measurements for formed flake tools is fairly widespread. While no micron group carries less than 8% of all data, there are small peaks in the 4.9-3.0 micron group (33%) and the 9.9-7.0 micron group (31%) with a significant depression in between (only 18% at 6.9-5.0

microns). Rather than indicating major shifts though time in the importance of formed flake tools, however, the data are reflecting the presence of distinct tool types that have decidedly different temporal signatures. For instance, Table 8.18 divides formed flake tools into three categories: "amorphous", "keeled", and "other". Amorphous forms are those that have had significant, intentional margin alterations but are inconsistent in cross-section and outline from one piece to the next; beyond shaped edges, other morphological attributes of amorphous tools reflect the shape of the original flake blank used in manufacture. In contrast, "keeled" formed flake tools are more intensively and consistently shaped, having a plano-convex cross-section, a broad base, pronounced shoulders, and a narrow blade. This tool form was probably hafted and curated for extended periods, being resharpened while in the haft several times during its lifespan. This scenario accounts for the narrowed blade and prominent shoulders on keeled tools, the latter element representing the contact zone between the used (exposed, reworkable) and unused (hafted, non-reworkable) sections of the tool. Many keeled specimens also show evidence of basal thinning, this probably done to make them more suitable for hafting. As for the "other" category, this group includes various "domed" tools, "endscrapers", and "spokeshaves", all of which are more extensively shaped than amorphous types and have multiple, well-shaped convex (domed and endscraper) or concave edges (spokeshave). These tools were probably curated as well, having attained formalized state through a combination of intentional shaping and recurrent maintenance retouch.

Returning to the data, rim readings for amorphous tools show a bimodal distribution similar to the one for all formed flake tools. They are best represented in the 4.9-3.0 micron group (35%) and in the 9.9-7.0 micron group (28%), but have strong presence in other groups as well. This implies that the amorphous type represents a "general purpose" tool in use throughout the history of Tableland occupation. However, in the full sample of formed flake tools there are ten artifacts with smaller, secondary hydration rims, all of them being amorphous types. With one exception, all secondary rims

on these pieces are smaller than 4.9 microns, and most (44%) are smaller than 3.0 microns. Seven of these tools have primary rims larger than 4.9 microns; if the secondary rims on these tools are used instead in reconfiguring the distribution of micron values, the proportion of amorphous tools with hydration rims under 5.0 microns jumps to over 50%. This hints at a rise in the importance of amorphous formed flake tools during Haiwee and Marana periods. Accordingly, it should be noted that three of the tools with secondary rims come from site MNO-2465, already singled out for having strong evidence of scavenging behavior (Basgall and Giambastiani 1995).

Hydration data for keeled formed flake tools, on the other hand, have a totally different distribution. They consist mainly of larger readings, all but one being greater than 4.9 microns and most (73%) measuring 7.0 microns or more. This evidence is compelling but not surprising. The antiquity of this tool type has already been recognized on the Tableland based on its association with Fish Slough Side-notched points at MNO-1992, a site located on the edge of the slough (Basgall and Giambastiani 1995; Giambastiani et al. 2000). A few keeled unifaces were also discovered at site MNO-894, northeast of the Tableland near Benton, all of which had large hydration rims that averaged 7.2 microns (Giambastiani 1998b). Delacorte (personal communication, 2000) also found several dozen keeled unifaces in association with Fish Slough Side-notched points in Deep Springs Valley, again at sites located in a wetland context. For the record, it should be noted that more than half of all keeled items (8 of 15) derives exclusively from site MNO-1992. Taken alone, this fact implies that keeled tools might represent a discrete occupational event at one site rather than a unique tool type with a strict temporal range. Nonetheless, the eleven hydration means of 7.0 microns or more in the project sample are spread between six different sites, two of them at Fish Slough (MNO-1992, FS14C-2) and four on the plateau (ENF5A-12, 5D-3, 5U-8A, and 5Y-7). Given other data from around the region, it seems likely that the keeled formed flake tool is a distinctive, ancient artifact type.

Data for cores parallels that of arrow-size points and point blanks, 60% of all hydration readings placing in the two smallest micron groups. This implies at least some functional association between cores and arrow-points, though a good portion of cores also aligns with the 6.9-5.0 and 9.9-7.0 micron groups. Despite the limited sample of cores, it is possible to sort out their temporal profile by segregating them into reduction type classes. As shown in Table 8.18, cores include mostly bifacial or bipolar forms, a few "other" types being unidirectional (two) or bidirectional in orientation; seven items which could not be identified to type are omitted from the table. Bifacial cores are more or less evenly distributed in all micron groups except the largest one, while bipolar and "other" cores favor the smaller micron groups (<4.9 microns) by a factor of 2:1. The profile for bifacial cores is commensurate with that seen for Early-stage bifaces, while the profile for bipolar cores agrees with Late-stage bifaces. While sample size limitations demand caution in speculating about this pattern, such a difference could indicate a stronger affiliation of bifacial cores to dart-point technology and a penchant of bipolar and non-bifacial cores for arrow-point technology. The idea that dart-point manufacture proceeded from the reduction of bifacial cores and preforms is certainly not a novel one (Callahan 1979; Collins 1975; Crabtree 1972; Flenniken and Wilke 1989; Holmes 1890; Muto 1971). It has also been held that the production of arrow-points does not require a percussion-shaped bifacial preform and could have been easily accomplished by pressure-shaping a small flake (Crabtree 1972; Plog 1974:138; Yohe 1992). Dart-point producers may have been primarily limited to using bifacial cores to make point preforms, but arrow-makers could have detached acceptable flake blanks from a variety of core types, including bipolar ones. In fact, though whole obsidian bipolar cores in the project assemblage (n=10) are quite limited in mass, and are also very small in size, many of them could have generated flake blanks large enough to make small arrow-points. It is likely too that bipolar cores were used to produce flakes for other tools, but it seems certain they were not used in dart-point manufacture.

Moving finally to debitage, recall that flakes were selected for hydration analysis in three ways. First, a sample of 136 flakes was examined by Basgall and Giambastiani (1995), these culled from buried horizons in discrete components at MNO-1992, MNO-2189, MNO-2190, MNO-2464, MNO-2465, and INY-399. Specimens were chosen primarily by size, resulting in the examination of several different flake types (six cortical, 20 interior, 68 biface thinning, 37 indeterminate percussion, and five pressure flakes). For the present study, another 512 percussion flakes were chosen from Enfield and Slough/Plateau survey sites that had yielded surface collections of adequate size for sampling. Where present, four cortical and four biface thinning flakes were selected from each site, with a few interior percussion flakes chosen to round out site samples on occasions when numbers of other flake types were insufficient. Another 173 pressure flakes were subjected to hydration analysis as well, these taken from buried horizons in discrete loci at excavated Slough and Plateau sites (between 1993-1997). Interior percussion flakes were basically ignored during the current hydration program because they are not truly diagnostic of any reduction stage (shaping, thinning, or finishing) or any core reduction technique (bifacial or other). Indeed, of 27 specimens examined only seven were selected for use in this analysis, serving only to round out site hydration samples in a few cases.

Due to these varied recovery tactics, percussion flakes culled for examination derive largely from surface contexts, while pressure debris hails exclusively from buried deposits. This really makes no difference, however, because debitage pulled for hydration was expected to reveal basic temporal differences in lithic reduction strategies, not to identify site-specific reduction patterns. Thus, having removed items with diffuse or otherwise unreadable hydration rims, as well as those specimens of indeterminate reduction technology, we can separate flake hydration data from major reduction groups (Decortication, Biface Thinning, Pressure) into standard micron classes (Table 8.19). The resulting distributions are remarkably consistent between flake type categories. Overall, these data imply a

TABLE 8.19. Debitage by reduction group and micron class.

	Decortication	Biface Thinning	Pressure	Total
<3.0 μm	26 (15%)	28 (7%)	5 (3%)	59
3.0-4.9 μm	46 (26%)	108 (28%)	47 (26%)	201
5.0-6.9 μm	38 (22%)	91 (24%)	40 (23%)	169
7.0-9.9 μm	39 (22%)	111 (29%)	55 (31%)	205
>9.9 μm	27 (15%)	45 (12%)	31 (17%)	103
Total	176 (100%)	383 (100%)	178 (100%)	737

regularity in lithic reduction throughout the hydration sequence, particularly in those micron groups encompassing the Newberry interval (6.9-3.0 microns). Perhaps more importantly, proportions of each flake type drop sharply in the <3.0 micron group. Biface thinning and pressure flakes show the most dramatic losses, each falling by over 20% from the 4.9-3.0 micron group. The drop in rim readings for biface thinning flakes parallels a decrease in bifaces in the <3.0 micron group (see Table 8.15), implying relatively less biface use in recent times. It is strange that this change does not occur earlier in the sequence, if arrow-point technologies really account for as much as 4.5 microns of hydration. Unless bifaces were still a critical component in Haiwee period arrow-point technology, which seems unlikely, their continued presence in the 4.9-3.0 micron class probably testifies to the use of bifaces as tools, or, as Bettinger (1978) would suggest, in the production of Humboldt Basal-notched points or bifaces.

At first glance, the near-absence of pressure flakes in the <3.0 micron group seems contradictory to the timing and mechanics of arrow-point manufacturing, in which pressure reduction is paramount. It is possible that sampled sites simply failed to contain recent pressure flakes (due to sampling or functional reasons), but it is also known that specimens used for hydration analysis are

relatively large as far as pressure flakes go (averaging about 3 mm wide and 5-7 mm long). Indeed, judging by the dimensions of pressure scars on bifaces, dart points, and arrow points in project collections, it is likely that most or all of the pressure flakes taken for hydration derive from larger bifaces and dart points. However, it is probably also true that the exceedingly small pressure flakes normally detached from arrow-points (widths of about 1-2 mm and lengths of 3-5 mm) regularly escape collection when 1/8" (3-mm) mesh screen is used for control sampling. For these reasons, the paucity of pressure flakes in the <3.0 micron group probably relates partly to a decline in finishing work on bifaces, and partly to the failure of excavation sampling in recovering microdebitage.

Summary

Results of the obsidian hydration program support many of the temporal shifts in flaked stone technology recognized by Basgall and Giambastiani (1995). Large dart points and highly formalized unifacial tools are important parts of pre-Newberry assemblages (especially at Fish Slough), and in these situations they are accompanied by light quantities of other tools and reduction debris. Newberry-age assemblages consist largely of bifaces and related thinning flakes, with a few bifacial cores included as well. Haiwee and Marana assemblages still contain bifaces, but Marana debitage is seldom associated with bifaces, which is suggestive of a drop in biface production; non-bifacial cores (especially bipolar forms) also become important among Marana debris. Also, after the Newberry period the use of smaller core forms and an increase in tool scavenging could reflect a decline in toolstone importation and bifacial tool manufacture. Taken in concert, the main thrust of these data points to an apparent shift in biface use and core technology on the Volcanic Tableland that is concurrent with the timing of the dart- to arrow-point transition. It is assumed that, with the introduction of the bow-and-arrow, stoneworkers were able to produce blanks for projectile points in a greater number of ways, as the size of required preforms shrank considerably. Bifacial cores could

still function in this regard by providing large biface thinning flakes, but other core forms and large tool fragments may have also become potential sources of flakes (cf. Goldberg et al. 1986). Smaller raw material packages could also be accessed, increasing the value of smaller cobbles found at source locations or in secondary geologic deposits. A shift from bifacial to bipolar and alternate core forms is consistent with this premise, as is a late-period (Marana) increase in scavenging behavior demonstrated by hydration profiles.

It is important to recall that concerns for toolstone conservation and replenishment were probably paramount on the Tableland, given the absence of any primary obsidian deposits for at least 35 km in any direction. In fact, the study area may be the most isolated location in eastern California, in terms of proximity to regional obsidian sources. There is a distribution of obsidian float in the southeast quarter of the Tableland, but the concentration of useable nodules is neither substantial nor widespread. While the distances to Casa Diablo or Truman-Queen were not prohibitive to procuring obsidian directly, it is evident that more lengthy occupations on the Tableland involved some toolstone conservation, as reflected by the extensive reduction of core masses, by frequent attempts to reuse and rejuvenate tools, and by the use of local, poor-quality lithics (non-obsidian) as flaked implements. Late-period assemblages demonstrate these characteristics best, and it is no coincidence that they tend to occupy the same places as Newberry-age deposits, which usually contain large amounts of lithic debris suitable for reuse (e.g., MNO-1992, MNO-2189, MNO-2190, FS10B-2, FS14C-1, FS14D-1).

Chapter Nine

EVALUATION OF RESEARCH RESULTS

Having now laid out all the significant trends in obsidian source and technological data, it is time to explore broader implications of research results. To do so it will be necessary to consider several critical outcomes of hydration studies that form the chronological basis for reconstructions of obsidian use and settlement strategies. The focus of this discussion will center on evaluation of obsidian hydration rates in the study area, and of variability in rate parameters for different temperature regimes across eastern California. The performance of existing hydration rates are assessed and the relative rates for other obsidians hypothesized, using the current Truman-Queen rate developed on the Tableland as a baseline. Assumptions about the validity of projectile points as time markers in the Great Basin are also explored and tested with hydration data.

Following this, changes in flaked stone technology on the Volcanic Tableland are compared with evidence from other parts of the western Great Basin. Patterns observed in this study speak directly to shifts in lithic use that accompanied the introduction of the bow-and-arrow in eastern California. Implications for the timing of the bow-and-arrow's emergence, and those pertaining to the effects this tool had on lithic procurement and technological organization, are addressed using a combination of obsidian hydration and artifact attribute data. These discussions are critical to understanding how regional settlement systems may have included the Volcanic Tableland.

OBSIDIAN HYDRATION RATES ON THE VOLCANIC TABLELAND

Given the large number of obsidian sources found in project artifact collections, discussions in preceding chapters have taken a coarse-grained approach in using hydration data to measure shifts

in obsidian procurement and changes in lithic technology. Dividing hydration rim readings into broad micron groups has been necessary to augment sample sizes in many cases, but as a result the timing of certain technological shifts has only been approximated. It remains to evaluate observed changes more closely, if possible, using known hydration rates for major obsidians found on the Volcanic Tableland. Unfortunately, there are few eastern California/western Nevada obsidians that have been studied carefully enough to develop testable and capable hydration rates. Only the rate for Coso obsidian is backed directly by radiocarbon assays (Basgall and McGuire 1988; Basgall 1990a), while others have been developed for Casa Diablo, Fish Springs, and Truman-Queen obsidians based on diagnostic projectile point sequences. Of existing hydration rates, only the Casa Diablo (Hall and Jackson 1989) and Coso (Basgall 1990a) formulas have been tested repeatedly and demonstrated to work reasonably well throughout the Inyo-Mono region when effective hydration temperature (EHT) corrections are applied. Authors of rates for Fish Springs glass (Bettinger 1989b; Delacorte and McGuire 1993; Basgall 2000) have not been wholly satisfied with age estimates produced for older point types. As for Truman-Queen obsidian, previous efforts to determine a suitable hydration rate for the Truman Meadows/Montgomery Pass area have been unsuccessful (Ramos 2000; Weaver 1992). The current working rate for Truman glass (Basgall and Giambastiani 1995), developed on the Volcanic Tableland, has only been evaluated archaeologically with any rigor within its own geographic/climatic context (cf. Giambastiani 1995, 1996, 1998b; but see Halford 1997). However, Ramos' (2000) work at the Truman-Queen source suggests that the rate does not perform well at the quarry locality. This is likely due to the elevational/temperature difference between the primary source area (~1900-2000 m amsl) and the Tableland (~1600 m on average), but probably also to the presence of reused projectile points in Ramos' hydration sample.

To more thoroughly assess the timing of observed changes in source use and flaked stone technology, the first task is a re-examination of existing hydration rates as they apply to the study

area. Much of the emphasis will be on Truman-Queen obsidian, this glass being most prominent on the Volcanic Tableland and, as it happens, the least studied. The applicability of hydration rates for Casa Diablo and Fish Springs are also evaluated, both on their own merits and by comparison with the Truman-Queen rate. A few other obsidians that are well-represented among projectile point samples but for which hydration rates have not yet been configured, such as Mono Glass Mountain and Mt. Hicks, can also be scrutinized in comparison to existing hydration rates for Truman-Queen and Casa Diablo glasses. This will at least provide insight to the relative hydration speed of obsidians that are less common but still present at archaeological sites in the Inyo-Mono region.

Truman-Queen Hydration

The first attempt to generate a workable hydration rate for Truman-Queen obsidian was made by Richard Weaver (1992), who employed a set of 103 diagnostic projectile points of Truman-Queen obsidian. Some of these specimens had been obtained from Enfield collections and from collections by Ruth Simpson, both made at the Truman Meadows locality (the north flank of the Truman-Queen source area), while others were acquired from collections made by Dr. Matthew Hall in the vicinity of Montgomery Pass (a few miles east of the primary Queen outcrops). All items were surface finds, the lot assembled from more than two dozen archaeological sites within the study area. Because the subject sites all lay within 1000 feet of elevational gradient, Weaver took this as reason to consider EHT essentially constant across the study area.

The hydration data set ultimately used to generate rate equations for Truman-Queen obsidian totaled 96 specimens, including 24 Little Lake Series, 31 Elko Series, 25 Rosegate Series, and 16 Desert Series points. Micron values were assigned to temporal intervals following Thomas' (1981) point chronology (Weaver 1992:Table 4). Unfortunately, micron breakdowns showed extreme overlap between temporal periods and exceedingly large ranges and standard deviations for Elko and

Little Lake variants (Table 9.1). After calculating 16 different hydration rates, four each based on linear, exponential, logarithmic, and power equations, Weaver's best-fit analysis showed that a power rate of $y = 34.42\ x^{3.22}$ performed best. Its success rate, however, was not very high, placing at best only 68.7% of Desert series points within their associated time frame and at worst just 19.3% of all Elko series specimens into their expected age bracket. Weaver also noted that many Little Lake specimens with rims over 4.6 microns correlated with age estimates in excess of 12,000 B.P. and as much as 40,000 B.P., clearly indicating that the slope of the fitted hydration curve was too steep (Weaver 1992:75). Hypothesizing that the analysis might have been compromised by problems relating to the supposed timing of Little Lake points (cf. Flenniken and Wilke 1989), Weaver re-ran the data without Little Lake specimens. The best-fit logarithmic rate from this test, $y = {}^{-}1571.44 + 2864.45\ _{log}\ x$, again performed acceptably through the Rosegate series but provided age estimates that were too young for rim readings of 5.0 microns or more. The author's own caution was to reject both of these rate formulae (Weaver 1992:80).

In suggesting a number of reasons for the failure of this effort, such as broad temporal overlap in projectile point styles, the effects on hydration from long-term artifact storage, and the inadequacy of semi-quantitative XRF analysis, Weaver also raised the possibility that Truman-Queen obsidian simply hydrates at varying speeds due to changes in the hydration process through time or to the effects of geochemical variability. This last issue is most troubling, as it implies that Truman-Queen does not hydrate at any regular, measurable rate like other obsidians in eastern California. While some evidence is now emerging to indicate slight variations in hydration rate due to geochemical variability (T. Origer, personal communication regarding Bodie Hills obsidian), such variance is probably not great enough to account for the divergences seen in the Weaver study. If it is instead assumed that Truman-Queen obsidian *does* hydrate in a consistent manner, there must be another explanation for the problems encountered in this initial rate research.

Table 9.1. Micron ranges for Truman-Queen assigned to temporal periods by Weaver (1992).

Temporal Period	Micron Range	Mean	Standard Deviation	Median
Marana (150-650 B.P.)	1.5-3.1	2.19	0.45	2.30
Haiwee (650-1250 B.P.)	1.8-3.8	2.39	0.45	2.50
Newberry (1250-3250 B.P.)	2.6-7.4	4.19	1.56	3.80
Little Lake (3250-4950 B.P.)	2.7-9.0	4.90	1.88	4.35

In reviewing Weaver's study, it is my impression that significant errors may have been committed in the process of projectile point classification. In an effort to anticipate this very problem, Weaver went to extreme lengths to classify subject projectile points by Thomas' (1981) metric criteria for Monitor Valley. In the end, he concluded that the Monitor Valley typology did not fare well in regard to Desert or Rosegate series points but that it conformed better to Elko and Little Lake forms in the study sample. Nonetheless, Weaver did not strictly use Thomas' criteria, indicating that classifications were "...qualitatively based assignments predicated on experience" (Weaver 1992:23). While I agree with the approach taken in Weaver's research, an examination of his final typology suggests there may be a number of misclassified points in the Elko and Little Lake categories that have skewed the micron ranges for these types. For example, a review of the photographic plates for Elko and Little Lake points (Figures 8-14) shows five Elko Corner-notched specimens that better resemble Rose Spring points based on assessments of their overall morphology (Artifact #'s 50, 51, 65, 66, and 70). Together, the basal configurations (short stems with gracile, angular bases) and narrow widths of these points seem to distinguish them from other Elko Corner-notched forms. Not surprisingly, four of five items returned hydration readings commensurate with post-Elko times according to the Basgall and Giambastiani (1995) rate (2.9-3.8 microns), the

exception (# 51) having a 5.1 micron rim falling within the Elko time period. There are also many Elko Corner-notched points that look to be correctly classified yet have hydration rims of 3.8 microns or lower (Artifact #'s 49, 52, 53, 61, 62, 63, and 68). These and the previous five artifacts together account for more than half (12 of 22, or 55%) of all Elko Corner-notched and nearly one-third (32%) of all 31 Elko series points used in rate construction.

Unfortunately, it is difficult to quantify any morphological differences between Elko Corner-notched points with Elko and post-Elko hydration using metric criteria provided in the document. Neither basal width, stem length, neck width, maximum thickness, or proximal shoulder angle alone is sufficient to separate these items from other Elko Corner-notched specimens. Stem length-to-basal width ratios do not work either. What is interesting, however, is that nearly all Elko Corner-notched points used in the study are quite short and stunted in appearance, having exceedingly large widths relative to their (inferred) lengths. Most specimens were too fragmented to provide maximum length estimates but three measurements that were obtained range between 36.5-40.9 mm, and there are several other items missing only tips that were surely not ever much longer. Considering that Elko Corner-notched points typically attain lengths in excess of 50 mm (Flenniken and Raymond 1986) and often greater than 60 mm (cf. Basgall and McGuire 1988), it seems that Weaver's point collection contains a number of whole but *reworked* specimens, pieces that were shortened during reshaping or resharpening (Flenniken and Wilke 1989; Thomas 1981). Indeed, Goldberg et al. (1986) have shown that reworked Elko points typically achieve maximum lengths of <45.0 mm and are often much shorter; the same situation occurs in collections from the Volcanic Tableland (Basgall and Giambastiani 1995) where a variety of reworked Elko points includes a lot of shortened items. If the above premise is true, it may be that post-Elko hydration values on Elko Corner-notched points in the Weaver collection relate to later episodes of artifact reworking.

An altogether different classificatory problem may affect Little Lake points. Careful scrutiny of Weaver's Figures 11-14 shows several Elko Eared and Little Lake points that obviously

resemble "Pinto" variants, having proximal ends that are more robust in appearance and shoulders that are less pronounced (wider notch openings) than on other Little Lake points (Artifact #'s 80, 81, 91, 103). Two of these, one Elko Eared (# 80) and one Little Lake (# 103), had quite large rims of 7.3 and 8.3 microns thickness (respectively), and there are other Little Lake items which also manifest very thick hydration bands (Artifact # 90, 7.4 μm; # 102, 7.5 μm; #104, 9.0 μm). Apparent morphological differences are again difficult to quantify, especially given so few examples, but there is little doubt that the sample of Little Lake specimens exemplifies the range of variability in bifurcate-stemmed projectile points as discussed by Basgall and Hall (2000) and Delacorte et al. (1995). The more gracile items in the Weaver collection better fit the Gatecliff Split-stem model (Thomas 1981), whereas robust forms are more properly classified as Pinto points, particularly if using Basgall and Hall's threshold of >80° for notch-opening angle measurements on Pinto forms. For historical reasons (cf. Bettinger and Taylor 1974; Green 1975; Harrington 1957) there is still some crossover in the use of "Little Lake" and "Pinto" in reference to bifurcate-stemmed projectile points in eastern California (cf. Gilreath and Hildebrandt 1995). There seems little reason to continue lumping the two types together, at least due to supposed similarities in morphology (see Basgall and Hall 2000).

Also, as seen in the present study and in others around eastern California (cf. Basgall and Giambastiani 1995; Basgall and Hall 2000; Delacorte et al. 1995; Hall 1990), there is a growing consensus that the timing of Gatecliff (gracile Little Lake) points is considerably later than that of Pinto points, and that the former have a northern affiliation and the latter a southern one. Regarding the Weaver study, this is a more critical concern than the misclassification of certain point styles, as both Pinto and Gatecliff (Little Lake) forms exist in the sample of "Little Lake" specimens used to develop temporal points for the Truman-Queen hydration rate. For example, the current study yielded hydration means for Gatecliff (Little Lake) and Pinto points of Truman-Queen obsidian of 5.6 and 10.8 microns, respectively (see below). Similarly, Hall (1990) recovered a pair of Little

Lake forms made of Truman glass from MNO-2206 in Adobe Valley that measured 5.9 and 5.6 microns each (mean = 5.75, std = 0.21). Re-considering Weaver's hydration data for Gatecliff (Little Lake) points in this light (n=24, mean = 4.90 microns, std = 1.88), most readings (n=19) would appear to conform to the lower means observed in other studies. The five readings mentioned earlier, though, for points that should be classified as Pinto (range = 7.3-9.0 μm; mean = 7.9 μm, std = 0.73), align closer to the range for Pinto points seen in the present study (shown below). What this all means is that the mixture of Pinto and Gatecliff points resulted in adding rim values that lowered the young end of the hydration range for the "Little Lake" period; this created too much overlap between the micron ranges for Little Lake and Newberry periods.

Whatever the reasons for the problems encountered in Weaver's rate construction, hydration data from the Tableland confirm the premise that Truman-Queen obsidian hydrates at a regular, measurable rate. Most telling in this regard are hydration data for the various projectile point types examined. Table 9.2 presents hydration data for 316 projectile points, including 159 items of Truman-Queen obsidian. The original sample of Truman-Queen points was 169, but anomalous readings on 10 artifacts points were rejected and are not included in the following calculations. Five were excluded because they appeared to represent anomalous hydration bands or more recent attempts at projectile point reuse (11.9 and 11.5 micron rims on Humboldt Basal-notched and Gatecliff/Little Lake points, a 7.8 micron reading on an Elko Corner-notched point, a 1.9 micron reading on a Rose Spring point, and a 3.5 micron rim on a Desert Side-notched point). These eliminated, means and standard deviations were calculated and another five readings were discounted using Chauvenet's criterion (Long and Rippeteau 1974), being well outside the range of normal distributions for point type means (a 3.8 micron value for Gatecliff, a 3.1 value for Humboldt Basal-notched, a 2.7 micron rim for Elko Eared, a 1.6 value for Rose Spring, and a 5.0 micron rim for Desert Side-notched). Losing these as well, means and standard deviations were again recalculated to their present configuration (Table 9.2).

Table 9.2. Hydration data for select projectile point types by obsidian source.

	BH	CD	FS	MO	MH	QI	SV	TQ	IN
Cottonwood									
n	-	8	-	1	5	-	4	11	2
Range	-	1.0-3.1	-	-	1.2-2.3	-	1.6-2.3	1.1-2.7	1.7-3.6
Mean	-	2.0	-	1.5	1.7	-	2.1	1.9	2.7
Desert S-N									
n	-	3	-	4	7	-	1	13	1
Range	-	1.8-3.0	-	2.0-3.4	1.3-3.0	-	-	1.3-2.7	-
Mean	-	2.2	-	2.8	2.2	-	1.6	2.0	1.8
Rose Spring									
n	1	10*	5	2	2	-	-	26	-
Range	-	2.5-4.8	2.7-4.4	0	3.2-3.3	-	-	2.4-4.4	-
Mean	3.4	3.6	3.3	3.4	3.3	-	-	3.5	-
Eastgate									
n	1	6	1	1	2	-	-	5	-
Range	-	3.0-3.9	-	-	2.8-4.1	-	-	2.4-4.0	-
Mean	3.4	3.6	3.0	4.1	3.5	-	-	3.5	-
Humb B-N									
n	-	4	-	1	-	-	1	9	-
Range	-	3.7-6.2	-	-	-	-	-	4.3-6.1	-
Mean	-	5.0	-	6.4	-	-	5.4	5.0	-
Elko Eared									
n	-	10	1	2	7	-	3	38	2
Range	-	4.2-7.1	-	6.0-6.5	5.3-7.1	-	4.7-5.4	4.1-6.5	4.3-5.3
Mean	-	5.4	4.9	6.3	6.0	-	5.0	5.4	4.6
Elko C-N									
n	1	3*	4	1	1	-	-	11	-
Range	-	5.8-7.2	6.4-7.0	-	-	-	-	4.7-7.1	-
Mean	5.5	6.6	6.8	5.6	5.8	-	-	6.0	-
Elko C-S									
n	-	4	1	-	-	-	-	8	-
Range	-	4.8-6.1	-	-	-	-	-	4.9-6.6	-
Mean	-	5.6	4.4	-	-	-	-	5.7	-
Little Lake									
n	-	2	2	-	1	-	-	4	-
Range	-	5.4-6.9	5.5-5.7	-	-	-	-	4.9-6.1	-
Mean	-	6.2	5.6	-	5.6	-	-	5.6	-
Leaf-Shaped									
n	-	1	-	1	-	1	-	2	-
Range	-	-	-	-	-	-	-	5.8-5.9	-
Mean	-	8.1	-	5.5	-	7.2	-	5.9	-

Table 9.2. Hydration data for select projectile point types by obsidian source (Cont..).

	BH	CD	FS	MO	MH	QI	SV	TQ	IN
Fish Slough									
n	-	7	1	2*	1	-	-	20	2
Range	-	7.8-11.7	-	9.8-9.9	-	-	-	6.8-9.9	8.8-9.0
Mean	-	9.8	8.8	9.9	8.7	-	-	8.5	8.9
Pinto									
n	-	6*	2	1	3	-	-	6	2
Range	-	8.0-11.6	8.6-9.9	-	7.8-11.6	-	-	8.4-13.2	9.7-10.2
Mean	-	9.9	9.3	10.9	9.8	-	-	10.8	10.0
GBCB/Stem									
n	-	3	1	2	-	1	-	5	2
Range	-	8.0-13.3	-	10.6-15.4	-	-	-	7.4-13.2	10.2-11.5
Mean	-	10.4	11.6	13.0	-	10.6	-	10.3	10.9
Sample Totals	3	67	18	18	29	2	9	159	11

Note: BH, Bodie Hills; CD, Casa Diablo; FS, Fish Springs; MO, Mono Craters/Mono Glass Mtn; MH, Mt. Hicks; QI, Queen Impostor; SV, Saline Valley; TQ, Truman-Queen; IN, Indeterminate Source; GBCB, Great Basin Concave Base.
* One statistical outlier excluded via Chauvenet's criterion.

In this study, raw micron ranges and means for Truman-Queen obsidian undeniably show a direct correlation between inferred artifact age and hydration thickness (Table 9.3). Consistent with other eastern California obsidians, progressively older points of Truman-Queen glass manifest increasingly older hydration ranges and means. The same patterns emerge in hydration data from Bouscaren (1985) and Halford (1997) for artifacts found at sites in a similar temperature regime as the Tableland (Table 9.3). At the Sawmill Road site (INY-1386) about half a mile south of the southern edge of the Tableland, Bouscaren (1985) cut a small sample of Truman-Queen projectile points, including three Elko and three Humboldt points. Hydration rims for Elko points ranged from 4.1-6.0 microns, with a mean of 4.8 μm, while those for Humboldt points ranged from 4.4-6.4

Table 9.3. Hydration ranges, means, and standard deviations for Truman-Queen projectile points.

	n	Range	Mean	Standard Deviation
Giambastiani 2004				
Cottonwood	11	1.1-2.7	1.89	0.50
Desert Side-notched	13	1.3-2.7	1.99	0.49
Rose Spring	26	2.4-4.4	3.45	0.60
Eastgate	5	2.4-4.0	3.48	0.63
Humboldt Basal-notched	9	4.3-6.1	4.98	0.60
Elko Eared	38	4.1-6.5	5.40	0.49
Elko Corner-notched	11	4.7-7.1	5.99	0.83
Elko Contracting Stem	8	4.9-6.6	5.73	0.56
Little Lake	4	4.9-6.1	5.63	0.58
Fish Slough Side-notched	20	6.8-9.9	8.45	0.88
Pinto	6	8.4-13.2	10.77	1.64
Stemmed/Concave Base	5	7.4-13.2	10.32	2.21
Halford 1997				
Cottonwood	3	2.5-3.5	3.1	0.35
Desert Side-notched	5	1.8-3.5	2.7	0.63
Rose Spring	3	3.4-4.2	3.7	0.44
Hall 1990				
Cottonwood	4	1.6-2.7	2.28	0.48
Desert Side-notched	8	1.6-2.6	2.13	0.35
Rose Spring	6	1.9-3.5	2.73	0.55
Eastgate	3	2.9-3.7	3.27	0.40
Elko Eared	2	3.7-4.7	4.20	0.71
Elko Corner-notched	3	4.0-4.6	4.23	0.32
Elko Contracting Stem	2	5.6-5.9	5.75	0.21
Little Lake	2	5.6-5.9	5.75	0.21
Great Basin Stemmed	2	7.8-10.4	9.10	1.84
Hall 1983				
Humboldt Concave-Base	4	2.3-4.6	3.02	1.07
Elko Eared	2	2.9-3.7	3.30	0.56
Elko Corner-Notched	1	-	4.16	-
Elko Contracting Stem	1	-	3.86	-
Little Lake	1	-	3.43	-
Unnamed Shouldered Forms	2	4.6-4.8	4.69	0.14

microns and had a mean of 5.7 μm. Halford (1997) recovered a sample of 11 projectile points during surveys throughout Hammil and Benton Valleys on the northeast flank of the Tableland (Table 9.3). Means and ranges compare favorably with the current profile, as well as with data for Truman-Queen points collected by Hall (1990) from sites in eastern Mono Valley, Adobe Valley, and the southern Benton Range, areas which range between about 7200-6800 feet elevation. Finally, Hall (1983) also found a consistent pattern of hydration by examining a series of Truman-Queen projectile points from MNO-561 in the town of Mammoth Lakes, a location at a much higher elevation (7900 feet) than the Tableland (Table 9.3).

Thus, despite elevational (and temperature) differences, available data from several locations show that Truman-Queen projectile point types sort out as expected based on their presumed chronological order. Not only does this contradict problems associated with Truman-Queen hydration posited by Weaver (1992), it supports the notion that Queen obsidian hydrates fairly consistently in various environments and at different elevations (Tableland [dry scrub, lower] vs. Benton Range [pinyon woodland, higher]). However, it is also evident, as Basgall and Giambastiani (1995:45) noted, that hydration means for Rosegate and Elko points in the Benton Range are smaller than those on the Tableland by a factor of 0.5-1.5 microns. This pattern is even more pronounced in comparing Elko Eared points from the Tableland with those from site MNO-561, the latter having much smaller hydration rims by a factor of 1.2-2.8 microns. This surely reflects the higher temperature regime on the Tableland rather than cultural differences between the two areas.

Evaluating the Basgall/Giambastiani Truman-Queen Hydration Rate

Despite employing a much larger sample of projectile points than did Basgall and Giambastiani (n=38), this study contributes little to the improvement of the existing hydration rate for Truman-Queen obsidian (Basgall and Giambastiani 1995:44). This calculation, expressed as

$$\text{years B.P.} = 82.74 \text{ microns}^{2.06}$$

was formulated using micron-age pairs developed for Desert, Rosegate, and Elko series projectile points and their associated time frames (Marana, Haiwee, and Newberry periods). As no reliable age estimate could be assigned to the Elko-Little Lake interface, this data point was not used in the rate calculation. At the outset of this research it was hoped that the resulting data set might offer a means to rework the Basgall/Giambastiani hydration rate for Truman-Queen obsidian. Unfortunately, as this project assumed its obsidian-dominant design it was obvious there would be no way to obtain better chronological resolution for pre-Elko periods except through hydration analysis. Without any other, independent notion of the temporal parameters for older point styles (Little Lake, Fish Slough Side-notched, Pinto, or Stemmed), there is no way to justify the selection of any particular period midpoints to pair with micron values in rate construction. The upshot of all this is that the present work offers no insight *independent of hydration data* to the timing of cultural shifts or the duration of cultural periods prior to the onset of the Newberry interval (3200 B.P.). While this effectively prohibits reconfiguration of the Truman-Queen hydration rate in this context, it is still possible to evaluate the ability of the rate in predicting inferred age using micron values. Current hydration data also speak to the relative age of different projectile point styles, particularly those that have long been questioned or contested.

In considering the predictive aspects of the Truman-Queen rate, recall that it was developed using a curvilinear model based on radiocarbon-micron pairs dating back to only about 2000 B.P. (Basgall and Giambastiani 1995). Because no data points were available to represent the previous 6-7000 years of occupation on the Tableland, a rate equation was selected that would extrapolate the ages of older artifacts as best as possible. As shown in Table 9.3, Truman-Queen micron values seen in hydration data from northern Owens Valley range between 1.0-14.0 (Basgall and Giambastiani

1995; Giambastiani 1995, 1996; Halford 1997; Hall 1990; Ramos 2000). When the rate equation is applied, resulting age estimates per micron increment (unadjusted for EHT) reflect exaggerations at both ends of the range, as expected of a curvilinear rate formula. Age differences between micron values increase substantially beyond 10.0 microns, enough so that they fail to correspond with the presumed onset of human occupation on the Tableland (~8500-9000 B.P.) and even with the inferred beginnings of human habitation in North America (~12,000 B.P.). A similar problem has been noted in the application of Basgall's (1990a) Coso hydration rate (Basgall 1990a; Gilreath and Hildebrandt 1995; King 2000). Hydration rims on Coso artifacts often reach 14.0-15.0 microns in thickness (Basgall and McGuire 1988; Delacorte et al. 1995; Gilreath and Hildebrandt 1995) but age estimates beyond 13.0 microns are inconsistent with the presumed beginnings of human occupation in the region.

Without a doubt, the overestimation of ages for older artifacts is of greatest concern in using the current Truman-Queen hydration rate. This is especially true given other inconsistencies in hydration rim development that are already more likely to occur with increased artifact age (artifact breakage and re-use, rim diffusion, etc.). Such factors tend to produce highly variable rim widths in hydration samples of Early and Middle Holocene point types; data from the Tableland demonstrate this kind of "scattering" quite clearly in regard to GBCB/Stemmed and Pinto points (see Table 9.3). Interestingly enough, this does not occur among other kinds of dart points, including Fish Slough Side-notched points which appear to be of comparable age to Pinto points. While limited sample sizes for GBCB/Stemmed and Pinto points must be contributing somewhat to hydration scattering, the fact that Fish Slough points are very tightly clustered (n = 20, range 6.8-9.9 μm, standard deviation = 0.88) implies that Truman-Queen obsidian hydrates at a *regular and consistent* rate up to 10.0 microns.

Table 9.4. Micron values, age estimates, and age differences between values for Truman-Queen.

Micron Value	Estimated Age B.P.	Differences
1.0 μm	80	-
2.0 μm	350	270
3.0 μm	800	450
4.0 μm	1440	640
5.0 μm	2280	840
6.0 μm	3320	1040
7.0 μm	4560	1240
8.0 μm	6000	1440
9.0 μm	7650	1650
10.0 μm	9500	1850
11.0 μm	11560	2060
12.0 μm	13830	2270
13.0 μm	16310	2480
14.0 μm	19000	2690

What all these issues demonstrate, more than anything else, is a need for better chronological controls for the Early and Middle Holocene in formulating hydration rates. Particularly for Truman-Queen, which works to about 3300 B.P. before having to extrapolate the hydration curve farther back, and for Coso, which does well to around 2200 B.P., it will be necessary to establish older radiocarbon-micron pairs before any improvements to the rates are possible. For Truman-Queen, such pairs are unlikely to come from sites in Owens Valley (where this obsidian is rare) or from the Fish Slough area on the Tableland, where older components are ephemeral and constitute thin scatters of flaked stone debris. Directed efforts will have to be made in order to find older, pre-Newberry cultural deposits that contain dateable organic remains and Truman-Queen artifacts in association.

Casa Diablo Hydration

The parameters of Casa Diablo hydration on the Volcanic Tableland were briefly explored by Basgall and Giambastiani (1995). Examining a sample of 18 diagnostic projectile points, it appeared that that Casa Diablo obsidian hydrates faster in the study area than at the source location in Long Valley (Hall 1984, Hall and Jackson 1989), with a difference of 1.2-1.4 microns occurring consistently throughout the projectile point sequence. This same pattern is evident in the current data set, though to a somewhat larger degree. Hydration data for Casa Diablo projectile points from Long Valley (Hall and Jackson 1989) and the current project are compared in Table 9.5. Differences in hydration ranges and means are minimal for Cottonwood and Desert Side-notched points, but beginning with Rose Spring points it looks as if that artifacts from the Tableland are hydrating at a faster rate. Means differ significantly for the various Elko forms, ranging between 1.3-2.2 microns but averaging about 1.6 μm. Comparisons between Little Lake and Pinto points are complicated by the fact that Little Lake and Pinto specimens are combined in the Hall and Jackson (1989) sample and segregated in the present one. Still, based on ranges for Fish Slough Side-notched and robust Pinto points on the Tableland, it appears that micron values for Fish Slough Side-notched points and Pinto forms in Long Valley should fall within the 6.0-7.0 micron range. Means for Stemmed points in both locations imply that the hydration gap expands past Elko types through the early end of the projectile point sequence, separated by as much as 3.0 microns within Early Holocene point styles.

Temperature variance due to elevational differences between the subject locales is most likely responsible for observed discrepancies in hydration rim development. Indeed, Basgall (1989) has offered an effective hydration temperature (EHT) of 9.3° C for Long Valley, while Powell and Klieforth (1991) suggest that Bishop has a mean annual temperature of 13.3° C, a separation of 4.0 degrees Celsius. In attempting to reconcile a comparable situation with Coso obsidian, Basgall (1990a) proposed a 6% micron correction for each degree (Celsius) of difference in EHT between

Table 9.5. Hydration data for Casa Diablo projectile points from Long Valley (Hall and Jackson 1989) and the Volcanic Tableland.

	CTW	DSN	RSP	EGT	HBN	EED	ECN	ECS	LLK	FSN	PTO	STM
LV n=	12	13	3	13	3	19	26	15	9*	-	-	7**
Max μ	3.4	2.1	5.2	4.3	5.5	5.0	5.8	5.0	7.8	-	-	9.0
Min μ	1.3	1.2	2.9	1.4	1.2	2.9	2.7	3.6	3.8	-	-	5.2
Mean μ	2.2	1.6	3.1	3.0	3.5	4.1	4.2	4.2	5.7	-	-	7.2
VT n=	8	3	10	6	4	10	3	4	2	7	6	3
Max μ	3.1	3.0	4.8	3.9	6.2	7.1	7.2	6.1	6.9	11.7	11.6	13.3
Min μ	1.0	1.8	2.5	3.0	3.7	4.2	5.8	4.8	5.4	7.8	8.0	8.0
Mean μ	2.0	2.2	3.6	3.6	5.0	5.4	6.6	5.6	6.2	9.8	9.9	10.4

Note: CTW, Cottonwood; DSN, Desert Side-notched; RSP, Rose Spring; EGT, Eastgate; HBN, Humboldt Basal-notched; EED, Elko Eared; ECN, Elko Corner-notched; ECS, Elko Contracting Stem; LLK, Little Lake/Pinto; FSN, Fish Slough Side-notched; PTO, Pinto; STM, Stemmed; LV, Long Valley; VT, Volcanic Tableland. * Includes all "Pinto-like" variants (Hall and Jackson 1989). ** Includes only "Wide-stem, narrow-shouldered" variants similar to Lake Mohave (but not Silver Lake) forms from southern California (Hall and Jackson 1989).

the base locality where his hydration rate was developed (site INY-30 near Lone Pine) and any locality for which a correction was being made. Although this approach to temperature correction has been debated (cf. King 2000; Tremaine 1987; Hull 2001), it has successfully estimated ages in many different locations throughout California (Basgall 1990a). The method can be applied to our examination of Casa Diablo obsidian, if only to model the severity of temperature-related hydration rim variation seen on the Volcanic Tableland.

In order to quickly assess the basic effects of a 6% per degree correction for Casa Diablo artifacts on the Tableland, Long Valley micron means for each point type can be multiplied by a factor of 1.24 to account for the 4° greater temperature in the study area. As noted earlier, Cottonwood and Desert Side-notched points appear to deviate only slightly and do not require a major correction. For Rose Spring and Eastgate forms, a 6% correction does increase the Long

Valley means to match those for like points on the Tableland (3.8 and 3.7 microns, respectively). However, beginning with Humboldt points a mere 6% correction fails to bring subject means into close enough correlation. Considering the average difference of 1.6 microns noted between Elko means for the two localities, a correction of at least 9% (a 1.36 multiplier) is needed to add the 1.5 microns necessary to bring Long Valley means in line the Volcanic Tableland. Moreover, the Long Valley mean for Stemmed points requires a correction of at least 10% to make it correspond even roughly with the Tableland mean. In general, older point forms seem to require a larger micron correction for increased EHT than do younger forms, perhaps testifying to the cumulative effects of a higher temperature regime through time on Casa Diablo obsidian. In a broader sense, these data imply that changes in the rate of obsidian hydration, as a function of long-term exposure to increased temperature, may not occur in a simple linear fashion through time. Such a conclusion is consistent with results of induced hydration studies that suggest the relationship between temperature and hydration is exponential rather than linear (Trembour and Friedman 1984; Michels et al. 1983; Stevenson et al. 1989; Tremaine 1987).

Mt. Hicks and Fish Springs

Only two other Inyo-Mono glasses occurred in large enough quantities to afford adequate samples of projectile points for hydration analysis. Some 29 diagnostic points attributed to the Mt. Hicks source provided measurable rims, as did 18 items of Fish Springs glass. The former comprise a variety of types, from Desert series to Pinto variants, while the latter include mainly dart-point forms (see Table 9.1). As of yet, no archaeological research has been directed to producing a hydration rate for Mt. Hicks obsidian, and one of the more recent formulas for Fish Springs glass has met with only moderate success (Delacorte and McGuire 1993). While these facts preclude a detailed examination of Mt. Hicks and Fish Springs hydration on the Tableland, hydration data for

both samples can still be compared to micron ranges for Truman-Queen points to assess the relative rates of rim development.

Looking first to Mt. Hicks, micron means and ranges for all point types appear consistent with those for Truman-Queen obsidian (Table 9.6). The only obvious differences are seen in Pinto points, where Mt. Hicks shows a slightly lower range than Truman-Queen. This would indicate that Mt. Hicks and Truman-Queen obsidians hydrate at a comparable speed on the Volcanic Tableland. However, it is not known how the behavior of Mt. Hicks obsidian on the Tableland relates to its rate of hydration at the source. Even though Mt. Hicks and Truman-Queen obsidians originate at similar elevations (ca. 2300 and 2000 m, respectively), it is presumably colder at Mt. Hicks given its appreciably higher latitude. In a study on the Dry Lakes Plateau in the Bodie Hills, Halford (1998:109) suggests that Mt. Hicks glass hydrates slightly faster than Bodie Hills obsidian, means for diagnostic points showing a difference of about 0.5-1.0 microns in favor of Mt. Hicks.

When compared to the present study, Halford's data clearly indicate that Mt. Hicks obsidian hydrates more slowly on the Dry Lakes Plateau (2500 m elevation) than on the Tableland (averaging about 1600 m elevation). As shown in Table 9.6, with the exception of Little Lake forms all Mt. Hicks points hydrate considerably faster on the Tableland, by a magnitude of between 1.1-1.8 microns per point type. Again, the higher temperature regime on the Tableland is probably contributing to an amplified hydration rate for Mt. Hicks obsidian. If the Dry Lakes Plateau environment is a reasonable approximation of the environment at Mt. Hicks, it would seem that Mt. Hicks obsidian is hydrating about 1.5 times faster on the Volcanic Tableland than at its source.

A pattern of basic coherence also emerges from the Fish Springs points analyzed in this study. Still, there are hints that Fish Springs obsidian is hydrating a bit slower than other glasses (see Table 9.1). In particular, either the upper end of the micron range (where available) or the sample mean for each point type represented is lower for Fish Springs than Truman-Queen, the lone

Table 9.6. Hydration data for Mt. Hicks projectile points from the Dry Lakes Plateau (Halford 1998) and the Volcanic Tableland.

		RSG	ELK	LLK	FSN	PTO
Dry Lakes Plateau	n=	7	6	5	2	2
Max μ		3.5	5.0	7.6	7.1	7.2
Min μ		1.5	2.6	4.1	7.1	6.8
Mean μ		2.3	4.0	6.3	7.1	7.0
Tableland	n=	4	8	1	1	3
Max		4.1	7.1	5.6	8.7	11.6
Min		2.8	5.3	5.6	8.7	7.8
Mean μ		3.4	6.0	-	-	9.8

Note: RSG, Rose Spring/Eastgate; ELK, Elko; LLK, Little Lake; FSN, Fish Slough Side-notched; PTO, Pinto; STM, Stemmed.

exception being Fish Slough Side-notched points where only one Fish Springs item is present. Given an essentially constant EHT between the Volcanic Tableland and the Fish Springs area, variance in overall temperature regime cannot really account for the slower rate of Fish Springs hydration. The pattern is consistent, however, with the parameters of recent Fish Springs and Truman-Queen hydration formulae (Delacorte and McGuire 1993, curvilinear rate; Basgall and Giambastiani 1995). For instance, without correcting for temperature, a 4.0 micron reading for Truman-Queen glass equates to a 4.5 micron reading for Fish Springs in terms of age estimates. Differences between these glasses in Tableland data are not always on the order of 0.5 microns, but they do occur in most projectile point classes (Eastgate, Elko Eared, Elko Contracting Stem, Pinto). Without further data, it seems safe to conclude that Fish Springs obsidian is hydrating within expected parameters on the Volcanic Tableland, as it is not subject to a drastic increase in EHT from its source location.

PROJECTILE POINTS AS TIME MARKERS ON THE VOLCANIC TABLELAND AND IN EASTERN CALIFORNIA

In the 1980s and 1990s, a debate emerged between flintknappers and archaeologists concerning the utility of Great Basin dart points as temporal markers. On one side, the results of several replicative studies in projectile point manufacture led several researchers to discount the stability of dart point morphology (Flenniken 1984, 1985; Flenniken and Raymond 1986; Flenniken and Wilke 1989). In attempting to determine the most efficient way to refurbish broken dart points, it was discovered that supposed "diagnostic" projectile point types could change shape during rejuvenation. Elko Corner-notched forms were singled out in particular as transforming into Elko Contracting Stem or Elko Eared points simply by modifying the proximal end, or into Pinto or Rosegate forms given an overall reduction in point size due to both distal and proximal reworking (Flenniken and Raymond 1986). These conclusions suggested that the use of dart points as time markers was flawed, and that prehistoric chronologies based on point styles were unfounded (Flenniken and Wilke 1989).

These assertions were met with negative reactions from archaeologists who for many years had been using Thomas' (1981, 1983) Monitor Valley point typology and the Bettinger-Taylor (1974) chronology as guides for interpreting temporal patterns in the Great Basin. Thomas (1986) was the most vocal, citing two main reasons why projectile point types work as time markers: (1) the demonstrated, tested ability of point types to predict associated radiocarbon dates; and (2) the fact that projectile point morphology varies in a consistent, repeated manner through time. Thomas' arguments also included discussions of how inaccurate "technology-only" attitudes can be in interpreting the *reasons* for change in artifact types. Also, Bettinger et al. (1991) demonstrated that certain dart point styles argued by Flenniken and Wilke (1989) to be derived from other "archetype"

forms were actually of greater mass than their supposed progenitors. Together, these arguments seem to have satisfied most Great Basin archaeologists and maintained the validity of projectile point types as temporal indicators.

Unfortunately, there are still rumblings in the discipline about the inability of certain dart point types to function in this manner (Schroth 1994; Yohe 1992). A recent study of some Great Basin dart point morphologies (Basgall and Hall 2000) has responded to these criticisms by defining metrical criteria that reliably segregate Elko from Pinto forms and by demonstrating contrasting material profiles between them, effectively rejecting the premise that these point types cross over as a result of reworking (cf. Flenniken and Wilke 1989). Adding to the results achieved by Basgall and Hall, details of the present study also bear on the issue of points as temporal markers. In Figure 9.1, hydration data for Truman-Queen projectile points show clear separations of point types through time, with minimal temporal overlap evident between "suspect" types (Elko, Pinto, and Rosegate) and relatively tight hydration ranges for all temporal types. Desert and Rosegate series points overlap each other by 0.4 microns, as do both Rosegate and Elko forms and Elko and Fish Slough Side-notched points. The extreme regularity here is probably partly coincidental, but there seems little doubt that diagnostic point styles in this sample seriate out in a predictable manner given their inferred, relative ages.

Truman-Queen hydration data are also somewhat indicative of the actual ages of certain dart point types. As shown in Figure 9.1, a number of different point series cluster within the 7.1-4.0 micron range. Using the existing Truman-Queen rate, this range corresponds to a temporal interval of about 4700-1450 B.P. Considering Elko variants, all but one Elko Eared specimen falls within 6.5-4.6 microns (ca. 3900-1900 B.P.). Elko Corner-notched items have the broadest spread, from 7.1-4.7 μm (ca. 4700-2000 B.P.), with Elko Contracting Stem forms ranging only from 6.6-4.9 μm (ca. 4050-2200 B.P.). Relative to the accepted time frame for the Newberry period (3150-1350 B.P.)

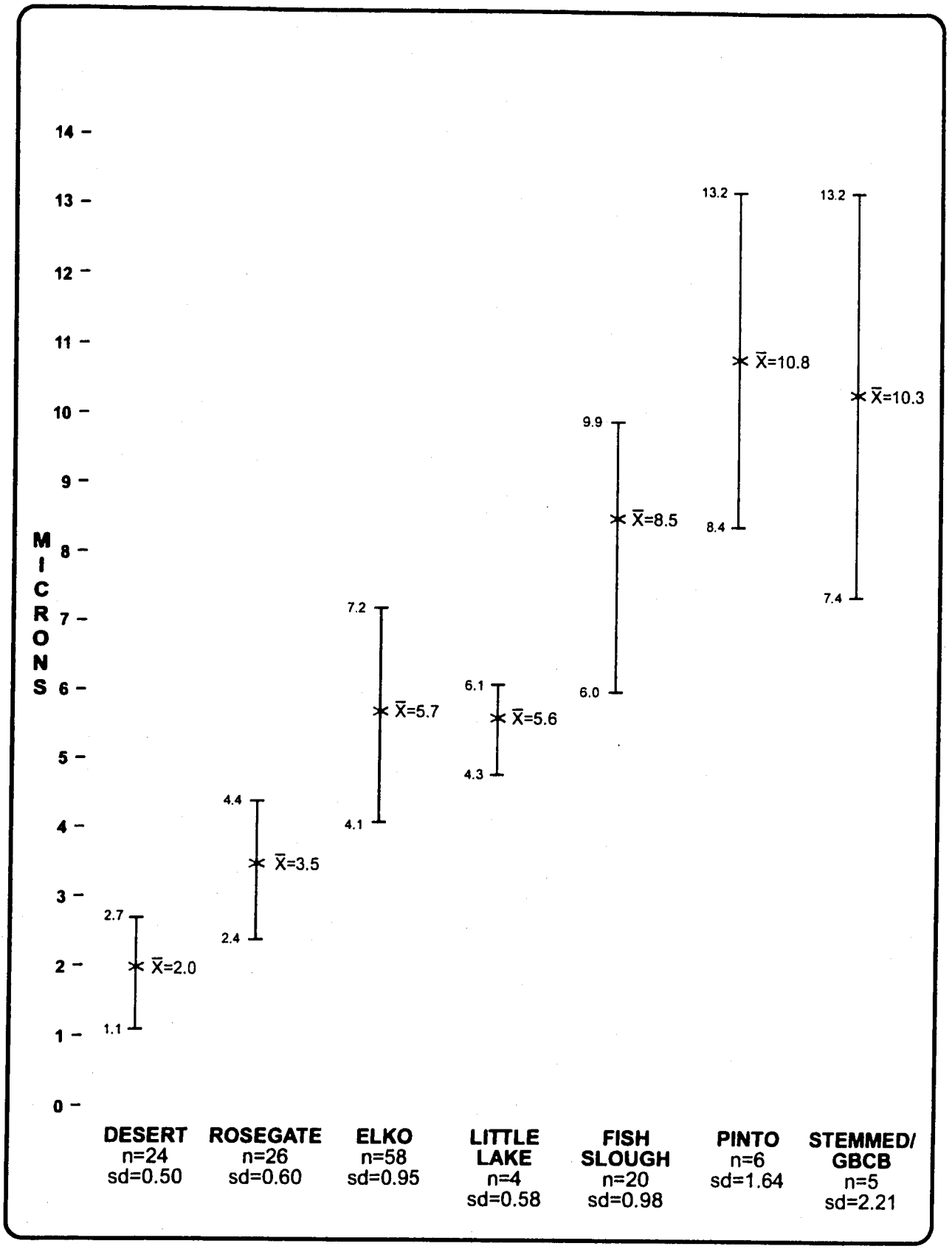

Figure 9.1. Micron ranges for diagnostic Truman-Queen projectile points.

[or 3200-1400 with the 2000 millennium correction]), it appears that a large group of Elko points (n=18) pre-dates the early end of this interval, those represented by micron values of 6.0 or more.

In reference to the Bettinger and Taylor (1974) chronology, the onset of Elko points at about 4700 B.P. in this study would overlap about half of the preceding Little Lake period (5950-3150 B.P.). There is some precedence, however, for extending the early end of the Newberry period. Based on hydration data, Gilreath and Hildebrandt (1995) proposed a date of 3500 B.P. for the onset of Newberry times in the Coso region, and others have posited a similar time frame for Newberry assemblages in southern Owens Valley (Delacorte et al. 1995). In the Mojave Desert, Gypsum Cave points (synonymous with Elko Contracting Stem) have long been argued to date as early as 4000 B.P. (Basgall 1993, 1995; Warren 1980, 1984; Warren and Crabtree 1986). Recently, Hall and Basgall (1994) and Basgall and Giambastiani (2000) have also suggested that Gypsum points could be even older, perhaps on the order of about 5000-7000 B.P. The purpose here is not to suggest a revision of eastern California chronology, but to consider that Elko points might be slightly older than normally perceived, at least in northern Owens Valley.

It is also interesting that Little Lake points of Truman-Queen glass range only between 6.1-4.9 microns, or roughly 3400-2200 B.P., being more in line with the Newberry interval and the main thrust of Elko hydration. As noted earlier, Bettinger and Taylor's (1974) chronology would have Little Lake points being slightly older, between about 6000-3000 years ago. Thankfully, the long-standing problem regarding morphological and temporal differences between gracile, bifurcate stemmed points (Gatecliff Split-stem or Little Lake) and more robust variants (Pinto) has finally been addressed (Basgall and Hall 2000). Results of this study indicate that Gatecliff/Little Lake points are generally later Holocene markers (5000-3000 B.P.) than Pinto points (> 4000 B.P.). It is even suggested that the Little Lake name should be abandoned, given temporal consistency among gracile split-stem points. In this context, hydration values for Little Lake points are in agreement

with the time frame proposed for Gatecliff points rather than Pinto forms. This is true for Little Lake points of Casa Diablo and other obsidians as well (see Table 9.2). Pinto forms also appear much older in comparison, with Truman-Queen hydration values greater than 8.0 microns (pre-dating 6000 B.P.) and rim values for other obsidians showing comparable age.

Micron values for Humboldt Basal-notched points are also consistent with the accepted age of this point form in eastern California, representing an interval that spans the Newberry period and continues into Haiwee times (Basgall and McGuire 1988; Bettinger 1989a; Delacorte 1990; Delacorte and McGuire 1993; Delacorte et al. 1995; Gilreath and Hildebrandt 1995; Hall 1983, 1990; Thomas 1981). Rim readings for nine Truman-Queen specimens convert to age estimates between 3400-1700 B.P., a time frame that fits squarely within the Newberry period. Though one Truman-Queen hydration band of 3.1 microns was discarded via Chauvenet's criterion for this analysis, its estimated age (850 B.P.) would not be unreasonable given the overlap of Humboldt points into the Haiwee period.

It is also significant that Fish Slough Side-notched points have a very strict temporal span (see Table 9.2). The 20 Truman-Queen specimens range between 6.8-9.9 microns, with a mean of 8.5 microns that equates to approximately 6800 B.P. Ranges and means for other obsidians also show close parallels, as do obsidians in the "indeterminate" group. These data undoubtedly signify that Fish Slough points are older than Elko series points by a significant margin, on the order of 1000 years or more. They also seem to be a bit younger than Pinto and Stemmed forms, both of which yield slightly larger means irrespective of obsidian source. Not only does this indicate that Fish Slough Side-notched points constitute a "real" temporal type, their apparent age range (ca. 9300-4300 B.P.) fills a temporal gap in the point sequence between the middle and early Holocene. The prevalence of these points on the Volcanic Tableland also has implications for the configuration of early Holocene settlement systems in northern Owens Valley (see Chapter Ten).

Finally, most important to discussions of long-term change in flaked stone technology is the temporal pattern demonstrated by Rose Spring and Eastgate points. Hydration data show a remarkable consistency between the point types and within different source samples (see Table 9.1). Means vary from 3.3-3.6 microns for Rose Spring points and between 3.0-4.1 for Eastgate points, and both types have like means for Truman-Queen (3.5 μm) and Casa Diablo obsidians (3.6 μm). The slightly broader hydration range for Rose Spring points of Truman-Queen glass would correspond to age estimates of 1750-500 B.P., with the mean for both styles equating to about 1100 years B.P. The mean for Casa Diablo specimens converts to an age of roughly 1300 B.P. using Hall and Jackson's (1989) formula. Both of these predictions are well within the accepted time range for the Haiwee period (1400-700 B.P.), though they imply that Rosegate points in this collection date primarily to the early end of this interval, around 1200 B.P. Despite some claims to the contrary (e.g., Yohe 1992), there is no evidence from this study to support a placement of Rosegate points any earlier than is commonly accepted.

CHANGES IN FLAKED STONE TECHNOLOGY ASSOCIATED WITH THE INTRODUCTION OF THE BOW-AND-ARROW

Detailed technological studies of flaked stone artifacts from eastern California began in the late 1960's (cf. Davis and Shutler 1969; Tadlock 1966; Tuohy 1969; Borden 1971), but the first regional syntheses of flaked stone industries or changes in tool production through time did not emerge until much later (Basgall 1983; Basgall and McGuire 1988; Bettinger 1989a; Hall 1983; T. Jackson 1985). Likewise, the introduction of the bow-and-arrow into eastern California has long been thought to mark a major shift in prehistoric subsistence adaptations, but the first attempts to consider the effects of its adoption on modes of obsidian use were not made until the 1980s (Ericson

1982; Hall 1983; Bouey and Basgall 1984). These earlier efforts focused primarily on how the exchange-related procurement and production of obsidian might have been affected; inquiries as to how the adoption of the bow-and-arrow may have influenced the organization of lithic technology have only recently been put forth (Basgall and Giambastiani 1995; Bettinger 1989a; Gilreath and Hildebrandt 1995; Yohe 1992).

The arrival of the bow-and-arrow in the western Great Basin is usually associated with the appearance of Rosegate (Rose Spring and Eastgate) projectile points, which occurred sometime prior to about 1200 years ago. Yohe (1992) has offered a date of 1600 B.P. based on recent work at the Rose Spring site (INY-372), but most research efforts place the emergence of the bow-and-arrow in eastern California at around 1400-1300 B.P. (Basgall and Giambastiani 1995; Basgall and McGuire 1988; Bettinger 1989a, 1991a; Bettinger and Taylor 1974; Delacorte et al. 1995; Delacorte and McGuire 1993; Gilreath and Hildebrandt 1995; Gilreath and Nelson 1999; R. Jackson 1985; others). Similar estimates emerge from the present research as well, indicating that the appearance of the bow-and-arrow was consistent throughout the Owens Valley, Rose Valley, and Coso regions. Studies in the southwestern Great Basin correlate as well, though Rose Spring points might be slightly older in the Mojave Desert (Basgall 1993; Basgall et al. 1988a; Warren and Crabtree 1986; Warren et al. 1984).

One of the main assumptions concerning the change from dart- to arrow-size projectile points is related to presumed differences in the reduction sequence for the two point forms. The production of a dart-size point normally required the use of a fairly large flake blank, perhaps 10 cm or more in length, which was initially percussion-shaped and thinned into a symmetrical bifacial preform. Once prepared in this manner, the final product was reduced from the preform using more delicate percussive techniques (e.g., using a softer hammer or billet) and thorough, invasive pressure flaking. This process has been proposed or implied by archaeologists studying North American

quarry refuse for over a century (K. Bryan 1950; Ellis 1965; Elston and Zeier 1984; Elston et al. 1987; Ericson and Purdy 1984; Holmes 1919; Pond 1930) and is supported by replicative experiments conducted by contemporary lithic analysts and experienced flintknappers (Amick and Maudlin 1989; Bradley 1975; Callahan 1979; Collins 1975; Crabtree 1972; Driskell 1986; Elston 1986; Muto 1971).

The manufacture of arrow-points, in contrast, did not require the fabrication of a percussion-thinned bifacial preform. In most cases a moderate- to small-size flake, perhaps 5-6 cm in length, was suitable as an initial blank that could be shaped directly by light percussion and heavy pressure flaking into the desired form. This is demonstrated by the fact that arrow points were often finished in outline but remained unworked across the body, leaving an unaltered surface on the original flake blank. While only large blocks or cores were able to provide flake blanks big enough for dart points, a variety of smaller core forms, including bifacial cores, could have produced flake blanks for arrow points. Indeed, there are many examples of unfinished Rosegate and Desert series points that are longitudinally curved, a fact betraying their origins as biface thinning flakes (see figures for arrow points in Basgall and Giambastiani 1995; Bettinger 1989a; Delacorte and McGuire 1993; Delacorte et al. 1995).

A shift toward smaller flake blanks also implies that less raw toolstone was needed in the production of arrow-points. Bettinger (1989a) and Thomas (1978) have argued that projectile point mass decreased significantly following the change from dart to arrow points, and there is little doubt that overall point size became drastically reduced as well (Bettinger et al. 1991; Thomas 1981, 1986; many others). These thoughts have been echoed by other research (Basgall and McGuire 1988; Delacorte and McGuire 1993; Gilreath and Hildebrandt 1995; Hall 1988; Yohe 1992), but Ericson (1982) has claimed that arrow-point users may have used as many as ten times the number of projectiles as dart-point users, thus effectively *increasing* the amount of toolstone needed for arrow-

point production. This position has been refuted for a number of reasons, not the least of which is evidence of marked production declines at Bodie Hills, Casa Diablo, and Coso obsidian quarries during the last 1000 years (Bouey and Basgall 1984; Gilreath and Hildebrandt 1995; Hall 1984, 1988; T. Jackson 1984).

It is logical to expect that the shift from the atlatl-and-dart to the bow-and-arrow would have had some effects on the organization of flaked stone technology, let alone other impacts relating to the procurement of raw materials for bow staves and arrow shafts rather than atlatls and dart shafts (see Hester et al. 1974). Presumably, arrow point production could have been accomplished using a variety of smaller toolstone packages, cores, and flake blanks, did not require bifacial preforms, and used considerably less overall toolstone than did dart point production. If these premises are true, one might expect to see several changes in lithic technology following the introduction of the bow-and-arrow to eastern California: (a) an increase in the use of alternative (non-bifacial) core strategies; (b) a decrease in the production of bifaces for use as point preforms; (c) a decrease in regularized quarry production at major obsidian sources; and (d) the initial or heightened use of previously untapped raw material deposits, such as obsidian sources containing fairly small cobbles and nodules. Data from the Volcanic Tableland bear upon most if not all of these issues.

Changes in the Use of Bifaces, Cores, and Flake Tools

Spurred by Robert Kelly's (1988) discussion of the roles bifaces might have played in the technological repertoire of mobile hunter-gatherers, many archaeologists assume that biface technology was essential to the transport of raw material and the manufacture of tools and projectiles during the Archaic period of Great Basin prehistory. The general impressions of atlatl users are that they carried with them a set of finished tools but also maintained a variety of bifacial cores and prepared bifacial preforms, the latter of which could be hafted for use as knives or quickly retouched

into finished dart points when needed. Unifacial flake tools were also important in Archaic tool-kits, but the reliance on bifacial preforms for points must have required the regular manufacture and transport of these items. The large volumes of obsidian reduced to bifacial form at quarries like Bodie Hills, Casa Diablo, and the Coso Volcanic Field during the Newberry period reflect the importance of bifacial technology in the western Great Basin and in California before the arrival of the bow-and-arrow (Bouey and Basgall 1984; Elston and Zeier 1984; Ericson 1982; Gilreath and Hildebrandt 1995; T. Jackson 1984a; Singer and Ericson 1977). Bifaces and bifacial cores are by far the most common tool rejects at Casa Diablo quarries and associated secondary reduction sites, indicating that bifacing was the dominant production activity for thousands of years (Basgall 1983, 1984, 1987; Goldberg et al. 1990; Hall 1983; R. Jackson 1985; Michels 1965; Skinner and Ainsworth 1990).

Based on years of research in the southwestern Great Basin, it seems that a basic shift from biface- to flake-based reduction strategies occurred at about the same time the atlatl was supplanted by the bow (Basgall and Giambastiani 1995; Basgall and McGuire 1988; Basgall et al. 1988a; Delacorte and McGuire 1993; Delacorte et al. 1995). Differences in manufacturing techniques used for dart and arrow points have often been cited as a potential cause for this change, but it is also possible the shift relates to a more fundamental alteration in lithic technology brought on by increasing settlement centralization, decreasing residential mobility, and subsistence intensification (Basgall and Giambastiani 1995; Basgall and McGuire 1988; Delacorte et al. 1995; Kelly 1988; Parry and Kelly 1987). A model by Parry and Kelly (1987) associates reduction techniques to degrees of sedentism; bifacial strategies are suited to mobile lifeways, while more "expedient", flake-oriented technologies can be used by relatively sedentary groups. If an increase in population growth around the time the bow appeared forced native groups to restrict the size of their foraging areas, a shift to the use of flake-based technologies may have been a way to overcome decreased access to obsidian sources rather than a response to the needs of arrow-point production.

This study, along with previous work on the Volcanic Tableland (Basgall and Giambastiani 1995), has clearly demonstrated a late Holocene shift in flaked stone technology involving the roles of bifaces and cores. Bifaces persist in Haiwee (1400-700 B.P.) and Marana (700-150 B.P.) assemblages, but combined technological and hydration data show a decline in biface frequency and changes in biface and core morphology. Speaking to hydration data, bifaces on the Tableland generally have Newberry-age rim readings. Sometime during the Haiwee period, the quantity of bifaces drops sharply relative to point blanks and formed flake tools. Early-stage bifaces, which are presumed to be spent bifacial cores or point preforms broken during manufacture, and middle-stage bifaces, most of which are thinned preforms, both persist through the temporal sequence. Late-stage bifaces, which are probably pieces of completed or near-finished projectile points, do not follow suit. This reflects the continued use of bifaces as cores and processing tools but the end of their utility as point preforms. The decline in biface use during Haiwee/Marana times is paralleled by a drop in biface thinning debris, suggesting that fewer bifaces were being manufactured.

Cores take on a greater variety of forms during the Haiwee period. In hydration data, bipolar cores are well represented in the smallest micron groups, being prominent while other core types are quite rare. The use of bipolar cores, all of which are quite small in size, could not have produced flakes large enough for use in making dart points or bifacial preforms. Bipolar flakes were certainly large enough to function as simple flake tools, and many were probably of sufficient size to manufacture small arrow points. It is notable that most bipolar cores were made from small obsidian nodules (from the Tableland) that would have been largely ignored by atlatl users; this is a good example of how arrow-makers exploited lithic resources that had been previously unused.

Other research has shown that simple flake tools become more important during Haiwee-Marana times as bifaces fade (Basgall and Giambastiani 1995; Delacorte et al. 1995; Delacorte and McGuire 1993). The present study did not incorporate simple flake tools into the hydration

program, but it appears that numbers of flake-based arrow point preforms (point blanks) jump radically during the Haiwee interval and peak in the Marana period. Initial work on the Tableland (Basgall and Giambastiani 1995:243) showed that flake tools increase relative to bifaces between Newberry (1:1.11) and Haiwee-Marana components (1:0.91). It was suggested that increased flake tool use may have compensated for the decline in biface production, the former taking on many of the light-duty processing tasks previously held by bifaces. At the same time, the greater emphasis on a relatively expedient flake tool technology probably means that Haiwee-Marana populations were less residentially mobile and had less frequent access to quality lithic sources.

This model of technological change on the Tableland is mirrored across the Inyo-Mono region. Delacorte et al. (1995:352) claim that the relative fraction of bifaces drops by over half after the Newberry interval (from 36% to 17%). Late components at Alabama Gates also show an increase in flake tools over bifaces of more than three-to-one from Newberry contexts (0.3:1 to 1.0:1). Newberry and Marana contexts at INY-30 show a comparable increase in flake tools to bifaces (obsidian) as on the Tableland, from about 1:1 to 1:0.77 (Basgall and McGuire 1988:214). Farther south around Owens Lake, Delacorte and McGuire (1993:284) noted a drop in bifaces versus other flaked stone tools from 1:2 to 1:4 in Newberry and Haiwee components; simple flake tools increased at the same time (1:2 to 1:1). Many other examples can be cited, but the consistency of these few underscores the repetitiveness of technological patterns in eastern California. The source of these changes must lie at least partly in the greater flexibility of arrow point technology.

Changes in Production Levels at Obsidian Quarries

The original argument for the existence of prehistoric obsidian exchange relations, as put forth by Ericson (1977, 1982), holds that the massive volumes of biface production debris seen at major obsidian quarries in eastern California far exceeded the needs of resident populations in the

region. The demands for obsidian by much larger populations in central California has often been cited as the impetus for the development of trans-Sierran exchange. Briefly, two possible scenarios have been considered. In the first, eastern Sierra groups prepared and traded obsidian packages to groups inhabiting the west slope of the mountains, who then passed on the raw material to consumers in the central valley. In the second, west Sierran groups procured their own obsidian by direct access, preparing and transporting the stone themselves for trade with central California groups. In both cases bifaces were the desired products, as these items were easily transported and could be fashioned into ceremonial blades or any number of utilitarian tools. It is argued that this exchange system primarily involved three obsidians, Bodie Hills, Casa Diablo, and Coso (Bouey and Basgall 1984; Elston and Zeier 1984; Ericson 1977, 1982; Singer and Ericson 1977; Gilreath and Hildebrandt 1995). At all three locations, intensive trade may have begun sometime around 3000 B.P. and appears to have terminated about 1000 years ago, with a cessation of biface production.

Many reasons have been advanced to explain the collapse of these supposed exchange networks (Bouey and Basgall 1984; Ericson 1982; Hall 1983; Ramos 2000). Perhaps the most credible is a sharp increase in settlement centralization evident throughout the Inyo-Mono region at the Newberry-Haiwee interface (Basgall and McGuire 1988; Bettinger 1989a; Delacorte and McGuire 1993; Delacorte et al. 1995; Gilreath and Hildebrandt 1995). Conventional wisdom suggests this change occurred primarily in response to growing population pressure in eastern California, and had the effect of restricting the area covered during seasonal subsistence rounds. This necessitated a more intensive use of resources within smaller foraging radii and thus led to a greater exercise of territorial control over certain resources, one of those being obsidian. Resulting complications within social networks in eastern California responsible for conveying obsidian products to the west may have been enough to disrupt the exchange system and force central California consumers to pursue obsidians from the North Coast Ranges instead.

Notwithstanding this scenario, one would still expect to see a decrease in quarry production at the bow-and-arrow transition if bifaces were critical to dart point manufacture but not necessary for the fabrication of arrow-points. One might not go so far as to agree with Ericson (1982:145-146), who suggests that obsidian producers "...changed their technology from biface production to blade-flake production" in an attempt to meet the *increased* raw material needs of arrow-point users in central California. However, there seems little doubt that, whether direct access or exchange production was the force driving biface production at all eastern California quarries, bifaces should cease to be a *necessary* element of projectile technology once the bow-and-arrow was adopted. There would simply be much less of a need for large bifacial preforms. Alternatively, Ramos (2000) has suggested that a post-Newberry decline in artiodactyl hunting decreased the value of bifaces as butchering tools, thus accounting for the drop in quarry production at Truman-Queen. In truth, it is difficult to see the rationale for this argument given that faunal data from the Inyo-Mono region do not reflect a decrease in artiodactyl hunting at the Newberry-Haiwee interface (Basgall and Giambastiani 1995; Basgall and McGuire 1988; Delacorte and McGuire 1993; Delacorte et al. 1995). On the Tableland, bifaces persist in post-Newberry assemblages, used as cores for flake blanks and as processing implements. Rather, it is a change in the point production technology of local consumers, in the context of shrinking settlement ranges and subsistence intensification, that accounts for the declines in quarry production seen at major obsidian sources in the eastern Sierra.

Initial Use of Previously Unexploited Obsidians

On a final note, the fact that arrow-points can be manufactured from a much smaller flake blank than dart points means that size requirements for raw toolstone packages are less stringent when selecting stone for arrow-points. All else being equal, a wider range of raw materials and manufacturing debris can serve to produce blanks for arrow-points than blanks for dart points.

Recalling discussions in Chapter Two, we know that there are many obsidian sources in eastern California and western Nevada that offer mostly diminutive cobbles and nodules (Pine Grove Hills, Garfield Hills, Aurora Crater [Fletcher], Saline Valley). Other sources, like certain exposures of Mono Craters glass, have formed relatively recently and may have been unavailable prior to arrow-point times (Hall 1983).

Without giving too much attention to this topic, it should merely be noted that certain obsidian sources may have gone largely unexploited by dart-point users simply because their raw materials were generally too small. This may be especially true for sources like Pine Grove Hills and Garfield Hills which are located fairly close to the much more substantial Mt. Hicks source. In addition to offering only small cobbles, the fact that some sources (like Saline Valley) are so geographically isolated may have further discouraged dart-point producers from exploiting certain obsidians. Not until lithic technological requirements were relaxed would these kinds of sources increase in relative value. The upshot is that one might not expect to see the regularized use of some obsidians until after the appearance of the bow-and-arrow. On the Tableland, the use of Saline Valley obsidian might fit these expectations had scavenging at a few sites not complicated matters.

IMPLICATIONS FOR LATE ADAPTIVE CHANGE ON THE VOLCANIC TABLELAND

Several different models have been advanced to explain apparent shifts in human adaptation during the late Holocene era in eastern California (Basgall and McGuire 1988; Bettinger 1994; Bettinger and Baumhoff 1982; Delacorte 1990; Delacorte et al. 1995; Gilreath and Hildebrandt 1995; Hall 1983; Yohe 1992). Most of these interpretations are in general agreement about the timing of inferred changes in aboriginal subsistence-settlement, but they are less consistent in their emphasis on causal factors that promoted adaptive shifts. Forces pertaining to regional population

growth, large-scale human migration, variation in degree of residential mobility and the size of settlement ranges, shifts in resource procurement targeting and strategies, eruptive volcanic events, and climatic fluctuations have all been charged with responsibility for inducing cultural change. It is within this framework of events and processes that the shifts in obsidian use noted during the present research must be interpreted. Aspects of technological variation on the Volcanic Tableland relate directly to long-term changes in technological adaptation throughout the Inyo-Mono region, while adjustments in obsidian source use are indicative of areal shifts in the various regional settlement systems that exploited Tableland environments during the last 8500 or so years.

Shifts in projectile technology at the dart-arrow transition likely contributed to changes in flaked stone reduction systems, but it was a context of increasing settlement centralization during the Haiwee period that must have ultimately forced stoneworkers to alter modes of obsidian procurement and tool production. The influence of long-term population growth in Owens Valley seems to have culminated sometime around 1400 B.P., resulting in several major shifts in aboriginal land-use patterns throughout the Inyo-Mono region. First, the use of specialized, logistical hunting camps waned and ultimately terminated. Second, the exploitation of pinyon pine nuts and dryland grass seeds became intensive, reflected by an increase in the establishment of specialized pinyon harvesting camps and bulk seed-processing sites, such as those on the Tableland. And third, substantial village occupations were initiated in alpine environments (above 3200 m) of the White Mountains. The geographic extent of these changes was extensive, indicating that groups across eastern California adopted new ways of using food resources and local environments. Evidently, however, not all regions witnessed the same degree of adaptive transformation, and though broadly similar, late prehistoric (post-A.D. 600) patterns of subsistence resource use and settlement mobility are also quite different in many areas.

Settlement and Mobility

Bettinger (1975, 1977, 1982a, 1982b, 1989a) has described late settlement adaptations in Owens Valley as having been residentially stable. Relatively large groups occupied lowland villages situated throughout the valley in proximity to the many streams emanating from Sierran slopes. These villages were inhabited on a semi-permanent or nearly fixed basis, of which one to several were organized into local territorial districts. Subsistence resources were obtained through daily excursions to district-owned resource areas (seed plots, irrigated lands, hunting zones, etc.) and via longer trips to harvest pinyon nuts from tracts located in the White Mountains. Only if the fall pinyon crops were large enough would groups move into the mountains to stock up on pine nuts for the winter months. Once common in Owens Valley, temporary (and residential) seed camps were not used during the late period.

This fairly pronounced degree of residential sedentism is not implied by archaeological evidence from other parts of eastern California. Delacorte (1990, 1991) indicates that late prehistoric adaptations in Deep Springs Valley oppose the Owens Valley pattern. Family-sized groups living in Deep Springs Valley for most of the year appear to have used a variety of environments, shifting between various short- and long-term residential locations. Lowland and alpine occupations sites might be inhabited for weeks or months at a time by one to several several families, while seasonal pinyon or seed camps might be occupied for several days or weeks by smaller family complements. As in Owens Valley, the use of temporary camps for resource procurement declined considerably as residential mobility increased but logistic mobility decreased. Delacorte (1990, 1991) also suggests that contemporaneous patterns in Fish Lake Valley might resemble something in between those described for Owens and Deep Springs valleys, given evidence that both semi-permanent lowland villages and short-term seed camps existed there. In the White Mountains, Bettinger (1990, 1991; Bettinger and Oglesby 1985) has argued that late prehistoric

land-use is characterized by the establishment of seasonally occupied alpine villages. It is suggested this strategy of intensive, extended habitation was used to target a range of plant and animal resources, being distinct from an earlier, "pre-village" adaptation that used the alpine environment on a short-term basis primarily for hunting. Late-period temporary camps are essentially non-existent compared to the quantity and variety of such sites attributed to previous temporal intervals. Groups living in Owens Valley, and perhaps also in Deep Springs Valley (Delacorte 1990), look to have adopted this pattern of alpine village use.

A slightly different land-use pattern emerges after A.D. 600 on the Volcanic Tableland. There is no evidence (archaeological or ethnographic) to suggest that the Tableland ever had a resident population as did neighboring Owens Valley. Still, there are many sites with substantial middens, rock ring dwelling foundations, and bedrock milling outcrops or non-portable milling equipment, these locations suggestive of at least a few weeks' occupation and/or regular visitation. As in other parts of the Inyo-Mono region, the use of temporary (hunting) camps seems to have been more or less abandoned, but there are many sites at which a brief episode of seed milling appears to have been the sole activity. In addition, many of the sites inhabited during the Newberry period were reoccupied during later times and used as seed milling loci (Basgall and Giambastiani 1995).

Project hydration data are particularly illuminating in this regard (Table 9.7). Revealing temporal trends in site use, rim readings are divided into the standard micron groups used throughout this document and listed as totals and percentages (indexed to 1.0) within site type classes. As a result, drastic differences emerge between certain site types. Hydration readings at Type 1 sites (simple flaked stone scatters) cluster primarily in the two largest micron groups, some 73% of all measurements being equal to or greater than 7.0 microns. At Type 2 sites (flaked and ground stone scatters), distributions are more even but are strongest in the 6.9-5.0 micron group and the 4.9-3.0 micron group (61% combined). Type 3 sites (residential camps) show a similar pattern, but have

TABLE 9.7. Hydration data from Tableland sites by micron group and site type.

	Type 1 Simple Lithic		Type 2 Complex Lithic		Type 3 Residential		Type 4 Milling Station		Type 5 Structure Only		Total
≥ 10.0 μm	55	(.25)	29	(.13)	77	(.07)	-	-	1	(.50)	162
9.9-7.0 μm	107	(.48)	44	(.19)	213	(.18)	2	(.18)	-	-	366
6.9-5.0 μm	21	(.10)	69	(.31)	296	(.26)	3	(.27)	1	(.50)	390
4.9-3.0μm	27	(.12)	68	(.30)	408	(.35)	2	(.18)	-	-	505
<3.0 μm	11	(.05)	16	(.07)	163	(.14)	4	(.37)	-	-	194
n (=1.0)	221		226		1157		11		2		1617

twice the number of rim readings as Type 2 sites in the <3.0 micron group. An even greater proportion of rim measurements exists in the <3.0 micron group at Type 4 sites (milling stations), and no artifacts had hydration rims larger than 9.9 microns.

One of the most significant patterns is the relative scarcity of hydration rims smaller than 3.0 microns at Type 1 and Type 2 sites. This probably testifies to a drop in use of temporary camps during the Marana period, a pattern recognized by Bettinger (1990, 1991), Delacorte (1990, 1991), and others throughout the Inyo-Mono region. Hydration data for Type 1 sites show a dramatic falloff in readings at the onset of the Newberry period, while Type 2 sites show a drop after the Haiwee interval. The inverse of this is a steady rise in the proportion of progressively smaller rim readings at Type 3 sites. Measurements at Type 3 sites peak during the Haiwee interval (4.9-3.0 microns) but still decline by more than half in the Marana period (<3.0 microns). From these data it appears that Type 1 sites were established primarily during pre-Newberry times, Type 2 and Type 3 sites were initiated and occupied mainly during Newberry and Haiwee periods, and Type 4 sites are largely a Marana-age phenomenon.

If different kinds of sites have even rough temporal signatures, project hydration data are probably also suggestive of site re-use. Hydration profiles for Type 1-3 sites show that all of the standard micron groups are present; this probably means at least some locations were often reinhabited at different times in the past. Many sites could have been occupied for different purposes as well, short-term hunting camps being used later as residential bases, or vice-versa. At individual sites, this kind of reuse can produce the broad hydration ranges seen at Type 1-3 sites in the project sample. The process of artifact scavenging, however, can introduce younger artifacts to an old deposit or older artifacts to a younger deposit. It may also add smaller, secondary hydration rims to old artifacts or entirely remove primary rims through tool rejuvenation and reshaping. However, this does not appear to have been a major activity at every site on the Tableland, and it is likely that site type hydration profiles are more representative of site reuse than scavenging (but see Basgall and Giambastiani 1995, site MNO-2465).

To explore this further, hydration data from select Type 3 and Type 1 sites can be used to demonstrate the potential effects of site reuse. Table 9.8 presents distributions of rim readings by micron group for excavated Type 3 and Type 1 sites (Basgall and Giambastiani 1995; this study). Based on a variety of data, the occupational histories for most of the Type 3 sites are well-known. Several yielded diagnostic artifacts (points, beads, pottery) that reflect long use-histories (MNO-1992, MNO-2189, MNO-2190; FS14D-1, FS10B-2), all have midden deposits, and some have rock house constructions and/or bedrock threshing floors (MNO-1992, MNO-2189, MNO-2190, MNO-2465). Because these sites were obviously inhabited over the course of a few millennia, it is not surprising that their hydration profiles show widespread distributions of rim readings. There are peaks in each profile that may indicate major periods of occupation, but the evidence seems to depict site reuse over a long period of time. At the other Type 3 sites, the presence of multiple discrete components is suspected given that most hydration readings are partitioned into two micron groups.

TABLE 9.8. Hydration data from excavated Type 3 and Type 1 sites by micron group.

	≥10.0 μm	9.9-7.0 μm	6.9-5.0 μm	4.9-3.0 μm	<3.0 μm	n (=1.0)
Type 3 Sites						
MNO-1992	19 (.16)	54 (.46)	15 (.13)	23 (.20)	6 (.05)	117
MNO-2189	-	24 (.27)	43 (.49)	11 (.13)	10 (.11)	88
MNO-2190	2 (.01)	14 (.09)	27 (.18)	77 (.51)	32 (.21)	152
MNO-2465	-	2 (.03)	6 (.10)	27 (.43)	28 (.44)	63
533	5 (.15)	8 (.24)	9 (.26)	12 (.35)	-	34
FS14D-1	4 (.09)	9 (.21)	12 (.27)	12 (.27)	7 (.16)	44
FS14C-1	-	6 (.14)	23 (.52)	13 (.30)	2 (.04)	44
FS10B-2	-	10 (.11)	56 (.63)	19 (.21)	4 (.05)	89
FS12C-2	1 (.07)	5 (.36)	1 (.07)	6 (.43)	1 (.07)	14
Type 1 Sites						
FS14C-2	4 (.19)	10 (.48)	7 (.33)	-	-	21
FS18C-2	5 (.33)	9 (.60)	-	1 (.07)	-	15
FS18D-1	9 (.50)	8 (.44)	1 (.06)	-	-	18
FS20C-1	10 (.53)	8 (.42)	1 (.05)	-	-	19
FS22B-1	9 (.56)	7 (.43)	-	-	-	16
FS22C-1	5 (.20)	15 (.80)	-	-	-	20

Except for MNO-2465 and MNO-1992, all of these locations have hydration peaks in the 3.0-4.9 or 5.0-6.9 micron groups, presumably indicating periods of more intensive or regular occupation. Setting aside the effects of artifact scavenging, the patterns in these site profiles are likely the result of successive re-occupation. Site MNO-2465 is the only exception, being a late-period residence where a variety of scavenged, older items were imported and redeposited (see Basgall and Giambastiani 1995). In contrast, Type 1 sites appear to have shorter, more discrete use histories. Hydration samples are much smaller than for Type 3 sites, but rim readings obviously cluster to the early end of the hydration range. This is expected, given that all of the sites lie along Fish Slough where older cultural deposits are common, but it is interesting that these locations do not seem to have been reused during the late Holocene.

Late Holocene Subsistence Intensification

Judging by hydration data, the dry plateau of the Tableland was surely the main target of Haiwee period occupations. Beginning sometime in the Newberry period, and showing a drastic change at the Newberry/Haiwee interface, occupations shift away from Fish Slough and up onto the plateau (Table 9.9). Rim readings for debitage at Slough and Plateau sites show highly opposed distributions. At Slough sites, most readings (40%) are between 9.9-7.0 microns, with a substantial portion also being ≥10.0 microns (23%). Both the 6.0-4.9 and 4.9-3.0 micron groups contain moderate numbers of readings, but few measurements (3%) are <3.0 microns. A much different pattern is seen for Plateau sites, where most readings are between 4.9-3.0 microns (34%) or 6.9-5.0 microns (28%), a significantly greater proportion are <3.0 microns (13%), and relatively few are between 9.9-7.0 microns or ≥10.0 microns (25% combined). Distributions for bifaces are comparable, showing a prevalence of bifaces at Slough sites in the 6.9-5.0 micron group (arguably the Newberry period) and a peak in bifaces at Plateau sites in the 4.9-3.0 micron group (the Haiwee interval). While the data are biased to some extent by the selected study of several older sites at Fish Slough, the patterns here are unmistakable. Early use of the Tableland was focused on the Fish Slough valley, probably up until early Newberry times (~3200-3000 B.P.), and afterward an increase in the use of plateau environments peaked during the Haiwee interval and continued through Marana times. Taking into account the kinds of wetland resources available at Fish Slough, and the quite different offerings of the Tableland plateau, this shift can only represent a major subsistence intensification toward the recovery of what the Plateau mainly provides - a variety of seed-bearing plants. An adaptive move toward greater specialization in plant food exploitation, combined with effective decreases in residential mobility and foraging radii, is a trend recognized throughout the Inyo-Mono region during the late Holocene.

TABLE 9.9. Hydration profiles for debitage and bifaces at Slough and Plateau sites.

	DEBITAGE				BIFACES			
	Slough (21 sites)		Plateau (48 sites)		Slough (14 sites)		Plateau (52 sites)	
	Num	%	Num	%	Num	%	Num	%
≥ 10.0 μm	74	.23	30	.06	5	.08	8	.05
9.9-7.0 μm	126	.40	90	.19	12	.18	20	.13
6.9-5.0 μm	51	.16	133	.28	27	.40	42	.27
4.9-3.0μm	56	.18	165	.34	19	.28	78	.50
<3.0 μm	8	.03	65	.13	4	.06	7	.05
Totals	315	(1.0)	483	(1.0)	67	(1.0)	155	(1.0)

Note: Num, number; %, percentage indexed to 1.0.

Basgall (Basgall and Giambastiani 1995) first noted the intensification of subsistence practices on the Volcanic Tableland. The most obvious signature of this change is the appearance of "threshing floors", bedrock surfaces used to process seed grasses in bulk either through the "flash-burn" technique or simply mechanically. Few of these sites are located in the vicinity of Fish Slough, due in part to the rarity of bedrock surfaces along the slough margins, but even on the terraces above the slough they are not particularly abundant. Not surprisingly, sites with threshing floors also have a decidedly late hydration signature (Table 9.10). Considering all hydration readings from Plateau sites with threshing floors, the bulk of micron values is clearly weighted to later temporal periods. In both artifact categories, rim readings are most common in the 4.9-3.0 micron group, which basically represents the Haiwee period (1350-650 B.P.). Also apparent are fairly broad hydration ranges for sites with threshing floors; this was discussed earlier, but it seems evident that at least some threshing floors were established at existing sites containing older obsidian artifacts (see Basgall and Giambastiani 1995).

TABLE 9.10. Hydration profiles for Plateau sites with threshing floors.

	All Artifacts (28 sites)		Debitage Only (13 sites)	
	Num	%	Num	%
≥ 10.0 μm	17	.04	5	.03
9.9-7.0 μm	42	.10	18	.13
6.9-5.0 μm	86	.20	40	.28
4.9-3.0μm	196	.47	55	.39
<3.0 μm	81	.19	25	.17
Totals	422	(1.0)	143	(1.0)

Note: Num, number; %, percentage indexed to 1.0.

Somewhat confounding in Table 9.9 and in Table 9.10 is a serious drop in proportions of rim readings smaller than 3.0 microns. This implies that Marana period occupations were not especially frequent on the Tableland, though this is clearly not so. At Fish Slough, sites like MNO-6, MNO-1992, and 14D-1 show undeniable evidence of Marana use (beads, pottery, Desert series points; freshwater mussel detritus), and on the Plateau sites like MNO-2189 and MNO-2190 contain aboriginal house rings that most likely date to post-600 B.P. times (Basgall and Giambastiani 1995). Project hydration databases certainly have good numbers of rim readings, but as it happens many of these readings are on arrow-size projectile points (see Table 8.17). The dearth of Marana-age debitage, as most clearly implied in Table 9.9, could have something to do with scavenging behavior. As noted at site MNO-2465 (where, incidentally, threshing floors are abundant), there are sites on the Tableland where Marana occupants took advantage of previous artifact deposits, particularly in the use of flake tools (Chapter Eight here; Basgall and Giambastiani 1995). This cannot be the sole explanation, however, and it is tempting to consider that Marana occupations simply were less reliant upon obsidian use than earlier habitations. A focus on seed grass

procurement rather than tool manufacturing at Marana sites would be consistent with this premise, as would the production of relatively little debitage in making small, Desert series points (Basgall and Giambastiani 1995).

Chapter Ten

PREHISTORIC SETTLEMENT PATTERNS IN EASTERN CALIFORNIA

Having reviewed significant changes in obsidian use and flaked stone technology on the Volcanic Tableland, and examined their local and regional ramifications, we can finally move on to how project data can be used to model prehistoric settlement patterns in eastern California. This is essentially the culmination of the present research, a projection of what the areal boundaries of past regional settlement systems may have looked like in relation to the Volcanic Tableland. Generally, the assumptions held in the following discussions derive from studies of lithic procurement strategies, of the organization of flaked stone technology, and of the processes of lithic assemblage formation. Also critical to forthcoming arguments is the context of long-term prehistoric adaptive change and late period trans-Sierran trade relationships, though the latter must receive less emphasis as they are less pertinent to activities on the Volcanic Tableland and the geographic areas to which it was affiliated.

Modes of obsidian procurement, use, and discard on the Volcanic Tableland have far-reaching implications for how this area was occupied by populations centered in surrounding regions. The Tableland appears never to have had a resident population, and at best probably saw only moderate levels of early Holocene use at Fish Slough and late Holocene occupations at the slough and across the dry plateau. The longest episodes of continuous use at any one location were probably on the order of two to three weeks, with most encampments being inhabited for much shorter periods of time. Still, it is clear that groups coming from across eastern California and western Nevada visited the Tableland during seasonal and/or annual settlement rounds. Obsidian source and flaked stone analysis data provide the only real clues to where these people had been

prior to venturing onto the tableland and how recently they had visited different obsidian source locations during their journeys. Projectile point and obsidian hydration data are indicative of when various waves of habitation occurred during the last 8000-8500 years.

REGIONAL CONTEXT OF OBSIDIAN USE

Stepping back from the Tableland, one must try to envision a regional landscape where prehistoric people ranged over vast distances in search of food, water, mates, and a variety of social interactions. At the beginning of the Holocene, population densities in the Great Basin were much lower than they were at the time of Euroamerican contact. Archaeological sites older than 8000 years are rare, and though many have surely been lost to depositional processes or decomposition, and others overlooked by surveys that have failed to include ancient landforms, the scarcity of early sites is probably also indicative of lower population sizes during the early Holocene. With plenty of room to move when resources dwindled in a given area, or to take advantage of seasonal abundances, early Holocene populations were free to pursue a life of high mobility, shifting residence frequently within an arid environment characterized by a patchy subsistence resource base. Individual families or small groups of families appear to have traveled hundreds of miles during the course of a single year, establishing camps in lacustrine settings and a variety of other habitats.

Middle Holocene populations were able to move across the landscape with much the same freedom as earlier groups, though there is evidence that after about 5000 years ago their residential movements may have become more regularized in some parts of the Great Basin, particularly in eastern California. Rather than practicing a wide-ranging, relatively unpatterned settlement strategy as did their predecessors, populations in place during the middle Holocene look to have gradually altered their settlement adaptation to involve fewer residential shifts between a series of distant,

seasonal base camps. These camps may have been revisited on an annual basis or every few years, depending upon the productivity of subsistence resources in the vicinity. Lithic assemblages with full complements of milling tools imply that, by as early as 7500 B.P., human groups were "mapping on" to vegetal resources and associated habitats more regularly than before. By about 3000 B.P., there is evidence that aboriginal groups across the Great Basin were beginning to settle into even more consistent patterns of residential mobility and resource procurement. Domestic structures, like houses and storage facilities, begin to emerge with some regularity, and many residential occupations at the end of the middle Holocene produced well-developed organic middens. While groups still traveled great distances during seasonal moves, resulting base camps were probably occupied for much longer durations by increasingly larger groups.

By all accounts this situation changed significantly during the late Holocene, sometime after about 2000 B.P. Sites dating to this period increase greatly in number and occur in an expanded range of environments and landscape contexts. Presumably, the rise in site frequency is not simply a factor of preservation but represents a substantial increase in population levels. Fostering this change or occurring in response to it, a basin-wide pattern of subsistence "intensification" developed that introduced more labor-intensive methods of food exploitation. For example, what Bettinger (1994) refers to as "green phase procurement" were tactics used to obtain pine nuts and seed grasses that involved their collection prior to fully ripened state. Green pinyon cones were roasted whole until the nuts were cooked and cones opened, while immature seed grasses were taken in mass quantities, flash-burned to remove chaff, and milled in bulk on bedrock grinding surfaces or on portable stone slabs. These efforts allowed consumers to extend the natural harvest periods for these resources and prepare large quantities of food for winter storage. It is surmised that, along with increased population levels and heightened resource competition, the use of intensive procurement strategies resulted in an even further decline in residential mobility. Groups in the western Great

Basin never became fully sedentary (i.e., living year-round in one location), but people in Owens Valley developed a yearly subsistence round that was basically polarized between spring-summer and fall-winter camps.

These long-term shifts in settlement patterns are demonstrated by archaeological evidence throughout the Inyo-Mono region. Hall (1983) provides a synthesis of such patterns for Long Valley and the Mono Basin. Bettinger (1975, 1977, 1989a) has developed many of the basic tenets currently held for Owens Valley and for eastern California in general, while Basgall and Giambastiani (1995) and Delacorte (1990) have also contributed to the understanding of adaptive changes in the Owens Valley region. Other studies in southern Owens Valley and at even lower latitudes have revealed evidence of long-term adaptive shifts in the Coso region, the most notable of these being work by Basgall (1989) and Basgall and McGuire at INY-30 (1988), by Gilreath and Hildebrandt at the Coso Volcanic Field (1995), by Delacorte in Deep Springs Valley (1990) and in two interpretive summaries of the Owens Valley/Coso area (1991, n.d.). All of these studies show the same basic, late-period changes in land-use patterns involving subsistence intensification and increasing population circumscription.

Settlement data from central-western Nevada, north of the Mono Basin, are generally consistent with patterns seen in Owens Valley. Regional overviews by Elston (1982, 1986), Grayson (1993), Pendleton et al. (1982), and Thomas (1982) portray aboriginal settlement patterns as comparable to those recognized in eastern California. Thomas' (1985) re-examination of Hidden Cave provides an important background for more recent interpretations of regional patterns. Rhode (1990) has completed a settlement study in the Walker Lake watershed, and there is a host of information available from the Carson Sink-Stillwater Marsh region (Kelly 1990; Raven and Elston 1989; Raven 1994). Delacorte (1997) provides a current outline of long-term change in western Nevada settlement systems based on the results of research in the Pah Rah Uplands outside Reno.

While a number of broad similarities do exist between prehistoric adaptations in eastern California and in western Nevada, Owens Valley was somewhat of an anomaly in the western Great Basin. The semi-sedentary ethnographic pattern documented by Steward (1933, 1938), which was probably a post-contact phenomenon, was quite different from the dispersive settlement modes practiced in surrounding regions at the same time. Among many examples are Deep Springs Valley and the Coso region, two locations where Haiwee and Marana-period settlement regimes were more fluid and less geographically restricted than those in Owens Valley. Changes occurring in Owens Valley also seem to have had little influence on use of the Volcanic Tableland, as late prehistoric groups in the valley only went there for spring and summer seed grass harvests.

It is possible that a discrepancy existed between settlement patterns centered in Owens Valley and in other locations prior to Euroamerican contact. Evidence points to the onset of logistically-oriented settlement modes in Owens Valley by at least A.D. 600, and perhaps as early as 1200 B.C. (Bettinger 1975, 1977, 1982a, 1989a; Delacorte 1991, n.d.). This timing would place the inception of large lowland occupation sites in Owens Valley well ahead of similar adaptations in outlying areas (e.g., Deep Springs Valley, Coso) and would set Owens Valley apart from areas where such changes may have never occurred (e.g., Long Valley). As Delacorte (1990:366) has aptly noted, adaptations in the western Great Basin "...exhibit marked variations through time and across space in response to differences in demography and environment." The prehistory of the Inyo-Mono region is no exception.

Obsidian data sets from the western Great Basin are particularly compelling, showing geographic and temporal variations in the distributions and relative proportions of different glass sources. Following Basgall (1989) and others (Basgall and McGuire 1988; Delacorte and McGuire 1993; Delacorte et al. 1995), it has been shown that obsidian use patterns can play a crucial role in establishing the spatial and temporal parameters of regional settlement systems in a given area. In

doing this for the Volcanic Tableland, the first task is to compare its source profiles with those from surrounding regions to outline the basic spatial distributions of major obsidians. In Table 10.1, obsidian source distributions are presented for 14 major archaeological localities throughout the western Great Basin, both glass types (left to right) and locations (top to bottom) being organized geographically from north to south. Mt. Majuba/Majuba Canyon, Garfield Hills, and Fortymile Wash sources have not been discussed in this document, as they fail to occur on the Tableland, but have been included here to round out profiles for several places. Items in the "Other/Unknown" category represent both known and unknown sources. At Rye Patch Reservoir, known glasses placed in the "other" category include sources from northeast California (Cow Head Lake) and Nevada (Summit Lake, White Rock Canyon), and at the Pah Rah uplands they constitute mainly Nevada sources (Sutro Springs, Bordwell Springs, Patrick, and others). At Hidden Cave and Gatecliff Shelter, known "others" include a few Nevada sources (Box Spring, Crow Spring, Homecamp "A" and Homecamp "C" [see Hughes 1983a, 1985a]). The White Mountains profile includes one piece of Silver Peak and the Papoose Flat profile contains one piece of Montezuma Range glass. "Other" sources in the Pahute Mesa sample include Obsidian Butte, Split Ridge/Pahute Mesa, and Silent Canyon, all located in southwestern Nevada. For the most part, though, the Other/Unknown category represents many unknown sources that did not match the chemical signatures of known obsidian sources when these various studies were completed. Most of these are probably of eastern (Nevada) or far northern origin (northeast California and northern Nevada), glasses that would not regularly figure into obsidian source studies in eastern California.

Looking at source distributions overall, there is a general tendency for each location to have its nearest obsidian represented in greatest proportion. This is certainly the case for places far to the north, Rye Patch Reservoir showing affinity to the Mt. Majuba area and the Pah Rah Uplands having

TABLE 10.1. Archaeological representation of major obsidian sources for select locations in the western Great Basin.

	← NORTH											SOUTH →	
	Majuba Mtn/Can	Garfield Hills	Bodie/Pine Grove	Mt. Hicks	Truman-Queen	Mono	Casa Diablo	Fish Springs	Saline/ Queen Imp	Coso	Fortymile Wash	Other/ Unknown	Total
←NORTH/EAST													
Rye Patch Reservoir [1]	121	-	36	-	-	-	3	-	-	1	-	34	195
Pah Rah Uplands [2]	-	-	11	7	-	1	-	-	-	-	-	94	113
Hidden Cave [3]	26	8	33	60	13	-	1	-	-	-	-	12	153
Gatecliff Shelter [4]	-	-	2	-	23	-	1	-	-	-	-	28	54
Dry Lakes Plateau [5]	-	3	41	43	9	-	3	-	-	-	-	-	99
Long Valley, CA [6]	-	-	3	6	15	53	658	-	-	-	-	-	735
Volcanic Tableland	-	-	23	280	5183	585	1861	142	259	9	-	-	8342
Fish Lake Valley [7]	na	na	na	na	244	na	4	na	na	na	-	na	248
White Mountains [7]	1	-	1	3	51	10	28	-	-	-	-	11	105
Papoose Flat [8]	-	-	-	-	20	-	9	38	13	12	-	7	99
Alabama Gates [9]	-	-	3	6	8	33	128	307	10	578	-	37	1110
Blackrock[10]	-	-	-	2	21	9	18	110	36	23	-	6	225
Independence[11]	-	-	-	-	9	4	11	203	35	26	-	13	301
CA-INY-30 [12]	-	-	2	-	11	3	39	14	22	301	-	15	407
Contel [13]	-	-	1	6	2	6	15	146	7	306	-	8	497
Pahute Mesa [14]	-	-	-	1	2	-	1	-	3	1	60	150	218
Total	148	11	156	412	5581	691	2751	647	314	1208	60	396	12307
←SOUTH/EAST													

Note: [1] Data from Rusco and Davis 1987; [2] Data from Delacorte 1997; [3] Hughes 1985a; [4] Thomas 1983; [5] Halford 1998; [6] R. Jackson 1985; [7] Delacorte 1990; [8] Reynolds 1996; [9] Delacorte et al. 1995; [10] (ARC Only) Zeanah and Leigh 2002; [11] Basgall and Delacorte 2003; [12] Basgall 1989; [13] Delacorte and McGuire 1993; [14] Pippin 1995.

an abundance (46%) of Sutro Springs glass (Delacorte 1997:136). The same pattern is evident in the northern sector of the Inyo-Mono region (Dry Lakes Plateau, Long Valley, Volcanic Tableland, White Mountains, Papoose Flat), locations there dominated by either Bodie or Mr. Hicks, Casa Diablo, or Truman-Queen, and for locations in southern Inyo County (Alabama Gates, Blackrock, Independence, CA-INY-30, Contel) where Fish Springs and Coso obsidians are generally dominant. Locations in western Nevada (Hidden Cave, Gatecliff Shelter), however, show a surprising amount of Mono Basin obsidians, considering the proximity of the Majuba Mtn. source to Hidden Cave (Hughes 1985a) and of Box Spring, White Rock Canyon, and Crow Spring sources to Gatecliff Shelter (Thomas 1983). At Hidden Cave, obsidian from nearby Majuba Mtn. (130 km northwest) is swamped by glasses from the much more distant Mono Basin (about 200 km southwest). Mt. Hicks is the most dominant of all glasses, comprising some 39% of sourced items, while Mono Basin glasses together (Bodie Hills, Mt. Hicks, Truman-Queen, Casa Diablo) account for 70% of all sourced obsidian at Hidden Cave. Clearly, the obsidian profile at this site is heavily biased to southern obsidians rather than the nearest source.

A comparable pattern is evident at Gatecliff Shelter (Hughes 1983a; Thomas 1983). The Box Spring source lies on the east flank of Monitor Valley opposite the shelter, and the White Rock Canyon source is located at the south end of the valley, yet neither of these obsidians were exploited to any great degree by occupants of Gatecliff. Thomas (1983:394-395) indicates, however, that both of these obsidian sources are dispersed float deposits offering only nodules of extremely limited size (<5 cm diameter); thus, it is understandable that these obsidians were largely ignored. In contrast, the Crow Spring locality some 115 km southwest of the site provides "decidedly superior" obsidian relative to the previous sources (Thomas 1983:395). Considering its relative proximity to Gatecliff, and its better quality than Monitor Valley sources, one might expect Crow Spring to occur in substantial amounts. This is not the case, as only two pieces of Crow Spring were identified as

opposed to almost two dozen pieces of Truman-Queen. Indeed, nearly half (48%) of all obsidian subjected to XRF from Gatecliff Shelter derives from Mono Basin sources.

Spatial and Temporal Distribution of Truman-Queen Obsidian

Notwithstanding the fact that all major Mono Basin obsidians occur on the Volcanic Tableland, the disposition of Truman-Queen obsidian is paramount to discussions of settlement in this region. As shown in Table 10.1, the Volcanic Tableland hosts by far the greatest fraction of Truman-Queen obsidian of any major archaeological locality yet investigated in the western Great Basin. Even within the Inyo-Mono region, Truman-Queen obsidian is restricted primarily to the Volcanic Tableland with a limited distribution to the south and north. Because the Volcanic Tableland is relatively closer to the Truman-Queen source than any of the locations shown in Table 10.1, this distribution is expectable. However, this fact alone cannot explain the prevalence of Truman-Queen obsidian on the Volcanic Tableland, as obsidians from Mono Glass Mountain, Casa Diablo, and Fish Springs are actually of lesser or equal distances from the project area.

Looking south of the Tableland in Owens Valley, modest samples of Truman-Queen were found outside of Bishop at INY-1386 (Bouscaren 1985) and at several sites along Bishop Creek (York 1988), with small amounts found near Big Pine at INY-2146 (Bettinger et al. 1984a; Garfinkel 1980) and a few pieces from Manzanar (Gilreath and Nelson 1999), Blackrock (Zeanah and Leigh 2002), Independence (Basgall and Delacorte 2003), and INY-30 (Basgall and McGuire 1988). Beyond these places, Truman-Queen artifacts have not been found in any significant numbers within Owens Valley. Delacorte (1990) attests to a prevalence of Truman-Queen glass in the White Mountains, and predicts its abundance in Fish Lake and Deep Springs Valleys. Reynolds (1996) notes a substantial amount of Truman-Queen at Papoose Flat in the southern part of the White-Inyo Range.

To the north, the distribution of Truman-Queen obsidian is noticeably greater. Northeast of the Tableland, Benton and Hammil Valleys are loaded with Truman-Queen obsidian (Halford 1997), and Hall (1990) found an abundance of it in the nearby southern Benton Range and adjacent Adobe Valley. Also, both R. Jackson (1985) and Hall (1983) recovered substantial quantities of Truman-Queen artifacts from sites in Long Valley. Several locations in the Mono Basin have also yielded samples of Truman-Queen artifacts, MNO-446 (Bettinger 1981), MNO-2122 (Arkush 1995), and MNO-473 and MNO-474 in Mono Valley (Hall 1990). Halford (1998) also identified a small amount of Truman-Queen obsidian on the Dry Lakes Plateau in the Bodie Hills. General trends indicated by these occurrences are substantiated by results of the Caltrans Transportation Enhancement Authority (TEA) highway surveys throughout Inyo and Mono counties (Richman and Basgall 1998). The TEA data show that Truman-Queen glass has a limited radius of distribution in eastern California, being extremely prevalent along U.S. Highway 6 at least to the California-Nevada stateline but minimally present in the Mono Basin and Long Valley. According to Hughes (1983a), there is scant evidence that Truman-Queen obsidian was ever transported across the Sierra Nevada (Hughes 1981; Jack 1976; T. Jackson 1974). Arguments for the nature of production at the Truman-Queen quarries (Ramos 2000) would concur with this position.

Moving eastward into Nevada, there are many archaeological sites with samples of Truman-Queen obsidian. Hall (1990) indicates that twelve sites in the Anchorite Hills appear to have consistent and sometimes large quantities of Truman-Queen glass. Samples of sourced artifacts from Hidden Cave and Gatecliff Shelter both have notable portions of Truman-Queen obsidian, the former 8%, the latter 43%. Although the source sample from Gatecliff is small (54 pieces, mostly debitage), it is significant that other non-local obsidians derive from the Mono Basin (Bodie Hills) and locations to the southwest (Crow Spring); this lends further support to a pattern of southwest-northeast interaction between Gatecliff and the Mono Basin area. The fraction of Truman-Queen

glass at Gatecliff also compares favorably with shares in the much larger Tableland sample (62%) and in the sample from the White Mountains (49%). Adding Delacorte's (1990) note that Truman-Queen is abundant in Fish Lake Valley (98% vs. 2% Casa Diablo), these consistencies imply that the spread of this obsidian into Nevada was significant, extending at least 230 km to the north (Hidden Cave) and 185 km to the northeast (Gatecliff Shelter). Its southeast distribution may have extended well over 75 km into the southern White Mountains, Deep Springs Valley, and southern Fish Lake Valley.

At present, it is not known exactly how far north, east, or southeast Truman-Queen obsidian actually spread. One piece of Truman-Queen is reported by Delacorte (1997) from the Honey Lake Basin in northeast California, but none was recovered from the Pah Rah Range farther south. The occurrence of Truman-Queen obsidian in the Lake Tahoe area is still unknown. It apparently does not occur at Rye Patch Reservoir, along the Humboldt River, though other Mono Basin obsidians are present (Rusco and Davis 1987), and it is not reported from James Creek Shelter north of the Humboldt drainage (Elston and Budy 1990). Thomas (1988) found very little obsidian at Monitor Valley sites other than Gatecliff, and provides no source data for these studies. The reliance on chert and other non-obsidian materials at many of Thomas' sites, however, along with the absence of southern (Silver Peak, Montezuma Range, Dry Valley) or northern Nevada obsidians (Paradise Valley, Brown's Bench, Butte Mountain) at Gatecliff implies that glasses other than local pebble sources like Box Spring or White Rock Canyon were hard to come by in that part of central Nevada. Perhaps the largest void in our knowledge of Truman-Queen distribution is the area east of Fish Lake Valley in the vicinity of the Silver Peak and Montezuma Range obsidian sources. In California, detailed source studies in places like Deep Springs Valley, Saline Valley, or Death Valley could eventually shed light on the occurrence of Truman-Queen obsidian east of the Owens Valley trough.

Turning to the use and distribution of Truman-Queen obsidian across the Inyo-Mono region, the spatial bias seen in the relative abundance of this obsidian north and south of the Tableland is also marked by a temporal disjunction. This time difference can be easily shown by comparing distributions of XRF-sourced Truman-Queen projectile points in project samples north and south of the Tableland (Table 10.2). In both groups, locations are arranged from north to south. In the North Group, the Oxbow Corridor (Hall 1990) and Benton Valley (Halford 1998) samples are nearest to the Truman-Queen source, and the Ed Powers (Basgall et al. 2003) sample derives from sites adjacent to the Tableland in southern Round Valley; in the South Group, the Papoose Flat (Reynolds 1996) sample comes from the southern White Mountains while all others are from southern Owens Valley. For each point series, the number of Truman-Queen specimens and the total within that series are provided, along with the relative proportion of Truman-Queen in that series (percentages indexed to 1.0). There are a few important differences to note between the two groups of samples. In the North Group, the relative proportion of Truman-Queen in each project sample is fairly robust, ranging from 11% to 67% and averaging 33% overall. Overall, Truman-Queen obsidian is well-represented in all point series. It is common among Pinto and Great Basin Concave Base/Stemmed points, particularly in the Tableland sample where roughly a third of all Pinto and GBCB/Stemmed points are of Truman-Queen glass, and it is especially prevalent among Elko and more recent types. However, projects located well north of the Tableland and the obsidian source (Dry Lakes Plateau, Mammoth Lakes, Long Valley) have smaller portions of Truman-Queen, particularly in Rosegate and Desert series samples. The opposite is seen in samples nearer the Tableland and the Truman-Queen source, where portions drop from early dart points but increase dramatically among arrow points. Again, the Tableland sample is the exception, where proportions of Truman-Queen are strong among all point types.

TABLE 10.2. Totals and proportions of diagnostic Truman-Queen projectile points by project location relative to the Volcanic Tableland.

	DSRT		RSGT		HUMB		ELKO		FISH		PINT		GB/ST		Total	
	n/N	%	n/N	%	n/N	%	n/N	%	n/N	%	n/N	%	n/N	%	n/N	%
North Group																
Dry Lakes Plateau [1]	0/2	.00	0/10	.00	0/4	.00	2/16	.13	1/4	.25	1/9	.11	½	.50	5/47	.11
Mammoth Lakes [2]	0/0	--	0/0	--	4/19	.21	4/23	.18	0/0	--	1/5	.20	2/5	.40	11/52	.21
Long Valley, CA [3]	0/8	.00	6/12	.50	2/12	.17	7/27	.26	0/0	--	1/6	.17	1/20	.05	17/85	.20
Oxbow Corridor [4]	13/15	.87	6/9	.67	0/1	.00	5/7	.71	0/0	--	½	.50	2/16	.13	27/50	.54
Benton Valley [5]	9/13	.69	3/5	.60	½	.50	1/1	1.0	0/0	--	0/0	--	0/0	--	14/21	.67
Volcanic Tableland	24/72	.33	31/93	.33	9/29	.31	58/149	.39	20/38	.53	10/34	.29	5/15	.33	157/430	.37
Ed Powers [6]	2/10	.20	8/30	.27	8/27	.30	7/26	.27	0/0	--	0/0	--	0/1	.00	25/94	.27
Total	48/120	.40	54/159	.34	24/94	.26	84/249	.34	21/42	.50	14/56	.25	11/59	.19	256/779	.33
South Group																
Papoose Flat [7]	2/16	.13	4/28	.14	4/17	.24	9/25	.36	0/0	--	1/14	.07	0/0	--	20/100	.20
Alabama Gates [8]	0/23	.00	0/21	.00	2/8	.25	1/10	.10	0/0	--	1/19	.05	1/6	.17	5/87	.05
Independence [9]	2/45	.04	2/14	.14	0/3	.00	0/2	.00	0/0	--	0/0	--	0/1	.00	4/65	.06
Blackrock [10]	1/25	.04	0/18	.00	4/15	.27	3/22	.14	0/1	.00	0/9	.00	0/1	.00	8/91	.09
CA-INY-30 [11]	1/52	.01	0/16	.00	2/17	.12	3/9	.33	0/0	--	0/3	.00	0/2	.00	6/99	.06
Contel [12]	2/18	.11	2/18	.11	2/11	.18	3/21	.14	0/0	--	0/2	.00	0/4	.00	9/74	.12
Total	8/179	.04	8/115	.06	14/61	.23	19/89	.21	0/1	.00	2/47	.04	1/14	.07	52/506	.10

Note: DSRT, Desert series; RSGT, Rosegate series; HUMB, Humboldt series; ELKO, Elko, Gatecliff, and "Little Lake" Series; FISH, Fish Slough Side-notched points; PINT, Pinto series; GB/ST, Great Basin Concave Base and Stemmed series; n/N, sample/series totals; %, relative proportion in series; [1] Halford 1998; [2] MNO-651 (Hall 1983); [3] R. Jackson 1985; [4] Hall 1990; [5] Halford 1997; [6] Basgall et al. 2003; [7] Reynolds 1996; [8] Delacorte et al. 1995; [9] Basgall and Delacorte 2003; [10] (ARC Only) Zeanah and Leigh 2002; [11] Basgall and McGuire 1988; [12] Delacorte and McGuire 1993.

Totally different patterns emerge in the South Group. Truman-Queen obsidian is relatively rare, accounting for only 5-20% of points in each project sample and averaging only 10% overall. Its overall proportions are low in all point series but are greatest among Elko and Humboldt points, where it makes up about a fifth of all points, but is extremely scarce among older and younger point types. Most striking is the difference in Rosegate and Desert series classes, Truman-Queen virtually dropping out of all South Group project samples. There are probably more forceful ways to portray this pattern, but it is still evident that Truman-Queen obsidian failed to reach southern Owens Valley in any numbers, and that it hardly got there at all after the Newberry-Haiwee transition.

Distributions of Other Eastern California Obsidians in Owens Valley

The distributional biases shown for Truman-Queen obsidian occur in different forms in the distributions of other major eastern Sierra obsidians. Already in Chapter Three, an extensive set of research is devoted to the trans-Sierran exchange of Bodie Hills, Casa Diablo, and Coso obsidians. Somewhat less attention, however, has been paid to the geographic and temporal disposition of these and other Inyo-Mono glasses within their parent region. This subject was touched upon in Chapter Eight, but requires a more thorough discussion here. As noted earlier, most other northern obsidians, save Casa Diablo, follow the trend indicated by Truman-Queen in respect to their distributions in Owens Valley. Perhaps the most well-traveled south is Mono Glass Mountain, not surprisingly one of two southernmost Mono Basin obsidians (with Casa Diablo). Still, this glass makes never up more than trace quantities at any Owens Valley site and is normally overshadowed by Casa Diablo. Basgall (1989) has documented the basic geographic and temporal distributions of a few North glasses across eastern California. Based on this and other studies, it appears that site INY-30 near Lone Pine more or less defines the southern boundary of North obsidians, particularly Casa Diablo (Delacorte et al. 1995; Delacorte and McGuire 1993; Richman and Basgall 1998).

By comparison, the spatial distributions of south obsidians (Fish Springs and Coso) are better documented. Bettinger (1982b) has argued that the geographic parameters of Fish Springs obsidian were largely restricted to within Owens Valley. We know, however, that it reaches as far north as the Volcanic Tableland in modest amounts, and that it is also found in trace amounts in Long Valley (R. Jackson 1985). The southern limit of Fish Springs obsidian is dead obvious, as documented by Delacorte and McGuire (1993) on the Contel highway project. Investigations at more than a dozen sites between Big Pine and Little Lake show a dominance of Fish Springs glass south of Lone Pine. Site INY-3766, just north of Lone Pine, shows a mix of Fish Springs and Coso glass, but south of this point Fish Springs is basically absent. Site INY-30, just south of Lone Pine, also shows a dominance of Coso glass (Basgall and McGuire 1988), and results of the TEA survey show an abundance of Coso over Fish Springs at sites along SR-136 north/east of Owens Lake (Richman and Basgall 1998). As such, Fish Springs is basically limited to Owens Valley while Coso is rare in Owens Valley, being prominent only as far north as Lone Pine. The most important difference between Fish Springs and Coso is the major presence of the latter in the Mojave Desert, which indicates its primary use by southern rather than northern populations.

As for chronological parameters, the areal distributions of both Fish Springs and Coso outside Owens/Rose Valleys decline significantly with the onset of the Haiwee period. While the spread of Fish Springs was always fairly restricted (Bettinger 1982b), its use following the Newberry period may have been even more locally circumscribed to the valley proper. According to Basgall (1989) and Hall (1983), Fish Springs arrow-points are rare in Long Valley relative to dart-point forms (3 versus 6 items [1:2], both studies combined), with nearly half of all dart points being large stemmed forms. Also in Long Valley, the early-Holocene Komodo site (MNO-679) had an unusually high number of Fish Springs points, all of them large concave-base forms (Basgall 1988, 1989). The present study shows a ratio of Fish Springs arrow- to dart-points similar to that seen in

Long Valley (6 vs. 12 items [1:2]), with pre-Elko forms comprising half of all the dart points. In contrast, arrow-point forms of Fish Springs obsidian can be found all over Owens Valley, from Bishop to the southern White Mountains to Lone Pine (Bettinger 1989b; Bouscaren 1985; Reynolds 1996; Delacorte and McGuire 1993). However, it is curious given Bettinger's (1982a; 1989a, 1991) portrayal of Owens Valley settlement systems that Fish Springs obsidian fails to dominate site assemblages in the White Mountains (though it is common at Crooked Forks) but is abundant in Deep Springs Valley (Delacorte 1990:319, 321). Instead, Truman-Queen obsidian is dominant at many White Mountains sites, a fact that has implications for the route groups may have taken in order to access the alpine and sub-alpine zones of that range. As for Coso glass, this source rarely entered archaeological contexts in northern Owens Valley at any time in prehistory. A couple of Coso artifacts have been noted at the Partridge Ranch site (INY-2146) near Big Pine (Bettinger et al. 1984a; Garfinkel 1980), but to my knowledge the presence of Coso glass on the Volcanic Tableland, noted in this study, represents its northernmost occurrence. It is perhaps significant that the nine Coso artifacts from the Tableland include two dart points (one Elko), a simple flake tool, and six pieces of debitage; three of the flakes were subjected to hydration analysis, only one returning a rim measurement of less than 7.3 microns (1.9 μm). These data suggest Coso glass only moved north in any real quantity before the Newberry-Haiwee transition.

Few data exist to measure the geographic and temporal ranges of Queen Impostor or Saline Valley obsidians. Basgall (1988, 1989) originally recognized the presence of "unknown" obsidians, hailing from somewhere east of Owens Valley, at archaeological sites in the southern Inyo-Mono region. Two of these unknown glasses have now been identified as Queen Impostor and Saline Valley (Johnson 2002; Johnson et al. 1999a), both of which are most common south of Lone Pine (Basgall and McGuire 1988; Delacorte and McGuire 1993; Gilreath and Nelson 1999; Richman and Basgall 1998). A few pieces of "Unknown A" (which later turned out to be Queen Impostor) were

identified at the Komodo site (Basgall 1988), but as with Coso both Queen Impostor and Saline Valley glasses are present in modest amounts on the Tableland. This surely represents their northernmost occurrence in any numbers. Unlike Coso, however, the temporal distributions of Queen Impostor and Saline Valley on the Tableland are substantially more widespread. Although there is substantial evidence for late-period reuse of Newberry-age Saline Valley glass at a few sites (see Chapter Eight), point types and hydration data for Queen Impostor indicate some importation during the Haiwee period and perhaps later. Delacorte (personal communication, 2000) suspects that Saline Valley also occurs in the White Mountains and in Deep Springs and Fish Lake Valleys, which if true would imply a late movement of Saline Range obsidian as far north as the Tableland.

REGIONAL SETTLEMENT PATTERNS: A VIEW FROM THE TABLELAND

Available data concerning the spatio-temporal boundaries of obsidian distributions across the Inyo-Mono region imply two basic spheres of obsidian use that varied in spatial extent through time. A northern circuit, centered somewhere north of the Mono Basin, primarily involved Mono Basin obsidians (Casa Diablo, Mono Glass Mountain, Truman-Queen, Mono Craters, Bodie Hills) and more distant sources in western Nevada (Mt. Hicks, Pine Grove Hills). These glasses were routinely procured, transported, and used in areas north of Owens Valley and traveled farther south only occasionally. Trans-Sierran exchange mainly involved Bodie Hills and Casa Diablo obsidians, these being the largest, nearest, and most accessible sources to aboriginal groups in central California. A southern obsidian circuit involved some Casa Diablo glass, but centered mainly on the use of Fish Springs and Coso obsidians and kept primarily to southern Owens Valley and beyond. The movement of obsidian across the southern Sierra Nevada clearly focused on Coso glass, though Fish Springs does occur in the southern portion of the range (Roper-Wickstrom 1992;

Stevens 2000). Coso obsidian also traveled widely to the southeast into the Mojave Desert, as did limited amounts of Casa Diablo glass.

Because of its geographic location, the Tableland was situated at the juncture of these two spheres of obsidian use, being visited by groups traveling into and around the Mono Basin from the north and south. Accordingly, its obsidian profiles show significant differences in the spatial and temporal distributions of various sources, providing evidence of long-term changes in settlement use of this arid province. Flaked stone assemblages are dominated by Truman-Queen obsidian, being atypical of the many well-studied archaeological localities in eastern California. Neither simple distance-decay models nor exchange-related production behavior can explain this dominance of Truman-Queen obsidian, and it must be that most visits to the Tableland originated mainly to the north/northeast rather than to the south or west. This point was made earlier in Chapter Eight regarding the geographic affinities of prominent obsidians at project sites, but it remains to determine what implications obsidian source distributions have for the inclusion of the Tableland in regional settlement systems based outside the area.

Contemporary research into the organization of lithic technology has dovetailed with studies of obsidian source data to produce theoretical models that enable us to infer settlement behavior from a combination of evidence. Hypotheses concerning the nature of tool curation, transport, and discard activities, prehistoric settlement and mobility patterns, and raw material procurement strategies have been combined to create a model for obsidian use by hunter-gatherer groups in the arid west. In a situation of high residential mobility, groups moving long distances on subsistence-related forays would most efficiently acquire obsidian using an "embedded" procurement strategy (Binford 1979). This means that during settlement rounds, foraging groups will tend to place their residences in specific locations primarily for the purpose of obtaining local foodstuffs, but also to minimize distances to toolstone sources in a given area. This would allow groups to procure nearby

lithic materials without having to make extended trips to source locations, thus limiting the amount of time and energy spent in non-caloric pursuits. It is generally held that eastern California hunter-gatherers used this type of lithic procurement strategy, at least prior to the middle of the late Holocene (ca. 1400 B.P.).

One might expect that mobile groups, given a choice between two habitats equal in subsistence resources but unequal in lithic toolstone (one with lots of poor-quality material and the other with a few sources of high quality material), would select for the habitat containing better toolstone. This obviously depends on a variety of factors, including the frequency of residential mobility, the technological objectives of the consumer group, source location and access, and the relative package size, abundance, and spatial distribution of the raw material at issue. Holding Inyo-Mono obsidians essentially constant in terms of flaking quality, and keeping technological needs constant as well, there are certain sources that should have appeared more attractive to prehistoric groups. To the north, the Bodie Hills source area includes a number of extensive obsidian outcrops at moderate elevations (2500-2600 m) within an expanse of at least eight square kilometers (Camboia 2000; Singer and Ericson 1977; Hall 1980). Each exposure contains a variety of large cobbles and boulders suitable for the production of sizable artifacts. The Casa Diablo source is even more substantial, consisting of at least 26 separate exposures within an area of about 65 square kilometers at between 2200-2500 meters elevation. Casa Diablo obsidian occurs in small to extremely large packages and can be easily obtained from creek cutbanks and hillside vents. To the extreme south, the Coso Volcanic Field is the largest of all Inyo-Mono obsidian source areas, covering an area of about 80 square kilometers at roughly 1200-1570 meters elevation. At least 12 major obsidian deposits exist in the field, offering cobbles on the surface but larger boulders underground. Despite the fact that none of these source areas has a particularly good base of food resources, all three obsidians figured prominently in trans-Sierran exchange production and were

used extensively throughout the Inyo-Mono region. These sources happen to be the largest ones in eastern California, and are easily accessed from different locations and directions.

Other obsidian sources are distant or isolated from population centers in Owens Valley (Mt. Hicks, Pine Grove Hills, Queen Impostor/Saline Valley), offered less stone in smaller packages (Pine Grove, Fish Springs), are the result of fairly recent volcanic events (Mono Craters), or are less accessible due to landscape situation and elevation (Mono Glass Mountain, Truman-Queen). Of all Inyo-Mono obsidians, Casa Diablo was probably the most easily accessed by groups traveling up and down the east flank of the Sierra Nevada, not only because of its abundance but because its sources lie squarely within a direct travel corridor between Owens Valley and the Mono Lake basin. In this sense, we can view the Bodie Hills, Casa Diablo, and Coso areas as "hubs" of obsidian procurement within more wide-ranging settlement regimes, each of which routinely included access to a variety of different glasses during seasonal and/or annual rounds.

Early and Middle Holocene Settlement Patterns (8500-3500 B.P.)

On the Volcanic Tableland, Fish Slough was the focus of occupations during the early Holocene, between ca. 8500-6000 B.P. Source data indicate that a wide range of obsidians was brought to the slough, including glasses from distant northern and southern locations. It may never be possible to say what the overall geographic parameters of settlement systems were at this time, but the Tableland appears to have been included within at least one long-distance settlement range extending from Bridgeport to Coso along the east flank of the Sierra Nevada. Local and regional hydration data indicate that the northernmost reach of Fish Springs and Coso obsidians may have been Long Valley, while the southernmost range of Far North glasses, particularly Bodie Hills and Mt. Hicks, may have terminated somewhere in the vicinity of Owens Lake. Casa Diablo is the only obsidian that seems to have been moved widely to the north and south of its source location.

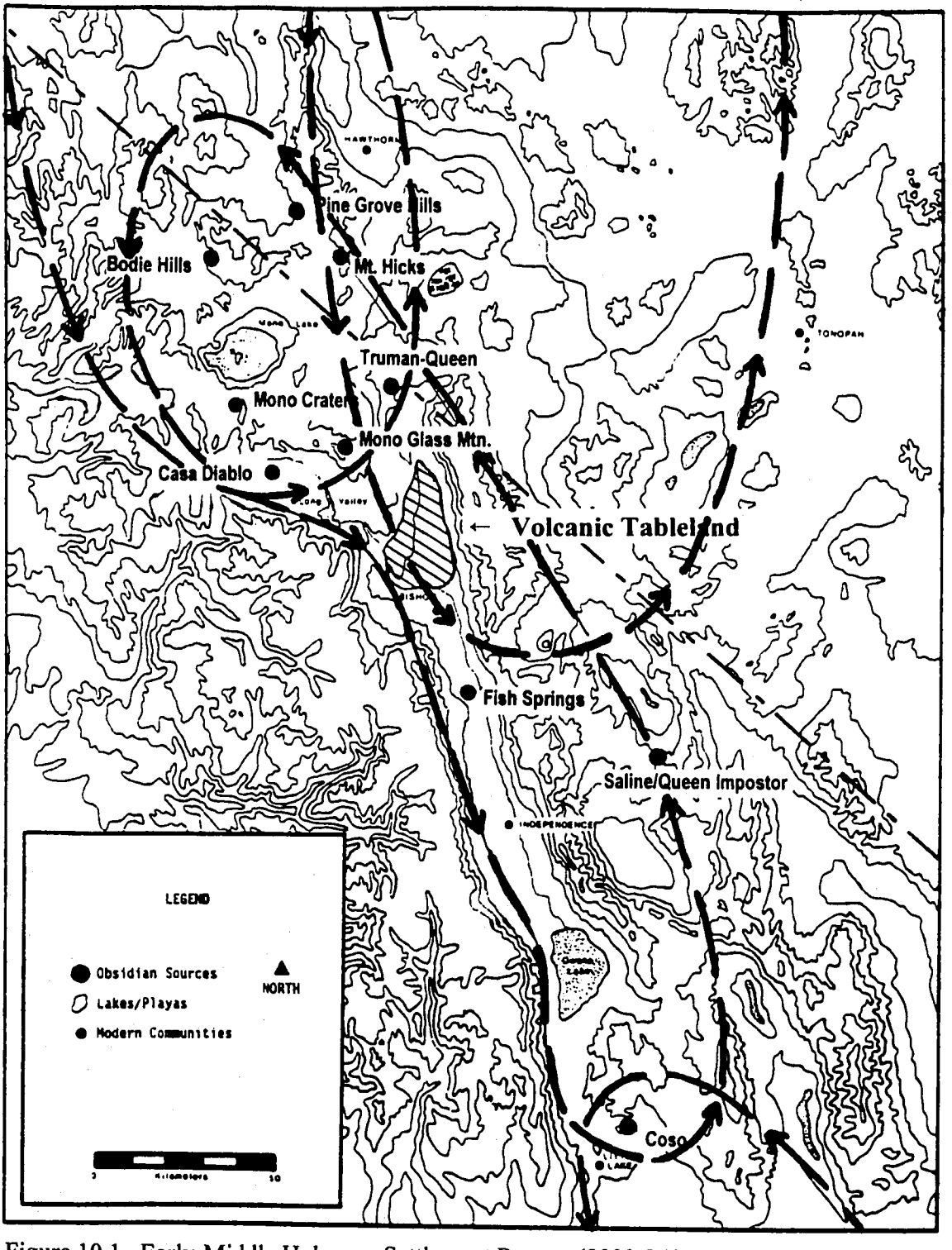

Figure 10.1. Early-Middle Holocene Settlement Ranges (8000-3500 B.P.).

Great Basin Concave Base, Stemmed, and Pinto points on the Tableland account for a range of northern, southern, and southeast obsidians, though as a group they are still dominated by Truman-Queen and Casa Diablo. Source patterns for early Holocene debitage show a slight prevalence of Truman-Queen and more or less even portions of Mono and Casa Diablo obsidians. This indicates that the Tableland was being visited primarily by incoming groups from the north, northeast, and west, presumably during settlement moves down into Owens Valley. The presence of Coso obsidian on the Tableland is also mainly an early Holocene phenomenon. This speaks to the geographic extent of early settlement rounds, but the extreme scarcity of Coso glass indicates that direct moves from Coso to northern Owens Valley were rare or at least very infrequent.

Jones et al. (2003) link the Truman-Queen source with an obsidian conveyance system in central Nevada during the Paleoarchaic and early Holocene, between ca. 11,500-8000 years B.P. This conclusion is based primarily on the presence of Truman-Queen obsidian at the Knudsen Site in Grass Valley, Nevada, though only 4 of 106 sourced artifacts (<4%) were so identified. This "Central Nevada" system used Mt. Hicks and Truman-Queen obsidians as south "anchors" and Double H Mountains and Brown's Bench obsidians as north anchors, both of the latter located in northern Nevada. The authors also postulate the existence of a "Western Great Basin" system that included the Bodie Hills source at its south end and the South Warners source at its northern end but did not involve Truman-Queen. This view contradicts the one taken in this study, which sees Truman-Queen as part of two distinct conveyance systems during the early Holocene. One to the north approximates the area covered by the "Western Great Basin" system, and one to the northeast is oriented similarly to the "Central Nevada" system (Jones et al. 2003). The two settlement systems described by Delacorte (1997) for the Pah Rah Range, which span the east flank of the Sierra Nevada from Massacre Lake/Guano Valley to the Mono Basin and Truman-Queen source, match fairly well the spatial parameters of the Jones et al. (2003) Western Great Basin system but are purported to be

of late Holocene age. Perhaps a more expansive Western Great Basin settlement/conveyance system, present during the terminal Pleistocene and beginning of the early Holocene, had already begun to shift southward by about 8500-8000 B.P. and continued to do so throughout the middle and late Holocene eras (see below).

Toward the end of the early Holocene, Fish Slough Side-notched points appear concurrent with a flurry of occupations at Fish Slough that originated in the direction of the Truman-Queen obsidian source. Casa Diablo and Mono obsidians were also imported as finished tools and debitage to the Tableland, but their acquisition was probably one or two retooling stops removed from landings in the project area. Most Fish Slough Side-notched points from site MNO-1992 are made from Truman-Queen obsidian, and many are made from Casa Diablo, while nearly all remaining items comprise other northern obsidians (Mono, Mt. Hicks, Bodie Hills). In fact, aside from two indeterminate artifacts, only one of 39 other Fish Slough points (<3%) is made of southern obsidian (Fish Springs). Considering the unique character of Fish Slough Side-notched assemblages at MNO-1992 and in Deep Springs Valley, it may be that the Tableland was affected by an unique outside influence during the later part of the early Holocene. As shown in Figure 10.1, it looks as if an eastern settlement regime existed at that time, one that probably extended north to the Mono Basin and east to the Nevada slope of the White Mountains. Discoveries of Fish Slough Side-notched points in the Benton Range and on the Dry Lakes Plateau lend support to this premise.

The boundaries of two other distinct, hypothesized settlement ranges, centered north of the Mono Basin and south of the Coso area, have also been depicted in Figure 10.1 to fill out the regional settlement picture. Given the hydration-inferred, early Holocene ages of many Coso obsidian artifacts in the Mojave Desert (Basgall 1993; Basgall and Hall 1992; Giambastiani and Basgall 2000b), the presence of a southern settlement sphere involving the Coso area at this time seems warranted. Less information is available to support the presence of a northern system, but

given the reconstruction by Delacorte (1997) and the fact that Mono Basin glasses appear at Hidden Cave by Newberry times, it is likely that some kind of long-range settlement regime existed between the Mono Basin, Walker Lake, and Carson Sink. Whatever their actual configurations, the four early Holocene settlement ranges shown in Figure 10.1 were probably shifting constantly, in that aboriginal groups may not have visited the same locations each year or even every few years. It may be more useful to conceive of the settlement boundaries as an "averaged", synchronic glimpse of the many "extended ranges" (sensu Binford 1982) traversed by early Holocene populations across the Inyo-Mono region.

These ranges appear to have held until just prior to the Newberry period, ca. 3500 B.P. Sourcing and hydration data for late Pinto/Fish Slough and early Newberry tools and debitage (micron values from 6.5-7.0) demonstrate the Tableland was still being occupied by groups using expansive settlement ranges. Like before, most incursions look to have been staged from the north/northeast and brought in major quantities of Truman-Queen glass. Habitations were evidently short-lived, targeting wetland subsistence resources at Fish Slough. Lithic assemblages still contained a variety of flaked stone implements, especially formed and simple flake tools, and on-site activities left only moderate quantities of debitage. There is some evidence for mid-Holocene occupation out on the Tableland plateau, but it is limited as compared to the rich record of ancient deposits at Fish Slough.

Early Late Holocene Settlement Patterns (3500-1400 B.P.)

Settlement ranges involving the Volcanic Tableland begin to change noticeably at the onset of the Newberry period (Figure 10.2). As indicated by the consistency in source profiles for Elko and Fish Slough Side-notched points, it seems the study area was still frequented by groups moving vast distances afield. However, visits to the Tableland were made with greater regularity and began

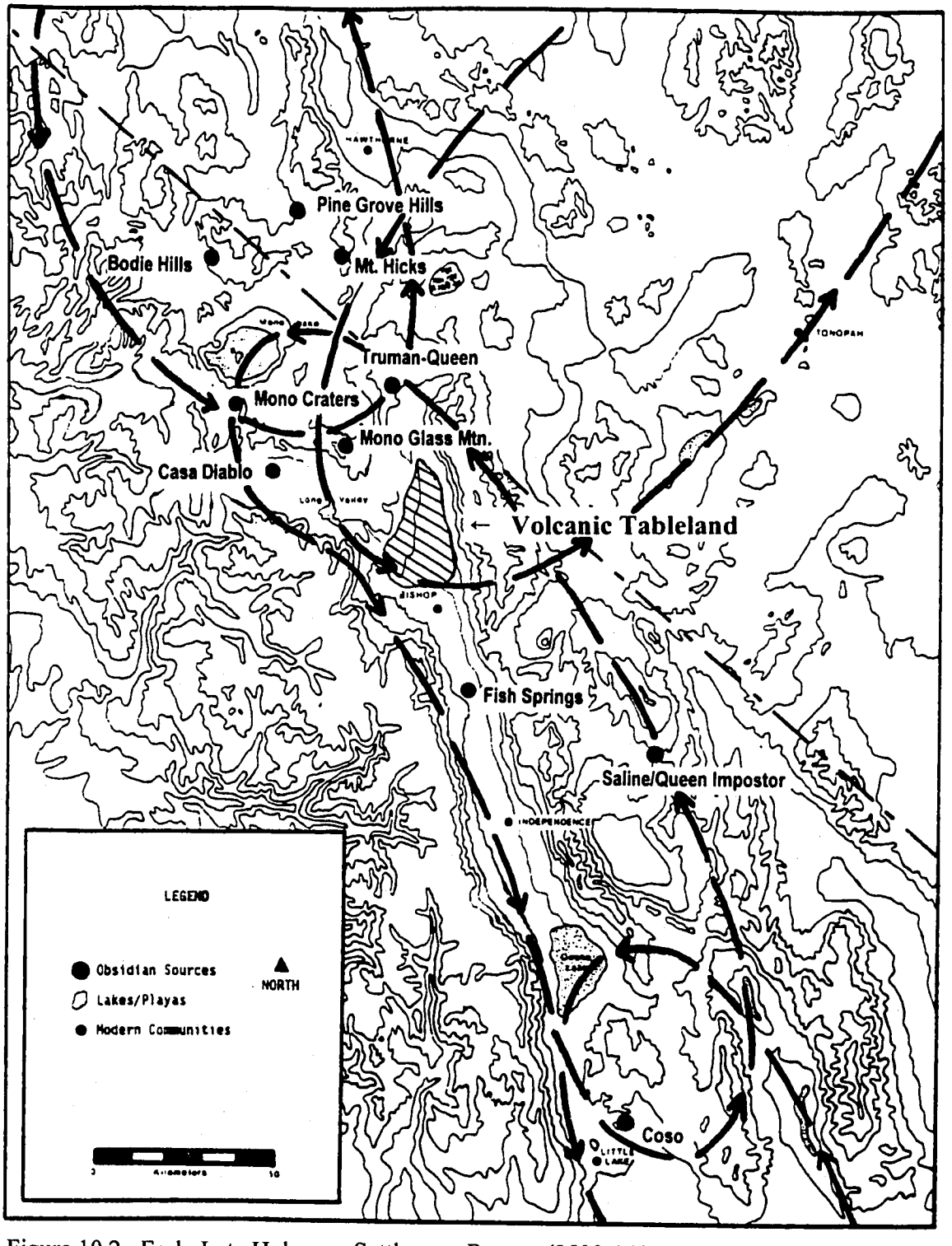

Figure 10.2. Early Late Holocene Settlement Ranges (3500-1400 B.P.).

to target locations other than Fish Slough. Volumes of debitage increase dramatically in Newberry-age deposits, with bifaces, biface thinning debris, and groundstone tools becoming significant components of lithic assemblages. Hydration data show a dramatic jump in Newberry presence at residential sites (Type 3) as opposed to simple lithic scatters (Type 1), testifying to a significant change in aboriginal land-use (Table 10.3). Occupations on the Tableland plateau were often more extended, or made by larger groups, leaving behind large quantities of flaked stone debris and midden deposits (see also Basgall and Giambastiani 1995).

The notion that the Newberry interval saw the beginnings of regularized settlement patterns in eastern California is far from novel. Based on data from INY-30, Basgall (1989; Basgall and McGuire 1988) posited the emergence of a regular north-south range between the Coso area and Long Valley during the Newberry period. Later studies have supported this idea, tending to portray Newberry settlement patterns as less fluid than those previous (Delacorte and McGuire 1993; Delacorte et al. 1995; Gilreath and Hildebrandt 1995). On the Tableland, Newberry-age projectile points show considerable source diversity but are still dominated by Truman-Queen obsidian. The prominence of Truman-Queen is also manifest among other tool forms and particularly in samples of debitage. From this it would appear that most visits to the Tableland were still being staged from the northeast. Given that peak use of Truman-Queen obsidian in Owens Valley also occurs during the Newberry period, it is likely the Tableland was occupied primarily by groups moving south into the Owens Valley area.

Nonetheless, an obvious rise in proportions of Mono and Casa Diablo debitage in Newberry assemblages is indicative of more frequent access coming from the west and northwest (e.g., Mono Basin and Long Valley). The use of Casa Diablo obsidian in Owens Valley also increased at this time (Basgall 1989), probably indicating more frequent moves between Long Valley and Owens Valley. In response to this change, the settlement system based north of Mono

TABLE 10.3. Frequency and proportion of obsidian sources by major site type and micron-age group.

	Pine Grove Hills	Bodie Hills	Mt. Hicks	Truman-Queen	Mono Craters/ Glass Mtn	Casa Diablo	Fish Springs	Saline Valley	Queen Impostor	Coso	Total
<u>≤3.0 microns</u>											
Type 1	- -	- -	2 (20%)	1 (10%)	2 (20%)	5 (50%)	- -	- -	- -	- -	10
Type 2	- -	- -	- -	9 (45%)	3 (15%)	4 (20%)	1 (5%)	- -	2 (10%)	1 (5%)	20
Type 3	- -	- -	13 (9%)	77 (50%)	24 (16%)	29 (19%)	3 (2%)	6 (4%)	- -	- -	152
<u>3.0-4.9 microns</u>											
Type 1	- -	- -	- -	14 (74%)	2 (11%)	2 (11%)	- -	- -	1 (5%)	- -	19
Type 2	- -	1 (2%)	1 (2%)	29 (44%)	9 (14%)	10 (15%)	6 (9%)	4 (6%)	6 (9%)	- -	66
Type 3	1 (<1%)	2 (<1%)	15 (4%)	178 (49%)	37 (10%)	102 (28%)	13 (4%)	8 (2%)	5 (1%)	- -	361
<u>5.0-6.9 microns</u>											
Type 1	- -	- -	1 (7%)	9 (60%)	1 (7%)	3 (20%)	1 (7%)	- -	- -	- -	15
Type 2	- -	- -	- -	33 (57%)	8 (14%)	15 (26%)	2 (3%)	- -	- -	- -	58
Type 3	- -	1 (<1%)	12 (4%)	152 (57%)	32 (12%)	66 (25%)	1 (<1%)	4 (1%)	1 (<1%)	- -	269
<u>7.0-9.9 microns</u>											
Type 1	- -	1 (1%)	1 (1%)	41 (59%)	11 (16%)	12 (17%)	2 (3%)	- -	- -	1 (1%)	70
Type 2	- -	- -	1 (3%)	20 (53%)	3 (8%)	3 (8%)	9 (24%)	- -	1 (3%)	1 (3%)	38
Type 3	- -	- -	6 (3%)	102 (54%)	20 (11%)	43 (23%)	15 (8%)	3 (2%)	- -	- -	189
<u>≥10.0 microns</u>											
Type 1	- -	1 (3%)	1 (3%)	18 (47%)	8 (21%)	8 (21%)	1 (3%)	- -	1 (3%)	- -	38
Type 2	- -	- -	1 (5%)	7 (35%)	6 (30%)	6 (30%)	- -	- -	- -	- -	20
Type 3	- -	- -	3 (4%)	23 (32%)	18 (26%)	24 (34%)	1 (1%)	1 (1%)	- -	- -	70

Basin may have recoiled a bit, continuing to cover the north half of Mono Basin but foregoing use of the Casa Diablo area (Figure 10.2). At Hidden Cave, the absence of Casa Diablo obsidian but persistence of Mt. Hicks, Bodie Hills, and Truman-Queen glasses among Elko and Humboldt points might provide testimony to a shift in this range (Hughes 1985a). All of this evidence supports the notion that Inyo-Mono settlement patterns were becoming increasingly regularized along a north-south trajectory, and implies that ranges in surrounding regions were adjusting to changes happening in Owens Valley.

The dominance of Truman-Queen obsidian during Newberry times on the Tableland corresponds to its apparent fluorescence in western Nevada. Hughes (1985a) notes that Truman-Queen projectile points at Hidden Cave are almost exclusively Gatecliff or Elko Series variants, two exceptions being Humboldt Basal-notched points. He argues that the presence of Mt. Hicks, Bodie Hills, and Truman-Queen obsidians at Hidden Cave indicates the existence of a "southern exchange route" operating between about 1500-2000 B.C. (3500-4000 B.P.). In central Nevada at Gatecliff Shelter, Hughes (1983a) notes a similar pattern. Peak use of Truman-Queen obsidian occurs in Horizons 8 and 9, dated by radiocarbon assays to between 3200-3600 B.P. (early Newberry). Although Hughes prefers to explain the presence of Mono Basin obsidians in Nevada as a result of exchange, it seems more likely that the transportation of Truman-Queen and other glasses out of eastern California was accomplished during long-distance settlement moves. This also makes sense considering that the two obsidian sources near Gatecliff (Box Spring and Crow Spring) offer only small nodules of low-quality glass. If a regularized, north-south settlement system was in place along the east flank of the Sierra Nevada during the Newberry period, there must have been another settlement system that moved Truman-Queen obsidian north (to Hidden Cave) and northeast (to Gatecliff Shelter) into western Nevada.

Based on work in the Pah Rah Range outside Reno, Nevada, Delacorte (1997) has postulated that sometime prior to 1350 B.P. a north-south settlement system extended from Massacre Lake in northeastern California to the Mono Basin. At Hidden Cave, not far east of Reno, Hughes (1985a:341) also suggested that populations in the Carson Sink and Mono Basin had regular contact, their relationships supposedly ending around 1500 B.C. (3500 B.P.). The system reconstructed by Delacorte (1997:Map 13) for the "Early Component (Old)" encompasses the Carson Sink area and is consistent with Newberry age. Unfortunately, other archaeological research in the Carson-Stillwater Marsh area has not yet provided obsidian data that might test these conclusions (cf. Kelly 1983, 1990; Raven and Elston 1988, 1989). There is evidence that pre-1500 B.P. adaptations were characterized by greater residential mobility, which itself implies more far-reaching settlement ranges, but there are few indications as to which surrounding regions the Carson populations may have used prior to 1500 B.P. According to Thomas (1985:21), protohistoric Toedökadö territory was quite restricted (encompassing only about 17,400 sq km) but groups did have economic relationships with people occupying the Walker River/Walker Lake area to the south.

While Delacorte's hypothesized settlement system could explain the presence of Truman-Queen glass at Hidden Cave, the presence of Truman-Queen obsidian at Gatecliff Shelter still implies the presence of a settlement system with a northeast-southwest orientation in relation to the Volcanic Tableland. Figure 10.2 thus portrays three major settlement systems utilizing Truman-Queen obsidian, with the Tableland situated within the bounds of two of them. Given that Truman-Queen and Mono Glass Mountain are two of the nearest, major obsidian sources to Gatecliff Shelter, and that local Box Spring and Crow Spring sources are largely inadequate, it is feasible that groups inhabiting the Reese River/Monitor Valley area had included the Mono Basin within a fairly regular, extended settlement range. This was probably not done solely for the purpose of getting obsidian, but also to take advantage of seasonal resource abundances and perhaps to maintain social contacts

with groups at Mono Lake and in Long Valley and Owens Valley. This northeast-southwest system may have developed out of something like the "Central Nevada" conveyance system described by Jones et al. (2003), a fact that would make its origins extremely ancient.

Later Holocene Settlement Patterns (1400-200 B.P.)

After about 1400 B.P., settlement systems typifying the previous interval became increasingly regularized but also more restricted in their geographic coverage. On the Tableland, source profiles for Rosegate projectile points and debitage show enhanced usage of Mono and Casa Diablo obsidians at the expense of Truman-Queen, and they tend to be more common at sites in the north half of the study area. Truman-Queen glass still dominates other obsidians, particularly as debitage, but does so to a lesser degree. These changes probably reflect a decline in residential mobility within settlement systems using the Tableland. By the Haiwee period, as subsistence ranges continued to shrink due to regional competition for resources (an effect of long-term population growth), food resources on the Tableland (like rabbits and ricegrass) may have drawn greater attention from groups moving into and around the Mono Basin and northern Owens Valley, particularly during the spring and summer seasons. More frequent visits to the study area from the Mono Basin introduced greater amounts of Mono and Casa Diablo obsidians, while incursions from the northeast brought Truman-Queen glass out onto the Tableland.

During the Marana period, Desert series points remain prominent in the north half of the Tableland while also increasing in number at Fish Slough. Source data for Marana-age points and debitage continue to demonstrate the rise of Mono and Casa Diablo obsidians relative to Truman-Queen. This is most obvious among debitage in the <3.0 micron group, where the relative portion of Truman-Queen glass drops to less than 50% (down more than 10% from Haiwee) and the portion of Mono glass jumps from over 10% to more than 25%. Portions of Far North obsidians,

particularly Mt. Hicks, also increase among Desert series points. The implications of this are a growing affiliation to northern regions and a greater frequency of settlement moves between the Mono Basin, Long Valley, and Truman-Queen areas.

It should be cautioned that the Marana source profile is disrupted to some degree by the effects of artifact scavenging. A putative recent influx of Saline Valley obsidian to the Tableland proved instead to be the result of intensive tool reuse activity at just a couple of sites, compromising projectile point source distributions to some degree. Be this as it may, the changes evident in the Marana period are reflective of ever-increasing residential centralization and must be the result of two major, separate settlement systems emerging within the Inyo-Mono region (Figure 10.3). A northern system, centered either in the Mono Basin or somewhere to the northeast, regularly included the north half of the Volcanic Tableland; this part of the range may have eventually been absorbed into the seasonal rounds of Benton Valley Paiute and Fish Lake Valley Paiute. Obsidians from Mono, Casa Diablo, and Truman-Queen sources were regularly used, with more distant northern glasses (Pine Grove Hills, Bodie Hills, Mt. Hicks) also filtering into Tableland deposits on occasion. Alpine and subalpine environments in the White Mountains were probably also exploited by groups in this northern system, as evidenced by the presence of Truman-Queen and Casa Diablo obsidian in highland sites (Delacorte 1990). Bettinger (1982b, 1989a, 1990, 1991) has suggested that after ca. 650 B.P. occupations in the southern White Mountains were made by Owens Valley Paiute groups. This is probably the case, but it is possible that sites in the northern White Mountains (which have yet to be investigated) were established by groups living in Fish Lake Valley and Queen, Benton, and Hammil Valleys, or at least entering the mountains from those locations.

The southern system presumably evolved into the classic Owens Valley ethnographic pattern depicted by Steward (1933, 1938). During Marana times, Owens Valley populations were becoming more and more tethered to their local habitats. Still, Owens Valley groups north of Big Pine

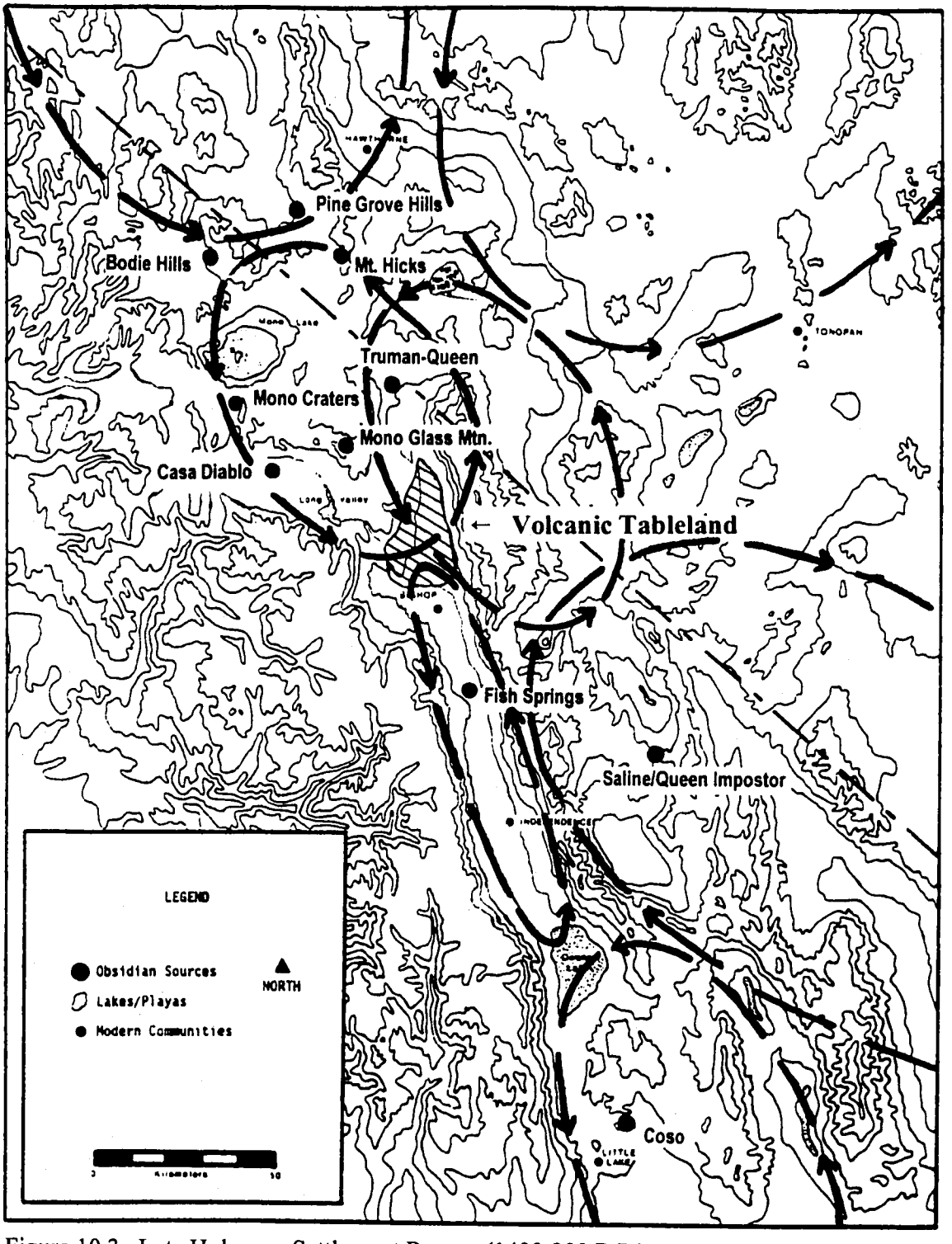

Figure 10.3. Late Holocene Settlement Ranges (1400-200 B.P.).

continued to directly procure Casa Diablo obsidian and probably used the south half of the Tableland for its seed grass resources. Traveling families might have accessed northern and western parts of the Tableland via Chidago Canyon, or from the north end of the Owens River Gorge, after having procured Casa Diablo and Mono Glass Mountain obsidians. The use of Fish Springs glass by northern Owens Valley groups, which one might expect to have been prominent in later periods, looks to have been restricted. In his examination of territoriality in Owens Valley, Bettinger (1982b) suggests that direct access to Fish Springs obsidian during the late Holocene was limited to aboriginal groups living in the immediate vicinity of the source. He places the northern boundary of the "supply zone", within which Fish Springs glass was readily available, across central Owens Valley about 0.5-1.0 mile south of the modern town of Bishop. Bettinger (1982b:124-125) cites a decrease in Fish Springs points within the supply zone and an increase in Fish Springs points beyond the supply zone at roughly 650 B.P. One explanation given for this pattern is the development of trade relationships between groups living within and outside the supply zone. If true, groups living in extreme northern Owens Valley (i.e. the Bishop/Round Valley area) may have seen their direct access to Fish Springs glass terminated sometime around the Haiwee-Marana interface. This may have forced them to increase logistic forays to Casa Diablo or Mono Glass Mountain, to promote trade relationships with eastern and southeastern groups (Fish Lake, Deep Springs, and Death Valley), or to rely more heavily on the reuse of lithic material culled from older artifact deposits.

Terminal Prehistoric Settlement Patterns (200 B.P. - Contact)

Although partially a reflection of artifact scavenging, the late presence of Saline Valley and Queen Impostor obsidians on the Tableland is difficult to explain given the strict territoriality that evidently emerged in Owens Valley during Marana times. It is assumed that the shortest, and probably easiest route over which to transport Saline Valley/Queen Impostor obsidians would have

been through Owens Valley. However, the fact that Truman-Queen obsidian is common on the Tableland, in the White Mountains, in Fish Lake Valley, and in Deep Springs Valley, but not in Owens Valley, implies that Truman-Queen glass was transported south along the east flank of the White Mountains. Alongside ethnographic accounts provided by Steward (1933, 1938), these patterns insinuate the recent emergence of social relationships between groups using the Tableland and populations centered east and southeast of the White Mountains, in Fish Lake, Eureka, Saline, and Death Valleys. It is easy to conceive of long-distance settlement shifts being responsible for moving obsidians between these locations during the early and middle Holocene, and even during Newberry times it is feasible that north-south connections through Owens Valley facilitated the procurement and mobilization of Truman-Queen and Saline Range glasses. Still, if increased settlement centralization in Owens Valley during the terminal prehistoric resulted in stricter territoriality, it is unclear what social or economic mechanisms might have allowed for the movement of Truman-Queen and Saline Range obsidians along the east side of the White Mountains during the last few hundred years.

What is implied is the existence of an Inyo-Mono settlement system that developed east of the White-Inyo Range and separate from Owens Valley during late Marana and terminal prehistoric times (Figure 10.4). There is not much concrete evidence to directly support this premise, but obsidian data from the Tableland certainly present a strong case. In addition, there is a lot of circumstantial evidence of relationships that existed between groups living in Saline, Eureka, Deep Springs, and Fish Lake Valleys with people living in Benton and Hammil Valleys on the east side of the Tableland. If we assume for the sake of argument that ethnographic groups in Benton and Hammil Valleys were responsible for many recent occupations on the Volcanic Tableland, it is worth examining the ramifications of available information.

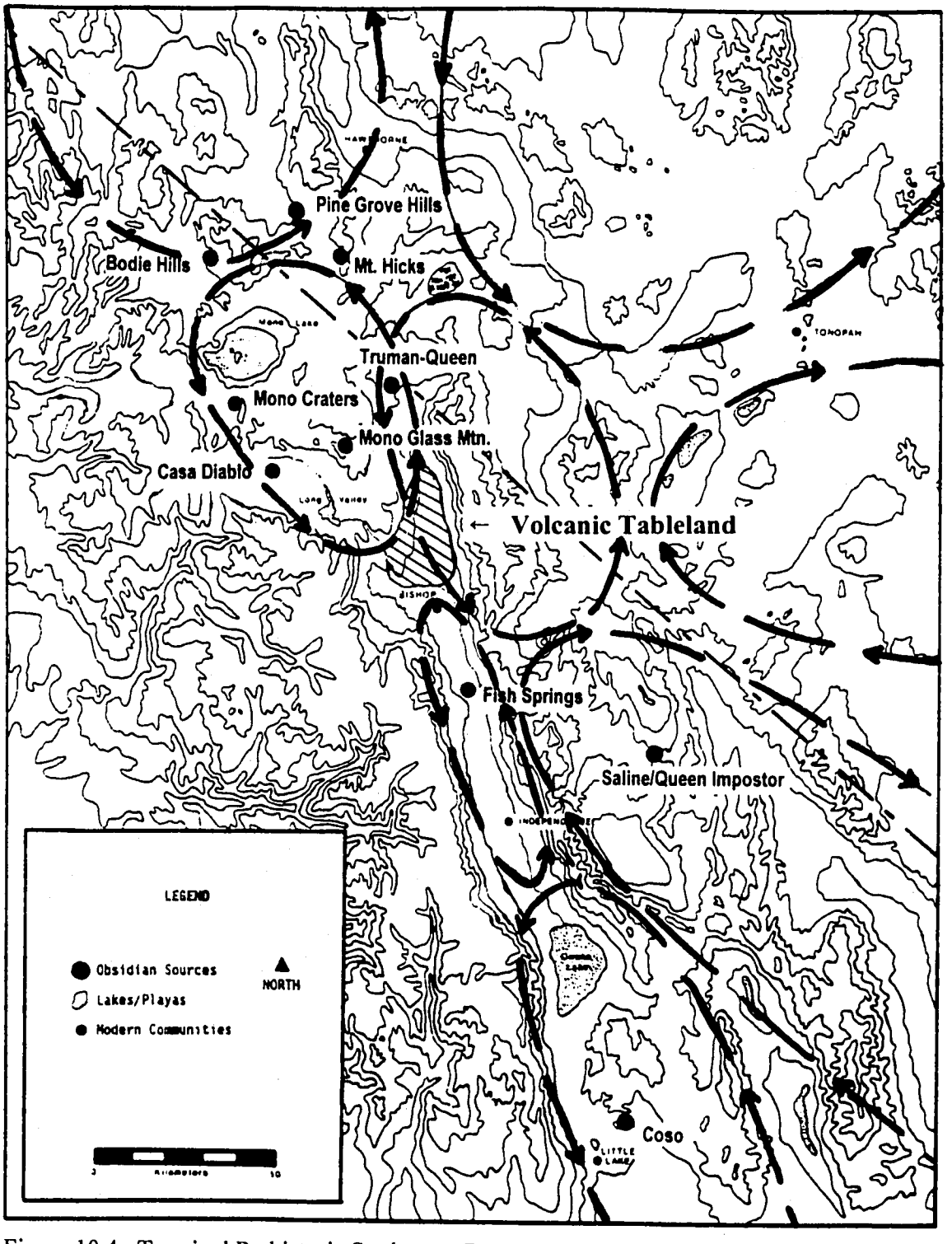

Figure 10.4. Terminal Prehistoric Settlement Ranges (200 B.P. - Contact).

Although Steward (1933, 1938) had little specific to say about the Volcanic Tableland (see Chapter Two, this document), there is much in his writings that is implied if considered carefully. First, there are hints of intermarriage relations between groups in Fish Lake Valley, Benton, and Hammil Valleys. Steward (1938:314), in presenting a "thumbnail" biography of informant Mary Harry, states:

> "Mary H was born in Hammil Valley at a place called Tepo'siinatü, where her family lived in a grass house. Sometimes her folks visited the villages at Bishop where her grandparents had lived."

He later adds:

> "When Mary was a small girl her maternal grandfather fell from a cliff and was killed while hunting eagles in the White Mountains. Desiring to go away because of their sorrow at his death, her parents took Mary and her brother to Geroux Ranch (Tu: na'va) in Fish Lake Valley to live. For many years they made this their winter home."

Steward also discussed marriage practices of Fish Lake Valley Paiute, indicating that "marriages outside the valley were with Northern Paiute of Owens Valley, Round Valley, and Benton, and with neighboring Shoshoni to the east." (1938:67).

Other data from Steward may pertain to the movement of Saline Range obsidians into the Owens Valley and onto the Volcanic Tableland. Steward's Map 1 (1933) places Saline Valley within Shoshone boundaries, and the Paiute/Shoshone border running northward east of Deep Springs Valley but directly through Eureka and Fish Lake Valleys. All along this border there were interactions between Shoshone to the east and Paiute to the west, involving the sharing of resources and information, marriage and other social relations, and economic trade. Steward (1938: Figure 7) depicts a myriad of group movements for subsistence purposes which may have facilitated long distance Paiute-Shoshone relationships between Saline Valley→Eureka Valley→Deep Springs

Valley→Fish Lake Valley, or connections from Saline Valley→Death Valley →Lida→Fish Lake Valley. In the first instance, though Steward's (1938) Figure 7 indicates "No Occupants" in Eureka Valley, a seed procurement locality is depicted at the southern end of the valley. Furthermore, he indicates that eastern California Shoshone occupied "...the southern end of Eureka Valley" (1938:71) and mentions the joint use of pine nut and seed areas in Eureka Valley by inhabitants there and from Saline Valley (1938:78-79). Steward also notes a "..vast archeological site which stretches for several miles along the northern foot of the dunes on the edge of the [Eureka Valley] playa" (1938:79-80), as well as an area "suitable for winter dwellings" between Saline and Eureka Valleys. A principal village at Waucoba Spring is shown in this area, which is not far from the sources of Queen Impostor and Saline Valley obsidians. Relationships between Eureka Valley and Deep Springs Valley are less clear-cut. There is again mention of trips from Deep Springs into Eureka Valley for seed collection (Steward 1938:59). Delacorte (1988) testifies to an abundance of distinctive green-grey chert in Eureka, Deep Springs, and Owens Valley sites that derives from a quarry in the Last Chance Range on the east flank of Eureka Valley; this material occurs at many Tableland sites as well. The distribution of this chert might reflect a pattern of specialized exploitation and not exchange relations between groups in each region, but it certainly indicates at least some interaction between groups in Deep Springs and Eureka Valleys and implies extended relationships between Eureka and Owens Valleys. In contrast to the sparse information available for the above locations, Steward (1933, 1938; Steward and Wheeler-Voeglin 1974) devotes many pages to the discussion of relationships between Deep Springs Valley and Fish Lake Valley Paiute. The two groups frequently intermarried, participated together in seasonal festivals and other social events, and even shared pine nut and seed gathering tracts. Steward's writings also indicate frequent social and trade interactions between Deep Springs, Fish Lake, and Owens Valley Paiute (1933:284; 1938). For this reason it is curious that Saline Range obsidians do not occur at sites in Owens

Valley; presumably obsidian was not something the Owens Valley Paiute needed in trade, having ready access to Fish Springs glass.

At the same time there are many references in Steward's work to eastward relationships between Saline Valley, Death Valley, and Lida/Silver Peak inhabitants. Figure 7 in Steward (1938) shows a number of group movements back and forth across the southern Last Change Range between Saline Valley and northern Death Valley. Groups from Saline Valley took place in rabbit drives held in Death Valley (Steward 1938:78) but more often attended festivals held in the mountains ("Sigai") separating Saline, Death, and Panamint Valleys where groups from all three districts converged (1938:77-80); Saline Valley people also attended festivals in Death Valley at Grapevine Canyon. A trail connecting Saline Valley and Death Valley was used by groups from Beatty, Nevada, to trade with Owens Valley Paiute (Steward 1938:45). Moving farther north, there are less data concerning relationships between Death Valley and groups in the Lida area at the east end of the Silver Peak Range. Steward's Figure 7 shows a pine nut connection between Lida and the northern Funeral Mountains on the east flank of Grapevine Canyon. There is also a note of a marriage relation between and individual from Gold Mountain (south of Lida) and Death Valley (Steward 1938:69). Steward suggests that, rather than being a separate sociopolitical group, populations in Lida were linked to Gold Mountain Shoshone, Fish Lake Valley Paiute, and other Shoshone groups to the east, especially through intermarriage (1938:68). He offers a wealth of information regarding interactions between Fish Lake Valley Paiute and Shoshone groups at Lida. Pigeon Spring, situated in the mountains at the east end of Fish Lake Valley, was a place where Fish Lake and Lida groups shared pine nut gathering activities and held festivals. People from southern Fish Lake Valley at Oasis (Sohodühatü) also participated in activities at Pigeon Spring. Steward also makes references to frequent intermarriage between Fish Lake and Lida groups and between Paiute and Shoshone, implying that recent social and economic ties between these two populations

were solid, if not strong. Delacorte (1990) has long supported the idea that marriage relationships existed between Deep Springs Valley and Fish Lake Valley populations and between Deep Springs and Owens Valley. If the direct acquisition of Fish Springs glass was denied residents of northern Owens Valley, it may have been these kinds of relationships which facilitated the northward movement of Saline Range obsidian during late Marana times. This would also account for a late transfer of Truman-Queen glass along the east side of the White Mountains, through Fish Lake Valley and into Deep Springs Valley.

Finally, to echo sentiments already expressed about ethnographic use of the Volcanic Tableland (Basgall and Giambastiani 1995), the present study garnered no real evidence to either support or denounce Steward's (1933, 1938) claim that ethnographic Bishop Paiute "owned" portions of the Tableland for ricegrass procurement. At Fish Slough, site FS 14D-1 did yield a few glass trade beads and a couple pieces of turquoise, but there is no way to link these items with ethnohistoric Bishop groups in particular. It is also evident that, had Bishop Paiute routinely acquired Fish Springs obsidian and used the south half of the Tableland for ricegrass harvesting, we would expect to find large amounts of recent Fish Springs glass at dryland sites. This is not the case, and one is left to conclude that Bishop groups either did not or could not regularly obtain Fish Springs glass, did not normally carry much of it onto the Tableland, or simply did not occupy parts of the Tableland other than Fish Slough during the terminal prehistoric. Given the level of territorial control supposedly exercised over seed plots in ethnographic Owens Valley, it seems likely that ricegrass crops on the Tableland would be considered valuable and worthy of control. It may be, however, that seed crops in Owens Valley and on the west flank of the White Mountains were sufficient to meet population needs. Whatever the answer is, this is a question that will require some direct future attention if it is to be resolved.

RELEVANCE TO THE NUMIC SPREAD

Since Bettinger and Baumhoff's (1982) proposal of the Numic Spread hypothesis, it has been necessary to contend with the possibility that late adaptive changes in eastern California may have resulted from a population replacement rather than from *in situ* cultural developments. While there is not much to be said here that has not already been explored in the extensive treatise on the Numic expansion compiled by Madsen and Rhode (1994), the current notions about the nature of terminal prehistoric settlement patterns are relevant to ongoing debates as to whether or not the Numic intrusion really occurred and, if so, when it may have happened.

The crux of the Numic hypothesis is a "quantitative" difference in subsistence adaptations between pre-Numic and Numic groups. In his most recent discussion of the subject, Bettinger (1994) suggests that the subsistence strategies used by the Numics were similar to but more intensive than those of their predecessors. Having available to them the same food resources and carrying a broadly similar technology, Numic groups were able to exploit plant and animal foods more thoroughly than pre-Numic groups by using labor-intensive, "green-phase" recovery and processing techniques that allowed them to extend harvest seasons and/or increase overall food yields. Only with respect to residential mobility was there a real "qualitative" difference between pre-Numic and Numic populations, the latter producing a "village" pattern typified by longer-term residences and, as a result, less frequent overall mobility (Bettinger 1994). While the introduction of the bow-and-arrow is generally thought to pre-date Numic arrival, Delacorte (1995b) has garnered some convincing data showing that spatial variations in the age of Desert Side-notched points across the western Great Basin are consistent with the timing, duration, and direction of the Numic expansion, specimens being older on average in the Owens Valley region and younger with increasing distance to the north.

For several reasons, the Volcanic Tableland should be an ideal location for measuring effects of the Numic Spread. Bettinger (1994:48) indicates that small, independent Numic groups most likely targeted "...unused and relatively out-of-the-way corners of pre-Numic territory", referring to locations that were little used and unpopulated relative to more densely occupied areas like central Owens Valley. Places like the Volcanic Tableland and White Mountains fit this criteria nicely, as they show relatively little occupation prior to about 3000 B.P. He also suggests (1994:53) that Numic peoples could spread "...wherever they confront situations in which, by Numic standards, there is underuse of plant and animal resources that are storable and available in bulk." The rich base of edible seed grasses on the Tableland also would have been of prime importance to the Numic adaptation, which focused on the bulk processing of low-ranked foods like seeds. Furthermore, a decrease in residential mobility presumably led to an increase in the use of local resources and raw materials; the use of obsidian would fit in regard to the latter. Again, the Tableland's rich obsidian profile, and its location intermediate major obsidian sources, afford an unique opportunity to see the archaeological results of a decrease of residential and overall settlement mobility.

In many ways, the adaptive changes seen in the record of the Volcanic Tableland provide circumstantial support for the Numic hypothesis. The late (post-1400 B.P.), intensive use of seed resources, along with an apparent increase in residential occupations, are consistent with the premises of the Numic Spread. As Bettinger himself (1994:50) state concerning intensive plant processing at or shortly after A.D. 600, green phase pinyon and ricegrass harvesting "...appear in the archaeological record precisely as predicted by the Bettinger-Baumhoff hypothesis." Indeed, the bedrock threshing floors common at many residential sites on the Volcanic Tableland and in Deep Springs Valley (Basgall and Giambastiani 1995; Delacorte 1990, 1995a) could be interpreted as a signature of Numic ricegrass procurement alongside the woven seed-beater. Bettinger (1976, 1994) also suggests that an association of late-period time marker artifacts with structures and caches is

an index of Numic occupation. This is clearly represented in distributions of Desert and Rosegate series projectile points on the Tableland (Table 10.4). Both series are extremely common at residential sites (Type 3), locations which usually contain rock ring house structures, bedrock threshing floors, or both. Desert and Rosegate forms show a greater affinity to Type 3 sites than any other point style, excepting Fish Slough Side-notched points of which nearly all (over 30 items) derive from a single Type 3 site (MNO-1992). Successively older forms show less and less proclivity for Type 3 sites, with Pinto and Great Basin Concave Base/Stemmed points being much less common at residential locations. Direct associations of Desert and/or Rosegate points with actual structure contexts is impossible to gauge with current data, but it appears that these forms relate a bit more frequently to residential sites than do older point types.

From examinations at several sites, Basgall and Giambastiani (1995) argued that the majority of rock ring features on the Tableland are probably of post-Newberry antiquity, based on project hydration profiles and given biases of diagnostic arrow points, beads, and ceramics to structure confines or vicinities. Nonetheless, it does seem that Elko and Humboldt points are only slightly less frequent at Type 3 sites than are later forms, by fractions of only about 5%. Along with a host of other evidence, this implies that residential occupations were often established during the Newberry period. Certainly, the bulk of obsidian debris at most Type 3 sites arrived at this time, and it is likely that midden deposits at many locations date to this interval as well. While artifact scavenging has probably narrowed variances in point distributions at certain sites, it may be that differences between Newberry and Haiwee/Marana adaptations on the Volcanic Tableland have been exaggerated. This very point was made by Basgall and Giambastiani (1995:265) concerning variation between pre-village and village adaptations in White Mountains (Bettinger 1990, 1991). Along these lines, it is possible that the differences between Newberry deposits (middens) and Haiwee/Marana occupations (house structures and threshing floors) on the Tableland are largely of

TABLE 10.4. Major projectile point series by site type on the Volcanic Tableland.

	Type 1		Type 2		Type 3		Type 4		Type 5		Total	
DESERT	3	(4%)	4	(6%)	60	(87%)	2	(3%)	-	-	69	(100%)
ROSEGATE	5	(5%)	7	(7%)	89	(88%)	-	-	-	-	101	(100%)
ELKO	4	(2%)	25	(14%)	153	(84%)	-	-	-	-	182	(100%)
HUMBOLDT	1	(4%)	4	(14%)	23	(82%)	-	-	-	-	28	(100%)
FISH SLOUGH	2	(5%)	1	(2%)	38	(93%)	-	-	-	-	41	(100%)
PINTO	6	(31%)	1	(5%)	11	(58%)	-	-	1	(5%)	19	(100%)
GBCB/STEM	2	(14%)	2	(14%)	10	(71%)	-	-	-	-	14	(100%)
Total	23		44		384		2		1		454	

degree, not kind. An emphasis on plant processing during both intervals is certainly implied, especially considering the well-developed milling tool assemblages found in Newberry contexts (Basgall and Giambastiani 1995), but it is evident that use of the Tableland during Haiwee/Marana times involved the bulk processing of seed grasses while earlier habitations employed less intensive exploitative methods. In this sense the establishment of residential sites on the Tableland would not be considered a Numic trait, but the use of threshing floors could be distinctively Numic.

All this given, as Delacorte (1997:156) states "...it remains nearly impossible to distinguish Numic from non-Numic occupations". On the Tableland, adaptive shifts during the terminal prehistoric imply a decrease in overall settlement mobility, and are generally consistent with the Numic Spread hypothesis, but they can just as easily be a result of *in situ* population growth and regional circumscription. Indeed, from the perspective of a single archaeological locality like Tableland the Numic Spread might be invisible, especially if the 600-year time frame for Numic expansion proposed by Young and Bettinger (1992) is correct. Delacorte's (1995b) effort to link Desert Side-notched points to the Numic Spread is insightful, and unfortunately the present study

offers little help along these lines. As with certain ethnographic questions, the answer to the Numic question awaits the discovery of tell-tale signatures and directed future study.

SUMMARY OF DISSERTATION RESULTS

The settlement reconstructions offered in this chapter are based heavily on the analysis of obsidian collections and rely primarily on the implications of technological organization theory. As with any kind of archaeological information, there are many ways to interpret patterning in obsidian source and hydration data, and the interpretations here represent but one way to look at things. For certain, most conclusions resulting from this study are most valuable as hypotheses for future evaluation and testing. However, the fact that many of the trends on the Volcanic Tableland match those seen by researchers in other parts of eastern California and the western Great Basin is compelling and suggests strong interregional continuity in prehistoric adaptive patterns.

Like most projects of this magnitude, this research set out to achieve several major goals and a few minor ones, ultimately succeeding at most of them. The most rudimentary intent was to generate a massive obsidian database from a wide range of sites at a single archaeological locality. This aim was clearly met, though in retrospect the various sampling strategies employed were more critical to the success of results than was the sheer quantity of artifacts for which obsidian source and hydration data were obtained. Visual and XRF sourcing programs achieved desired levels of accuracy and merged to form a cohesive set of source profiles. In some examinations it would have been useful to be able to separate Mono Craters from Mono Glass Mountain obsidians, but the main objectives of source analyses were not compromised by this problem. Overall, obsidian research was able to show how useful and explanatory obsidian source and hydration data can be if approached from a realistic, holistic perspective.

Chapters Five through Seven detailed the results of multiple seasons of fieldwork on the Volcanic Tableland, describing efforts made to make use of existing archaeological collections and reviewing the most important characteristics of obsidian artifact collections. Chapters Five and Six presented survey and excavation data to develop a site typology for the Tableland and to demonstrate variability in prehistoric land-use between Fish Slough and the dry, upper Plateau. Chapter Seven discussed how Enfield materials and collections from previous excavations on the Tableland (Basgall and Giambastiani 1995) were incorporated with recent collections to boost areal coverage and improve artifact sample sizes. The rationale and strategies employed to make use of the Enfield collections provide a good example of how research can be designed to salvage information from existing but outdated artifact collections. Formal results of the research were presented in Chapters Eight through Ten. In Chapter Eight, the Tableland was divided into four spatial quadrants, and obsidians were combined into geographic source groups according to their distance and direction from the Tableland. This allowed for discussion of gross spatio-temporal trends in obsidian source use. Details of long-term changes in flaked stone technology were also described. Chapter Nine focused on evaluating project results in terms of their implications for prehistoric adaptations on the Volcanic Tableland and in Owens Valley, and the present chapter has outlined hypothetical settlement ranges and basic adaptive patterns for the larger Inyo-Mono region and for west-central Nevada.

Spatial and Temporal Distributions of Obsidian Sources

From a synchronic perspective, all obsidians present on the Tableland behaved as they should according to spatial distance-decay models. Corresponding with its location relative to the project area, each obsidian source was most abundant in its nearest Tableland quadrant(s). Most of the distant sources occurred primarily as curated tools (points and bifaces), while proximal sources

occurred more equally as tools and debitage. It was initially perceived that Saline Valley obsidian was an exception to this, as it was determined to have a fairly strong presence on the Tableland despite a distant origin. Moreover, most Saline artifacts are unmodified flakes, a fact normally taken as a signature of a "local" obsidian. As it turns out, though, hydration data indicate that more than a third of all Saline Valley artifacts are the product of late-period scavenging behavior at only a couple of sites. Most Saline Valley artifacts probably arrived on the Tableland as a result of direct moves from the source, particularly ones that were imported prior to the Haiwee period, but the number of artifacts with Haiwee and Marana hydration values is exaggerated due to the effects of scavenging.

Also counter to distance-decay predictions, Fish Slough proved to be a magnet for all obsidian sources irrespective of their distance and orientation from the study area. This was most obvious for Far North sources like Pine Grove Hills, Bodie Hills, and Mt. Hicks, which (all else equal) should have been more prevalent in northern quadrants. Numerous archaeological data show that occupations at Fish Slough sites spanned nearly all of the Holocene, but the importation of distant glasses to the area was evidently an early Holocene (at least pre-5000 B.P.) phenomenon. Artifact assemblages from early sites at Fish Slough demonstrate a range and diversity of obsidian sources expected to result from long-range settlement moves between distant locations to the north and south.

Long-Term Changes in Flaked Stone Technology

Supporting trends noted by Basgall and Giambastiani (1995), there are many patterns in current obsidian data that indicate long-term changes in flaked stone technology on the Volcanic Tableland. Hydration readings clearly show the waxing and waning of different tool types through time. Dart-point use evidently peaked during the Newberry period (~5.0-6.9 microns), while arrow-

points and arrow-point blanks were all but absent until the beginning of the Haiwee interval (about 4.9 microns). Biface use also reached its zenith during Newberry and early Haiwee times. Marana-age bifaces are quite rare, those identified being Early- and Middle-stage forms that probably served as cores to produce small flake blanks. Formed flake tools, particularly keeled types, were most important during pre-Newberry times (>7.0 microns) but still used during the Haiwee and Marana periods. Cores were found in pre- and post-Newberry assemblages, though bipolar forms were obviously partial to post-Newberry times. This last pattern most likely results from efforts to extend on-site obsidian stores during Haiwee-Marana occupations, and is consistent with the implications of decreased residential mobility and declining opportunities for direct obsidian procurement. Technological profiles for obsidian debitage show a dramatic drop in waste production and in biface manufacturing following the Haiwee period. Pressure flakes are also scarce in Marana debitage samples, indicating that directed, invasive pressure-flaking ceased to be of major importance. The gracile nature of Marana arrow-points agrees with this notion, though it is also likely that many waste flakes from the final production of Cottonwood and Desert Side-notched points were too small for retrieval through standard mesh screens (3-mm). Overall, technological shifts at the Newberry-Haiwee transition are exactly what one would expect to see if the change from dart- to arrow-point use occurred at this time.

Chapter Nine concluded with an evaluation of the changes in flaked stone technology described in the previous chapter. I argued here that the change from dart- to arrow-point production must have had some effects on the organization of lithic procurement and tool manufacturing activities. The shift from a regular use of percussion-thinned bifaces for dart-point preforms to the use of small flake blanks for arrow-point preforms could easily have been responsible for the drop in biface production seen at many eastern California obsidian quarries about 1000 years ago. Especially if this change occurred in the context of increasing population circumscription, shrinking

foraging ranges, and decreased access to obsidian source areas, the adoption of the bow-and-arrow might also have led to the use of alternative core reduction strategies and an increased frequency of artifact reuse and scavenging. Hydration data from this project show clear trends toward the establishment of residential sites on the tableland during the Newberry period and the frequent re-use of these locations during subsequent Haiwee and Marana intervals. Not only does this suggest that subsistence adaptations were changing focus to make better use of dryland resources (seeds), it also indicates that Haiwee-Marana groups were able to take advantage of existing stores of lithic debris at the Newberry sites they often revisited. Scavenged materials were certainly not to be relied upon, nor were they in endless supply, but they may have been enough to support seasonal, short-term occupations at frequently reused sites that mainly targeted vegetal rather than faunal resources.

Truman-Queen Hydration Rate

Two minor but still important aims of this research were to re-evaluate the utility of the current, working Truman-Queen hydration rate and to examine the relative rate parameters for other obsidians on the Volcanic Tableland. In Chapter Nine, a previous study of Truman-Queen hydration rates by Weaver (1992) was revisited in some detail in order to determine why the rates developed from this study were unsuccessful. In my opinion, problems with Weaver's study pertain to errors in artifact classification and in the use of reworked specimens to generate micron-age pairs. The problem mainly involves Elko and pre-Elko dart forms that provided unusually small micron values, creating excessive overlap between ranges for dart- and arrow-points and implying ages too young for dart forms. Efforts by Ramos (2000) to test the working rate developed on the Volcanic Tableland (Basgall and Giambastiani 1995) and to formulate a new rate for the Truman-Queen source locality offer little clarification to these issues. This particular study was not examined in this context, but its failure to support the Basgall/Giambastiani rate stems from the fact that an EHT

correction for Truman-Queen quarry (situated at a much higher elevation and lower mean annual temperature than the Volcanic Tableland) was not applied.

Ramos' difficulty in producing an alternative hydration rate probably has to do with one of the same problems Weaver (1992) encountered, that is the presence of many reworked projectile points in analyzed collections. Along these lines, perhaps the most important outcome of the present study is the conclusion that Truman-Queen obsidian does hydrate at a regular, consistent rate through about 10.0 microns of adsorption. The original Basgall/Giambastiani rate is also supported by the currently expanded set of projectile point hydration data, which adds further justification for using the rate until better chronological resolution is available. As for other obsidians, Casa Diablo seems to be hydrating much faster than normal on the Volcanic Tableland. This is expectable given a greater EHT, but pre-Elko dart point forms on the Tableland seem to require a substantial correction (about -10% per degree Celsius) to bring them in line with hydration parameters at the Casa Diablo source. It is possible that the cumulative effects of the greater temperature regime in the study area has served to exaggerate Casa Diablo hydration over an extended period. Mt. Hicks obsidian also appears to be hydrating rather rapidly on the tableland, at a pace 1.5 times higher than it does on the Dry Lakes Plateau in the Bodie Hills (Halford 1997). In contrast, Fish Springs glass seems to hydrate at essentially the same rate on the Volcanic Tableland as it does at the source, presumably because the EHT in the study area is less than 0.5° C higher than at Fish Springs.

Projectile Points as Time-Markers

Hydration studies provided a context for revisiting the long-standing argument about the utility of projectile points as time markers in the Great Basin. In part this was an attempt to match chronological sequences to current projectile point hydration data, but also important was demonstrating how well each point style clustered together yet was separate from other types in

terms of hydration values. The fact that both dart- and arrow-points patterned out so well is an indication of how easily changes in point morphology can be observed and predicted through time. In addition, this exercise addressed several other questions concerning the relative ages of different point styles. Hydration values for gracile "Little Lake" points corresponded to Elko forms, while robust Pinto points were shown to comprise a much older, separate type. Basgall and Hall (2000) have made this same argument based on differences in point morphology, associated radiocarbon dates, and hydration data. In fact, there is every reason to abandon the term "Little Lake", as so-called variants in eastern California are largely consistent in morphology and age to Gatecliff Split-stem points in the western Great Basin (see also Basgall and Hall 2000).

Humboldt Basal-notched forms also appear to date primarily within the Newberry interval. The most interesting pattern, though, emerged in regard to Fish Slough Side-notched points. These forms are clearly older than Elko points and are at least contemporaneous with Pinto points. They also demonstrate an extremely tight hydration range relative to other dart points, and given their near-exclusion to a single site (MNO-1992) they may relate to an isolated occupational event or represent an unique adaptive pattern. As for arrow-points, the early end of Rosegate hydration for Truman-Queen obsidian correlates directly with the Newberry-Haiwee transition. Despite recent claims to the contrary (Yohe 1992), the present study supports the notion that the dart-to-arrow transition occurred at approximately 1400 B.P., squarely at the end of the Newberry period.

Settlement Ranges in Eastern California and West-Central Nevada

Taking all of this together, this last chapter has attempted to use project data to hypothesize the geographic ranges and temporal spans of regional settlement systems that once utilized portions of the Volcanic Tableland. Since about 8500 years ago the Tableland has felt the influence of populations based in all directions, but it appears that the most direct influences have originated

from the north and east. Still, the first early Holocene groups visiting the Tableland primarily targeted the Fish Slough wetland. Obsidians from as far south as Coso and from as far north as the Pine Grove Hills were brought to and discarded at the slough. These early encampments left few remains, mostly broken tools and flaking debris, and they appear to have come and gone within a relatively short period of time. While it is impossible to predict the areal boundaries of settlement ranges used by these early occupants, we can say that there was at least one system in place responsible for long-distance journeys north and south across the Inyo-Mono region. The presence of Fish Slough Side-notched points and keeled unifaces, however, could relate to a more eastern settlement system which incorporated areas east of the White Mountains and parts of western Nevada. During the middle Holocene, the far-reaching settlement patterns of the preceding interval appear to have persisted. A northern system may have developed at this time, linking use of the Mono Basin to groups in the Walker Lake and Carson Sink areas, and a northeast system may have been based somewhere in central Nevada. Hydration data from the Mojave Desert indicate that Coso obsidian was reaching places at Fort Irwin as early as the Pinto period (Basgall 1993; Basgall and Hall 1992; Jenkins 1987; Warren et al. 1984), so presumably a southern range existed at this time as well.

Major changes in regional settlement patterns did not occur until the onset of the Newberry period (~3500-3200 B.P.). At this time, use of the Volcanic Tableland became more frequent and expanded to incorporate dryland areas beyond Fish Slough. Truman-Queen obsidian assumes a dominant role in Newberry-period sites, both as discarded tools and debitage, while Casa Diablo increases slightly as well. Beyond the Tableland, the northward and eastward distributions of Truman-Queen obsidian may have peaked at this time, judging by its occurrences at Hidden Cave and Gatecliff Shelter. Delacorte (1997) suggests there may also have been regular interactions between the Mono Basin and areas as far north as Massacre Lake in northwestern Nevada, though

such contacts would have involved an entirely different settlement regime centered somewhere to the north. Perhaps what we are seeing during this interval is a fragmentation of the more expansive eastern Sierra settlement range of the early and middle Holocene into several smaller north-south ranges, the Mono Basin being one center of overlap and the Coso area south of Owens Lake being another. For certain, the regularity of north-south settlement moves, as identified by Basgall (1989; Basgall and McGuire 1988) and others in in Inyo-Mono region (Delacorte and McGuire 1993; Delacorte et al. 1995; Gilreath and Hildebrandt 1995), was established at this time and routinely included the Volcanic Tableland. The fact that northern obsidians are prevalent in the study area but southern glasses are not indicates that the Tableland was primarily visited during southward movements into Owens Valley or into the White Mountains.

Haiwee-Marana times probably saw the most radical changes in regional settlement patterns. Obsidian data show that the Volcanic Tableland was being used with greater frequency by groups carrying Mono, Casa Diablo, and Mt. Hicks glasses, and that occupations continued to target residential sites in dryland areas. Recent use also included Fish Slough, but the majority of arrow-point forms is found in the northern half of the study area. Northern sections of the Tableland were being used by groups making a fairly regular circuit throughout the broader Mono Basin-Long Valley area. Delacorte (1997) also suggests that a long-distance system may have extended from the Pah Rah Range to the Mono Basin at this time. Admittedly, some of the late occupations could derive from such a system, but it seems likely that a more localized system is responsible for patterns in the study area.

Meanwhile, the south half of the Tableland saw increasing visits from the Casa Diablo area, perhaps via Chidago Canyon or the Owens River Gorge. Again, this pattern could relate to a Mono Basin-Long Valley settlement system, but it could also represent movements of a separate settlement system based in Owens Valley. Groups in northern Owens Valley may have had more incentive

to acquire Casa Diablo glass if Fish Springs was becoming more difficult to access directly. Indeed, if any late-period occupations in the southern half of the Tableland were made by groups venturing up from Owens Valley, these people did not bring with them stores of Fish Springs glass.

Last, there is evidence for the emergence of a distinct settlement system on the east side of the White Mountains sometime during or after the Haiwee period. While there were certainly interactions between groups on the east side and those in Owens Valley during previous intervals, associated population levels were probably not high enough to create the need for regularized interactions. The beginnings of occupation in Deep Springs Valley around 3200 B.P., however, may have provided the foundations for a settlement range that included Saline Valley, Eureka Valley, Deep Springs, Fish Lake Valley, the White Mountains, and the Benton-Hammil Valley corridor. Parts of the northern Tableland may have been accessed by this system, a pattern that likely developed into the ethnographic rounds of Benton Paiute groups. Groups using Fish Lake Valley may have retained ties to groups farther east in western Nevada, but there is no evidence to show that late-period visitors to the Tableland had any direct ties to inhabitants of those areas. Unfortunately, an increase in artifact scavenging during the Marana period has complicated source profiles to some degree, and many patterns that were fairly discrete in Haiwee profiles become slightly blurred. This same problem has been noted in other research efforts in eastern California (Delacorte and McGuire 1993; Delacorte et al. 1995; Basgall and McGuire 1988), and it lends circumstantial support to the idea that the restriction of post-Newberry settlement ranges made direct access to obsidian sources more difficult.

All in all, the use history of the Volcanic Tableland corresponds well to contemporary notions about long term changes in prehistoric population densities, subsistence adaptations, and settlement systems in the western Great Basin. As with locations like Deep Springs Valley, the Tableland comprises a sort of "marginal" environment relative to neighboring Owens Valley. Fish Slough is

an obvious exception, maintaining a rich resource base and year-round water, but it accounts for only a tiny portion of the whole Tableland formation. It is logical to expect that the rocky, dryland plateau should be essentially ignored during early and middle Holocene times when aboriginal populations could pick and choose from better habitats in other locations. It is probably not mere coincidence, then, that Deep Springs Valley and the Tableland witnessed the onset of regular habitation during the Newberry period. This is the interval when eastern California populations began to increase and the effects of resource competition were beginning to push native groups to alter their adaptive strategies. Obsidian data from the Tableland indicate that regional circumscription was not restricted to Owens Valley, but that it was certainly a stronger force there than in the Mono Basin, in western Nevada, or on the east flank of the White Mountains.

CONCLUDING REMARKS

This study has made a number of important contributions to the understanding of local and regional archaeological patterns in eastern California. Beyond demonstrating the interpretive power of a large obsidian database, it has shown that the Volcanic Tableland had an unique affiliation with north and northeast settlement systems through the course of its prehistoric use. Research results have both supported and contradicted different premises about prehistoric settlement in Owens Valley, ultimately highlighting discrepancies in late prehistoric adaptations between Owens Valley and the Tableland. Perhaps most unique about the Tableland's archaeological record are its ancient occupation sites along Fish Slough, and the definitive side-notched points from MNO-1992, neither of which are duplicated in Owens Valley. The wide range of obsidians brought to this locale, from great distances and over several millennia, testify to the persistent importance of Fish Slough in settlement rounds of people from all across the Inyo-Mono region and beyond.

Although this research has addressed a number of significant issues regarding eastern California prehistory, it has also pushed some to the forefront. For instance, the obsidian source profile from the Volcanic Tableland is not yet fully fleshed out. There are surely additional, unidentified sources present, and it is not known how obsidian nodules native to the Tableland itself or those present in Fish Lake Valley factored into local tool production. Also, the relative importances of Mono Craters and Mono Glass Mountain sources were not been determined in this study, and the distributions of different Casa Diablo geochemical types (Dry Creek, Lookout Mountain, Sawmill Ridge) have not been examined. It is necessary to continue studying the behavior of Truman-Queen obsidian hydration, and given the restricted spatial distribution of Truman-Queen glass in eastern California the Tableland may be one of the only locations where its hydration rate can be properly evaluated and improved. Following Delacorte (1995), the age of Desert Side-notched points on the Tableland relative to other parts of the western Great Basin could also be more thoroughly investigated. More room is available for obsidian sourcing and hydration studies in these and other areas.

It seems that the Tableland was, in one sense, a true boundary zone between several different settlement systems. Why was it favored by groups from the north rather than the south through time? Clearly it has supported a somewhat different environment than Owens Valley over the past few millennia, one that is more similar to arid environments in western Nevada. Perhaps this had something to do with human perceptions of where the Tableland "fit" in the context of regional settlement systems; its resources were more familiar to groups from the north and east than from the south. But the fact that Fish Slough was a magnet location for occupation during the early and middle Holocene, while the broader Plateau was essentially ignored, indicates that dryland ecozones were not targeted until relatively late in time, a phenomenon clearly related to the intensification of subsistence pursuits. Also, the position of the Tableland relative to other stops on settlement rounds

remains in question. Most likely, occupations at Fish Slough were made during the winter, when other habitats were low on resources, while occupations on the Plateau were made during early spring and summer. If early and middle Holocene groups visited Fish Slough during the winter, they may have done so en route to warmer climes out of Nevada in search of game. And if late Holocene populations used the Plateau during the spring/summer, to obtain seed grasses and other dryland resources, they may have done so following winters in the pinyon zones of the White Mountains or other nearby ranges. Additional obsidian studies in areas east of the Tableland could help to test these and other similar hypotheses.

Finally, more work still needs to be done to help better understand the settlement systems that incorporated the Volcanic Tableland over the last 8500 or so years. This study has gone far in providing a possible outline of their spatio-temporal boundaries, but the intricacies of long-term changes in land-use and subsistence patterns, as well as other adaptive strategies, are still largely unknown. Now evident, though, is the value of large-scale obsidian studies in reconstructing prehistoric settlement ranges. Once other comparable studies are completed in eastern California and Nevada, it will be possible to refine the conclusions drawn here and delve deeper into the nature and character of prehistoric adaptations in the western Great Basin.

REFERENCES CITED

Aiello, P. V.

1969 *The Chemical Composition of Rhyolitic Obsidian and its Effect on Hydration Rate: Some Archaeological Evidence*. Unpublished M.A. thesis, University of California, Los Angeles.

Aikens, C. M. and Y. T. Witherspoon

1986 Great Basin Numic Prehistory: Linguistics, Archaeology, and Environment. IN Anthropology of the Desert West: Essays in Honor of Jesse D. Jennings, edited by C. Condie and D. Fowler, pp. 7-20. *University of Utah Anthropological Papers* 110. University of Utah Press, Salt Lake City.

Amaroli, P. E.

1982 *An Archaeological Investigation at CA-SON-995, Sonoma County, California.* Manuscript on file at Northwest Information Center, California State University, Sonoma.

Ambrose, W. R.

1973 Obsidian Hydration Rate Dating. Manuscript on file at Australian National University, Canberra, ACT.

1975 Dating Obsidian. Paper presented at ANZAAS Conference, on file at Australian National University, Canberra, ACT.

1976 Intrinsic Hydration Rate Determinators. IN *Advances in Obsidian Glass Studies*, edited by R. E. Taylor, pp. 81-105. Noyes Press, Park Ridge, New Jersey.

1994 Obsidian Hydration Dating of a Pleistocene Age Site from the Manus Islands, Papua New Guinea. *Quaternary Geochronology* 13(2):137-142.

1998 Obsidian Hydration Dating at a Recent Age Obsidian Mining Site in Papua, New Guinea. IN *Archaeological Obsidian Studies: Method and Theory*, edited by M. S. Shackley, pp. 205-222. Plenum Press, New York.

Ames, K. M.

1988 Early Holocene Forager Mobility Strategies on the Southern Columbia Plateau. IN Early Human Occupation in Far Western North America: The Clovis-Archaic Interface, edited by J. A. Willig, C. M. Aikens, and J. L Fagan, pp. 325-360. *Nevada State Museum Anthropological Papers* 21. Carson City.

Amick, D. S. and R. P. Maudlin (Eds.)

1989 Experiments in Lithic Technology. *British Archaeological Reports, International Series* 528. Oxford.

Amsden, C. N.
1937 The Lake Mohave Artifacts. IN The Archaeology of Pleistocene Lake Mohave, by E. W. C. Campbell, W. H. Campbell, E. Antevs, C. E. Amsden, J. A. Barbieri, and F. D. Bode, pp. 52-98. *Southwest Museum Papers* 11. Los Angeles.

Andrefsky, W.
1994 Raw-Material Availability and the Organization of Technology. *American Antiquity* 59(1):21-34.

Antevs, E.
1948 Climatic Changes and Pre-White Man. IN The Great Basin, with Emphasis on Postglacial Times. *University of Utah Bulletin* 38 (20), *Biological Series* 10 (7):168-191.

1952 Climatic History and the Antiquity of Man. *University of California Archaeological Survey Reports* 16:23-31. Berkeley.

Arkush, B. S.
1995 The Archaeology of CA-MNO-2122: A Study of Pre-Contact and Post-Contact Lifeways Among the Mono Basin Paiute. *University of California Anthropological Records* 31. Berkeley.

Asch, D. L.
1975 On Sample Size Problems and the Uses of Nonprobabilistic Sampling. IN *Sampling in Archaeology*, edited by J. W. Mueller, pp. 170-191. University of Arizona Press, Tuscon.

Aschmann, H.
1958 Great Basin Climates in Relation to Human Occupance. *University of California Archaeological Survey Reports* 42:23-36. Berkeley.

Bacon, C. R., D. M. Giovannetti, W. A. Duffield, G. B. Dalrymple, and R. E. Drake
1982 Age of the Coso Formation, Inyo County, California. *U.S. Geological Survey Bulletin* 1527.

Bacon, C. R., R. MacDonald, R. L. Smith, and P. A. Baedecker.
1981 Pleistocene High-Silica Rhyolites of the Coso Volcanic Field, Inyo County, California. *Journal of Geophysical Research* 86(B11):10223-10241.

Bailey, R. A.
1989 Geologic Map of the Long Valley Caldera, Mono-Inyo Craters Volcanic Chain, and Vicinity, Eastern California. *United States Geological Survey, Miscellaneous Investigations Series* Map I-1933.

Bailey, R. A., G. B. Dalrymple, and M. A. Lanphere
1976 Volcanism, Structure, and Geochronology of Long Valley Caldera, Mono County, California. *Journal of Geophysical Research* 81:725-746.

Bamforth, D.
1986 Technological Efficiency and Tool Curation. *American Antiquity* 51:38-50.

1990 Settlement, raw material, and lithic procurement in the central Mojave Desert. *Journal of Anthropological Archaeology* 9:70-104.

1992 Quarries in Context: A Regional Perspective on Lithic Procurement. IN *Stone Tool Procurement, Production, and Distribution in California Prehistory*, edited by Jeanne E. Arnold. Institute of Archaeology, University of California, Los Angeles.

Bamforth, D. B., R. I. Dorn, M. E. Macko, and E. B. Weil
1986 *Tradition and Transmission: Prehistoric Stone Procurement & Tool Production in the Mojave Desert, California.* Report prepared by Applied Conservation Technology, Westminster, CA.

Basgall, M. E.
1983 *Archaeology of the Forest Service Forty Site (CA-MNO-529), Mono County, California.* Report submitted to U.S. Forest Service, Inyo National Forest, Bishop.

1984 *The Archaeology of MNO-1529: A Secondary Reduction Site in Mammoth Lakes, Mono County, California.* Report submitted to U.S. Forest Service, Inyo National Forest, Bishop.

1987 Resource Intensification Among Hunter-Gatherers: Acorn Economies in Prehistoric California. *Research in Economic Anthropology* 9:21-52.

1988 The Archaeology of CA-MNO-679: A Pre-Archaic Site in Long Valley Caldera, Mono County, California. IN Early Human Occupation in Far Western North America: The Clovis-Archaic Interface, edited by J. A. Willig, C. M. Aikens, and J. L Fagan, pp. 103-120. *Nevada State Museum Anthropological Papers* 21. Carson City.

1989 Obsidian Acquisition and Use in Prehistoric Central-Eastern California: A Preliminary Assessment. IN Current Directions in California Obsidian Studies, edited by R. E. Hughes, pp. 111-126. *Contributions of the University of California Archaeological Research Facility* 48. Berkeley.

1990a *Hydration dating of Coso Obsidian: Problems and Prospects.* Paper presented at the 1990 annual meeting of the Society for California Archaeology, Foster City.

1990b *Early Holocene Faunal Exploitation in the Mojave Desert.* Paper presented at the 24th annual meeting of the Society for California Archaeology, Foster City.

1991 *The Archaeology of Nelson Basin and Adjacent Areas, Fort Irwin, San Bernardino County, California.* Report submitted to U.S. Army Corps of Engineers, Los Angeles.

1993 *Early Holocene Prehistory of the North-Central Mojave Desert.* Unpublished Ph.D. dissertation, University of California, Davis.

1995 Obsidian Hydration Dating of Early Holocene Assemblages in the Mojave Desert. *Current Research in the Pleistocene* 12:57-60.

2000 An Archaeological Assessment of Late Holocene Environmental Change in the Southwestern Great Basin. Paper presented at the 27th Great Basin Anthropological Conference, Ogden, Utah.

Basgall, M. E. and M. G. Delacorte

2003 *Phase II Evaluations at Nine Archaeological Sites Near Independence, Inyo County, California.* Report submitted to California Department of Transportation, Central Region, Fresno.

Basgall, M. E., M. G. Delacorte, and M. C. Hall

1995 Fish Slough Side-notched Projectile Points: An Early Holocene Time Marker in the Western Great Basin. *Current Research in the Pleistocene* 12:1-4.

Basgall, M. E., M. G. Delacorte, and D. W. Zeanah

2003 *An Archaeological Evaluation of Five Prehistoric Sites Near Bishop, Inyo County, California.* Report submitted to California Department of Transportation, Southern Sierra Analysis Branch, Fresno.

Basgall, M. E. and M. A. Giambastiani

1992 *Providing Good Measure: A Report on Three Seasons of Archaeological Investigation on the Volcanic Tablelands, Mono and Inyo Counties, California.* Report submitted to the Bureau of Land Management, Sacramento.

1995 *Prehistoric Use of a Marginal Environment: Continuity and Change in Occupation of the Volcanic Tablelands, Mono and Inyo Counties, California.* Center For Archaeological Research at Davis, Publication 12.

2000 *An Archaeological Evaluation of 13 Locations in the Deadman Lake Basin, Marine Corps Air Ground Combat Center, Twentynine Palms, California.* Report submitted to the U.S. Army Corps of Engineers, Sacramento, California.

Basgall, M. E., M. A. Giambastiani, and K. R. Bethard
2000 *An Evaluation of Nine Archaeological Sites in the Deadman Lake Basin, Mrine Corps Air Ground Combat Center, Twentynine Palms, California.* Report submitted to the U.S. Army Corps of Engineers, Sacramento, California.

Basgall, M. E. and M. C. Hall
1990 *Adaptive Variation in the North-Central Mojave Desert.* Paper presented at the 55th Annual Meeting of the Society for American Archaeology, Las Vegas, Nevada.

1991 Relationships between Fluted and Stemmed Points in the Mojave Desert. *Current Research in the Pleistocene* 8:61-64.

1992 *Archaeology of the Awl Site, CA-SBR-4562, Fort Irwin, San Bernardino County, California.* Report submitted to U.S. Army Corps of Engineers, Los Angeles.

1993 *Observations on Morphological and Temporal Variation of Pinto Points from the Southwestern Great Basin.* Paper presented at the 27th Annual Meeting of the Society for California Archaeology, Asilomar.

1994 *Archaeological Investigations at Goldstone (CA-SBR-2348): A Middle Holocene Occupation Complex in the North-Central Mojave Desert, California.* Report submitted to U.S. Army Corps of Engineers, Los Angeles.

2000 Morphological and Temporal Variation in Bifurcate-Stemmed Dart Points of the Western Great Basin. *Journal of California and Great Basin Anthropology* 22:237-276.

Basgall, M. E., M. C. Hall, and W. R. Hildebrandt
1986 *Research Design for Data Recovery Excavations in Drinkwater Basin, Fort Irwin, San Bernardino County, California.* Report submitted to U.S. Army Corps of Engineers, Los Angeles.

1988a *The Late Holocene Archaeology of Drinkwater Basin, Fort Irwin, San Bernardino County, California.* Report submitted to U.S. Army Corps of Engineers, Los Angeles.

Basgall, M. E. and R. Jobson
1986 An Archaeological Reconnaissance of the Sherwin Ski Area, near Mammoth Lakes, Mono County, California. Report on file at Inyo National Forest, Bishop, California.

Basgall, M. E. and K. R. McGuire
1988 *The Archaeology of CA-INY-30: Prehistoric Culture Change in the Southern Owens Valley, California.* Report submitted to California Department of Transportation, Sacramento.

Basgall, M. E., K. R. McGuire, and A. J Gilreath
1988b *Archaeological Test Excavations at CA-INY-30: A Multicomponent Prehistoric Site Near Lone Pine, Inyo County, California.* Report submitted to California Department of Transportation, Bishop.

Basgall, M. E. and D. L. True
1985 *Archaeological Investigations in Crowder Canyon, 1973-1984: Excavations at Sites CA-SBR-713, SBR-421B, SBR-421C, and SBR-421D.* Report submitted to California Department of Transportation, San Bernardino.

Bateman, P. C.
1965 Geology and Tungsten Mineralization of the Bishop District, California. *United States Geological Society Professional Paper* 470.

Baumhoff, M. A. and J. S. Byrne
1959 Desert Side-Notched Points as a Time Marker in California. *Reports of the University of California Archaeological Survey* 48:32-65. Berkeley.

Batchelder, G. L.
1970 *Post-glacial Ecology at Black Lake, Mono County, California.* Unpublished Ph.D. dissertation, Department of Anthropology, Arizona State University, Tempe.

Bedwell, S. F.
1973 *Fort Rock Basin: Prehistory and Environment.* University of Oregon Press, Eugene.

Bell, R. E.
1977 Obsidian Hydration Studies in Highland Ecuador. *American Antiquity* 42(1):68-78.

Bertin, E.
1978 *Introduction to X-Ray Spectometric Analysis.* Plenum Press, New York.

Bettinger, R. L.
1975 *The Surface Archaeology of Owens Valley, Eastern California: Prehistoric Man-Land Relationships in the Great Basin.* Unpublished Ph.D. dissertation, University of California, Riverside.

1976 The Development of Pinyon Exploitation in Central Eastern California. *Journal of California Anthropology* 3(1):81-95.

1977a Aboriginal Human Ecology in Owens Valley: Prehistoric Change in the Great Basin. *American Antiquity* 42:3-17.

1977b The Surface Archaeology of the Long Valley Caldera, Mono County, California. *University of California Archaeological Research Unit Monograph* 1. Riverside.

1977c Aboriginal Human Ecology in Owens Valley: Prehistoric Change in the Great Basin. *American Antiquity* 42(1):3-17

1978a *Archaeology of the Blue Flag Site (FS-05-04-53-37) (CA-MNO-34), Mono County, California.* Manuscript on file at the Archaeological Research Unit, University of California, Riverside.

1978b Humbodlt Basal-notched Bifaces as Time Markers in the Great Basin. *Tebiwa* 10:1-7.

1980 *Archaeology of the Triple R Site, FS-05-04-52-10 (CA-MNO-714), Mono County, California.* Manuscript on file at Inyo National Forest, Bishop, California.

1981 *Archaeology of the Lee Vining Site, FS-05-04-51-219 (CA-MNO-446), Mono County, California.* Manuscript on file at Inyo National Forest, Bishop, California.

1982a Archaeology East of the Range of Light: Aboriginal Human Ecology of the Inyo-Mono Region of Central-eastern California. *Monographs in California and Great Basin Anthropology* 1. Davis, California.

1982b Aboriginal Exchange and Territoriality in Owens Valley, California. IN *Contexts for Prehistoric Exchange*, edited by J. E. Ericson and T. K. Earle, pp. 103-127. Academic Press, New York.

1989a The Archaeology of Pinyon House, Two Eagles, and Crater Middens: Three Residential Sites in Owens Valley, California. *American Museum of Natural History Anthropological Papers* 67. New York.

1989b Establishing an Hydration Rate for Fish Springs Obsidian. IN Current Directions in California Obsidian Studies, edited by R. E. Hughes, pp. 59-68. *Contributions of the University of California Research Facility* 48. Berkeley.

1990 Aboriginal Life Above the Treeline: Alpine Villages in the White Mountains of California. *Newsletter of the Society for California Archaeology* 24:4-6.

1991 Aboriginal Occupation at High Altitude: Alpine Villages in the White Mountains of California. *American Anthropologist* 93:656-679.

1994 How, When, and Why Numic Spread. IN *Across the West: Human Population Movement and Expansion of the Numa*, edited by D. Madsen and D. Rhode, pp. 44-55. University of Utah Press, Salt Lake City.

Bettinger, R. L., M. E. Basgall, and M. G. Delacorte
1983 *An Archaeological Reconnaissance of Mammoth Mountain, Mono and Madera Counties, California.* Manuscript on file at Inyo National Forest, Bishop, California.

Bettinger, R. L. and M. A. Baumhoff
1982 The Numic Spread: Great Basin Cultures in Competition. *American Antiquity* 47:485-503.

1983 Return Rates and Intensity of Resource Use in Numic and Prenumic Adaptive Strategies. *American Antiquity* 48:830-834.

Bettinger, R. L., M. G. Delacorte, and R. J. Jackson
1984b Visual Sourcing of Eastern California Obsidians. IN Obsidian Studies in the Great Basin, edited by R.E. Hughes, pp. 63-78. *Contributions of the University of California Archaeological Research Facility* 45. Berkeley.

Bettinger, R. L., M. G. Delacorte, and K. R. McGuire
1984a *Archaeological Excavations at the Partridge Ranch Site (CA-INY-2146), Inyo County, California.* Report submitted to California Department of Transportation, Sacramento.

Bettinger, R. L., J. F. O'Connell, and D. H. Thomas
1991 Projectile Points as Time Markers in the Great Basin. *American Anthropologist* 93:166-173.

Bettinger, R. L. and R. Oglesby
1985 Lichen Dating of Alpine Villages in the White Mountains, California. *Journal of California and Great Basin Anthropology* 7:202-224.

Bettinger, R. L. and R. E. Taylor
1974 Suggested Revisions in Archaeological Sequences of the Great Basin and Interior Southern California. IN A Collection of Papers on Great Basin Archaeology, edited by R. Elston and L. Sabini, pp. 1-26. *Nevada Archaeological Survey Research Paper* 5. Reno.

Bieling, D. G.
1992 *Perspectives on Behavior Gained From Lithic Analysis and Archaeological Investigations Near Bridgeport, Mono County, California.* Unpublished M.A. thesis, Sonoma State University, California.

Billings, W. D.
1951 Vegetational Zonation in the Great Basin of Western North America. IN Les basis ecologiques de la reservation de la vegetation des zones Andes. *Union of the International Society of Biology* 9:101-122, Series 5. Paris.

Binford, L. R.
1975 Sampling, Judgment, and the Archaeological Record. IN *Sampling in Archaeology*, edited by J. W. Mueller, pp. 251-257. University of Arizona Press, Tuscon.

1977 Forty-Seven Trips. IN *Stone Tools as Cultural Markers: Change, Continuity, and Complexity*, edited by R. V. S. Wright, pp. 24-36. Australian Institute of Aboriginal Studies, Canberra, ACT.

1979 Organization and Formation Processes: Looking at Curated Technologies. *Journal of Anthropological Research* 35:255-273.

1980 Willow Smoke and Dog's Tails: Hunter-Gatherer Settlement Systems and Archaeological Site Formation. *American Antiquity* 45:4-20.

1982 The Archaeology of Place. *Journal of Anthropological Archaeology* 1:5-31.

Bleed, P.
1986 The Optimal Design of Unting Weapons: Maintainability or Reliability. *American Antiquity* 51(4):737-747.

Bloomer, W. W. and J. T. Hall
1998 *A Technological Overview of the Oakland Pond Basalt Quarry: Surface Investigations*. Report prepared for Tahoe National Forest, Nevada City, California.

Bocock, K. L., J. N. R. Jeffers, D. K. Lindley, J. K. Adamson, and C. A. Gill
1977 Estimating Woodland Soil Temperature From Air Temperature and Other Climatic Variables. *Agricultural Meteorology* 18:351-372.

Borden, F. W.
1971 The Use of Surface Erosion Observations to Determine Chronological Sequence in Artifacts from a Mohave Desert Site. *Archaeological Survey Association of Southern California Papers* 7.

Bouey, P. D.
1979 Population Pressure and Agriculture in Owens Valley. *Journal of California and Great Basin Anthropology* 1:162-170.

1984 Obsidian Source Determinations for CA-INY-2146. IN *Archaeological Excavations at the Partridge Ranch Site (CA-INY-2146), Inyo County, California*, by R. L. Bettinger, M. G. Delacorte, and K. R. McGuire. Report submitted to California Department of Transportation, Sacramento.

1986 *The Intensification of Hunter-Gatherer Economies: Archaeological Indicators of Change and Complexity in the North Coast Ranges of California.* Unpublished Ph.D. dissertation, University of California, Davis.

1988 Appendix A: Obsidian Source Analysis. IN *The Archaeology of CA-INY-30: Prehistoric Culture Change in the Southern Owens Valley, California*, by M. E. Basgall and K. R. McGuire. Report submitted to California Department of Transportation, Sacramento.

1991 *Recognizing the Limits of Archaeological Applications of Non-Destructive Energy-Dispersive X-Ray Fluorescence Analysis of Obsidians*. Materials Research Society Proceedings 185:309-320.

Bouey, P. D. and M. E. Basgall

1984 Trans-Sierran Exchange in Prehistoric California: The Concept of Economic Articulation. IN Obsidian Studies in the Great Basin, edited by R. E. Hughes, pp. 135-172. *Contributions of the University of California Archaeological Research Facility* 45. Berkeley.

Bouscaren, S. J.

1985 *Archaeological Excavations in the Lowlands of Northern Owens Valley: Report on the Sawmill Road Site (CA-INY-1386)*. Unpublished M.A. thesis, University of California, Riverside.

Bouscaren, S. J., M. C. Hall, and J. D. Swenson

1982 *Archaeological Test Excavations at Four Sites (CA-MNO-11, -823, -1644, -1645) near Mammoth Creek, Mono County, California.* Manuscript on file at the Archaeological Research Unit, University of California, Riverside.

Bouscaren, S. J. and P. J. Wilke

1987 *Excavations at Mammoth: Archaeological Data Recovery at Four Sites near Mammoth Creek, Mono County, California.* Report on file at Inyo National Forest, Bishop, California.

Bradley, B. A.

1975 Lithic Reduction Sequences: A Glossary and Discussion. IN *Lithic Technology: Making and Using Stone Tools*, edited by E. Swanson, pp. 5-14. Mouton Publishers, The Hague.

Brott, C. W.

1966 Artifacts of the San Dieguito Complex. IN *Ancient Hunters of the Far West*, edited by M. J. Rogers, pp. 141-193. Union Tribune Publishing Company, San Diego, California.

Bryan, A. L.

1979 Smith Creek Cave. IN The Archaeology of Smith Creek Canyon, edited by D. R. Tuohy, pp. 164-251. *Nevada State Museum Anthropological Papers* 17. Carson City.

1980 The Stemmed Point Tradition: An Early Technological Tradition in Western North America. IN *Anthropological Papers in Memory of Earl H. Swanson, Jr.*, edited by L. B. Harten, C. N. Warren, and D. R. Tuohy, pp. 77-107. Idaho Museum of Natural History Special Publication. Pocatello, Idaho.

1988 The Relationship of the Stemmed Point and Fluted Point Traditions in the Great Basin. IN Early Human Occupation in Far Western North America: The Clovis-Archaic Interface, edited by J. A. Willig, C. M. Aikens, and J. L. Fagan, pp.53-74. *Nevada State Museum Anthropological Papers* 21. Carson City.

Bryan, K.

1950 Flint Quarries - The Sources of Tools And, At the Same Time, The Factories of the American Indian. *Peabody Museum Papers XVII(3)*, Harvard University, Cambridge, Massachusetts.

Budinger, F. E.

1983 Evidence for Pleistocene Man in America: The Calico Early Man Site. *California Geology* 36:75-82.

Burton, J. F.

1986 *Archaeological Investigations at Bajada Camp (CA-INY-2596), Inyo County, California.* Report submitted to Bureau of Land Management, Bishop, California.

1990 An Archaeological Survey of the Contel Bishop to Inyokern Fiber Optics Line, Into and Kern Counties, California. Report submitted to Triad Engineering, Mammoth Lakes, California.

1996 *Three Farewells To Manzanar: The Archaeology of Manzanar National Historic Site, California.* Western Archaeological and Conservation Center Publications in Anthropology 67. National Park Service, Tuscon, Arizona.

Burton, J. F. and M. M. Farrell

1990 *Archaeological Test Excavations at theSnowcreek Site (CA-MNO-3), Mammoth Lakes, California.* Report prepared for the Dempsey Construction Corporation, Mammoth Lakes, California.

California Department of Water Resources

1964 Fish Slough Dam and Reserve Feasibility Investigation. *California Department of Water Resources Bulletin* 126.

Callahan, E.

1979 The Basics of Biface Knapping in the Eastern Fluted Point Tradition: A Manual for Flintknappers and Lithic Analysts. *Arcaheology of Eastern North America* 7(1):1-80.

Camboia, D. A.
2000 *Understanding Land-Use Within the Context of the Bodie Hills Obsidian Quarry.* Paper presented at the 27th Annual Great Basin Anthropological Conference, Ogden, Utah.

Campbell, E. W. C.
1949 Two Ancient Archaeological Sites in the Great Basin. *Science* 109:340.

Campbell, E. W. C. and W. H. Campbell
1935 The Pinto Basin Site: An Ancient Aboriginal Camping Ground in the California Desert. *Southwest Museum Papers* 9. Los Angeles.

1940 A Folsom Complex in the Great Basin. *The Masterkey* 14:1-7.

Carey, H. V. and J. D. Wehausen
1991 Mammals. IN *Natural History of the White-Inyo Range, Eastern California,* edited by C.A. Hall, Jr., pp. 437-460. University of California Press, Berkeley.

Clark, D. L.
1961a *The Application of the Obsidian Dating Method to the Archaeology of Central California.* Unpublished Ph.D. dissertation, Stanford University.

1961b The Obsidian dating Method. *Current Anthropology* 2:111-116.

1964 Archaeological Chronology in California and the Obsidian Hydration Method: Part I. *University of California Archaeological Survey, Annual Report* 1963-1964, pp. 141-209.

1984 Some Practical Applications of Obsidian Hydration Dating in the Subarctic. *Arctic* 37(2):91-109.

Cleland, J. H.
1988 *Problems in the Hydration Dating of Coso Obsidian at the Source.* Paper presented at the 22nd Annual Meeting of the Society for California Archaeology, Redding.

1989 *Induced Hydration Rates for Coso Obsidian: An Update.* Paper presented at the 23rd Annual Meeting of the Society for California Archaeology, Santa Rosa.

1990 *Sugarloaf Archaeological District Cultural Resources Management Plan.* Report submitted to the Environmental Branch, Naval Air Weapons Station, China Lake, California.

Clewlow, C. W.
1967 Time and Space Relations of Some Great Basin Projectile Points. *University of California Archaeological Survey Reports* 70:141-149. Berkeley.

1968 Surface Archaeology of the Black Rock Desert, Nevada. *University of California Archaeological Survey Reports* 73:1-94. Berkeley.

Clewlow, C. W., R. F. Heizer, and R. Berger
1970 An Assessment of Radiocarbon Dates for the Rose Spring Site (CA-INY-372), Inyo County, California. *Contributions of the University of California Archaeological Research Facility* 7:19-27. Berkeley.

Collins, M. B.
1975 Lithic Technology as a Means of Processual Inference. IN *Lithic Technology: Making and Using Stone Tools*, edited by E. Swanson, pp. 14-34. Mouton Press, The Hague.

Cowan, R. A. and K. Wallof
1974 *Final Report, Fieldwork and Analysis: Southern California Edison No. 2 Control-Casa Diablo 115 Kv Transmission Line.* Manuscript on file at the Archaeological Research Unit, University of California, Riverside.

Crabtree, D.
1972 *An Introduction to Flintworking.* Occasional Papers of the Idaho State University Museum 28. Pocatello.

Cronquist, A., A. H. Holmgren, N. H. Holmgren, and J. L. Reveal
1972 *Intermountain Flora: Vascular Plants of the Intermountain West, U.S.A., Vol. 1.* Hafner Publishing Company, New York.

Curry, R. R.
1969 Holocene Climate and Glacial History of the Central Sierra Nevada, California. *Geological Society of America Special Paper* 123.

1971 *Glacial and Pleistocene History of the Mammoth Lakes Sierra, California: A Geologic Guidebook.* University of Montana Department of Geology Geological Sciences Publication 11.

Davis, E. L.
1964 An Archaeological Survey of the Mono Lake Basin and Excavations of Two Rockshelters, Mono County, California. IN *Annual Reports of the University of California Archaeological Survey for 1963-1964*, pp. 251-392. Los Angeles.

1965 An Ethnography of the Kuzedika Paiute of Mono Lake, Mono County, California. Miscellaneous Paper 8. *University of Utah Anthropological Papers* 2:53-75.

1970 Archaeology of the North Basin of Panamint Valley, Inyo County, California. IN Five Papers on the Archaeology of the Desert West, edited by D. R. Tuohy, D. L Rendall, and P. A. Crowell, pp. 83-142. *Nevada State Museum Anthropological Papers* 15. Carson City.

1975 The Exposed Archaeology of China Lake, California. *American Antiquity* 40 (1):93-53.

Davis, E. L. and C. Panlaqui (eds.)
1978 *The Ancient Californians: Rancholabrean Hunters of the Mojave Lakes Country.* Los Angeles County Museum of Natural History Science Series 29.

Davis, E. L. and R. Shutler
1969 Recent Discoveries of Fluted Points in California and Nevada. IN Miscellaneous Papers on Nevada Archaeology, edited by D. L. Rendall and D. R. Tuohy, pp. 154-169. *Nevada State Museum Anthropological Papers* 14 (7). Carson City.

Davis, L. B.
1972 *The Prehistoric Use of Obsidian in the Northwestern Plains.* Unpublished Ph.D. dissertation, University of Calgary.

Davis, M. K., T. L. Jackson, M. S. Shackley, T. Teague, and J. H. Hampel
1998 Factors Affecting the Energy-Dispersive X-Ray Fluorescence (EDXRF) Analysis of Archaeological Obsidian. IN *Archaeological Obsidian Studies: Method and Theory*, edited by M. S. Shackley, pp.159-180. Advances in Archaeological and Museum Science Volume 3, series editors M. J. Aitken, E. V. Sayre, and R. E. Taylor. Plenum Press, New York.

Day, D. A., W. W. Bloomer, M. K. Davis, and T. L. Jackson
1996 *Basalt Distribution as a Reflection of Procurement and Mobility Across the North-Central Sierra.* Paper presented at the 25th Great Basin Anthropological Conference, North Lake Tahoe, California.

Delacorte, M. G.
1988 Hanging Rock Green-Grey: A Case for Specialized Exploitation of Chert in Central-Eastern California. Paper presented at the 21st Great Basin Anthropological Conference, Boise, Idaho.

1990 *The Prehistory of Deep Springs Valley, Eastern California: Adaptive Variation in the Western Great Basin.* Unpublished Ph.D. dissertation, University of California, Davis.

1991 Room to Move: Environment, Demography, and Adaptation in the Mono-Inyo Region of Eastern California. IN *Natural History of Eastern California and High-altitude Research: White Mountain Research Station Symposium, Volume 3*, edited by C. A. Hall, Jr., V. Doyle-Jones, and B. Widawski, pp. 342-355. University of California, Los Angeles.

1995a The Role of Structures. IN *Prehistoric Use of a Marginal Environment: Continuity and Change in Occupation of the Volcanic Tablelands, Mono and Inyo Counties, California*, by M. E. Basgall and M. A. Giambastiani, pp. 257-260. Center For Archaeological Research at Davis Publication 12.

1995b *Desert Side-Notched Points as a Numic Population Marker in the West-Central Great Basin.* Paper presented at the 29th Annual Meeting of the Society for California Archaeology, Eureka.

1997 *Culture Change Along the eastern Sierra Nevada/Cascade Front, Volume VII: Pah Rah Uplands.* Report prepared for Tuscarora Gas Transmission Company, Reno, Nevada.

n.d. *Beyond the Horizon: Adaptive Variation in Central Eastern California.* Manuscript in press, UCLA Institute of Archaeology, Monograph Series.

Delacorte, M. G., M. C. Hall and M. E. Basgall

1995 *Final Report on the Evaluation of Twelve Archaeological Sites in the Southern Owens Valley, Inyo County, California.* Report submitted to California Department of Transportation, District 09.

Delacorte, M. G. and K. R. McGuire

1993 *Report of Archaeological Test Evaluations at Twenty-Three Sites in Owens Valley, California.* Report prepared for Contel of California and Bureau of Land Management.

Denton, G. H. and W. Karlen

1973 Holocene Climatic Variations - Their Pattern and Possible Causes. *Quaternary Research* 3:155-205.

Dincauze, D. F and M. L. Curran

1983 *Paleoindians as Generalists: An Ecological Perspective.* Paper presented at the 48th Annual Meeting of the Society for American Archaeology, Pittsburgh.

Dixon, K. A.

1966 Obsidian dates from Temesco, Valley of Mexico. *American Antiquity* 31(5) Part1:640-643.

Douglas, G. A., D. L. Jenkins, and C. N. Warren

1988 Spatial and Temporal Variability in Faunal Remains from Four Lake Mohave-Pinto Period Sites in the Mojave Desert. IN Early Human Occupation in Far Western North America: The Clovis-Archaic Interface, edited by J. A. Willig, C. M. Aikens, and J. L. Fagan, pp. 131-151. *Nevada State Museum Anthropological Papers* 21. Carson City.

Drews, M. and R. G. Elston
1983 *An Archaeological Investigation of Drilling Locations and Power Plant Site in the Coso K.G.R.A., China Lake Naval Weapons Center*. Report submitted to the Environmental Branch, Naval Air Weapons Station, China Lake, California.

Driskell, B. N.
1986 The Chipped Stone Tool Production/Use Cycle. *British Archaeological Reports, International Series* 305. Oxford.

Dyson, J.
1960 Precise Measurements by Image-Splitting. *Journal of the Optical Society of America* 50(8):754-759.

Ebert, J.
1992 *Distributional Archaeology*. University of New Mexico Press, Albuquerque.

Ebert, W. L., R. F. Hoburg, and J. K. Bates
1991 The sorption of water on obsidian and a nuclear waste glass. *Physics and Chemistry of Glasses* 32(4):133-137.

Eerkens, J. W.
2001 *The Origins of Pattery among Late Prehistoric Hunter-Gatherers in California and the Western Great Basin*. Unpublished Ph.D. dissertation, University of California, Santa Barbara.

Eerkens, J. W., H. Neff, and M. D. Glascock
1999 Early Pottery from Sunga'va and Implications for the Development of Ceramic Technology in Owens Valley, California. *Journal of California and Great Basin Anthropology* 21(2):275-285.

Eisenman, L. and D. A. Fredrickson
1980 Temporal Seriation of Native American Sites at the Geysers. Paper presented at the 14th Annual Meeting of the Society for California Archaeology, Redding, California.

Ellis, H. H.
1965 *Flint-Working Techniques of the American Indians: An Experimental Study*. Ohio Historical Society Reprint (1939), Columbus, Ohio.

Elston, R. G.
1982 Good Times, Hard Times: Prehistoric Culture Change in the Western Great Basin. In: *Man and Environment in the Great Basin*, edited by D.B. Madsen and J. F. O'Connell, pp. 186-206. Society for American Archaeology Papers 2. Washington, D.C.

1986 Prehistory of the Western Area. In *Handbook of North American Indians, Great Basin,* Volume 11, edited by W. L. D'Azevedo, pp. 135-148. Smithsonian Institution, Washington D.C.

Elston, R. G. and E. E. Budy

1990 The Archaeology of James Creek Shelter. *University of Utah Anthropological Papers* 115.

Elston, R. G., C. Raven, and E. E. Budy

1987 *An Intensive Reocnnaissance of theTosawihi Quarries Archaeological District (Site 26Ek3032).* Report submitted to Touchstone Resources Company, Battle Mountain, Nevada. On file at Bureau of Land Management, Elko, Nevada.

Elston, R. G. and C. D. Zeier

1984 *The Sugarloaf Obsidian Quarry.* Report submitted to Public Works Department, Naval Weapons Center, China Lake, California.

Enfield, R. and G. Enfield

1964 Mammoth Creek Cave, Mono County, California. IN *University of California Archaeological Survey Annual Report: 1963-1964*, pp. 397-426. Los Angeles.

Ericson, J. E.

1975 New Results in Obsidian Hydration Dating. *World Archaeology* 7(2):151-159.

1977 *Prehistoric Exchange Systems in California: The Results of Obsidian Hydration Dating and Tracing.* Unpublished Ph.D. dissertation, University of California, Los Angeles.

1978 Obsidian Hydration Dating in California. *Society for California Archaeology Occasional Papers in Method and Theory in California Archaeology* 2:43-52.

1981 Exchange and Production Systems in Californian Prehistory: The Results of Hydration Dating and Chemical Characterization of Obsidian Sources. *British Archaeological Reports, International Series* 110. Oxford.

1982 Production For Obsidian Exchange in California. IN *Contexts for Prehistoric Exchange*, edited by J. E. Ericson and T. K. Earle, pp. 129-148. Academic Press, New York.

1989 Toward Flow-Specific Obsidian Hydration Rates: Coso Volcanic Field, Inyo County, California. IN Current Directions in California Obsidian Studies, edited by R. E. Hughes, pp. 13-23. *Contributions of the University of California Research Facility* 48. Berkeley.

Ericson, J. E., T. A. Hagan, and C. W. Chesterman
1976 Prehistoric Obsidian in California II: Geologic and Geographic Aspects. IN *Advances in Obsidian Glass Studies: Archaeological and Geochemical Perspectives*, edited by R. E. Taylor, pp. 218-239. Noyes Press, Park Ridge, New Jersey.

Ericson, J. E., A. Makishima, J. D. Mackenzie, and R. Berger
1975 Chemical and Physical Properties of Obsidian: A Naturally-Occurring Glass. *Journal of Non-Crystalline Solids* 17:129-142.

Ericson, J. E. and B. A. Purdy (Eds.)
1984 *Prehistoric Quarries and Lithic Production*. Cambridge University Press, London.

Erlandson, J. M. and T. K. Rockwell
1987 Radiocarbon Reversals and Stratigraphic Discontinuities: The Effects of Natural Formation Processes on Coastal California Archaeological Sites. IN Natural Formation Processes and the Archaeological Record, edited by D. Nash and M. Petraglia, pp. 51-73. *British Archaeological Reports International Series* 352. Oxford.

Evans, C.
1965 The Dating of Easter Island Archaeological Obsidian Specimens. *Reports of the norwegian Archaeological Expedition to Easter Island and the East Pacific* 2(18):469-495. Published as School of American Research and the Kon-Tiki Museum 24, Part 2.

Evans, C. and B. J. Meggers
1960 A New Dating Method Using Obsidian: Part II. An Archaeological Evaluation of the Method. *American Antiquity* 25(4):523-537.

Fagan, J. L.
1984 *The Dietz Site: A Clovis Base Camp in South-central Oregon*. Paper presented at the 49th Annual Meeting of the Society for American Archaeology, Portland, Oregon.

1986 Western Clovis Occupation in South-central Oregon: Archaeological Research at the Dietz Site 1983-1985. *Current Research in the Pleistocene* 3:3-5.

1988 Clovis and Western Pluvial Lakes Tradition Lithic Technologies at the Dietz Site in South-central Oregon. IN Early Occupation in Far Western North America: The Clovis-Archaic Interface, edited by J. A. Willig, C. M. Aikens, and J. L. Fagan, pp. 389-416. *Nevada State Museum Anthropological Papers* 21. Carson City.

Ferren, W. R., Jr.
1991 Geobotanical Observations. IN *Biotic Inventory and Ecosystem Characterization for Fish Slough,Inyo and Mono Counties, California*, edited by W. R. Ferren, Jr. and F. W. Davis, pp. IV-57 to IV-61. Report submitted to California Department of Fish and Game.

Ferren, W. R., Jr. and F. W. Davis (Eds.)
1991 *Biotic Inventory and Ecosystem Characterization For Fish Slough, Inyo and Mono Counties, California.* Report prepared for California Department of Fish and Game.

Findlow, F. J., V. Bennett, J. Ericson, and S. De Atley
1975 A New Obsidian Hydration Rate for Certain Obsidians in the American Southwest. *American Antiquity* 40(3):344-348.

Findlow, F. J. and S. De Atley
1976 Photographic Measurement in Obsidian Hydration Dating. IN *Advances in Obsidian Glass Studies*, edited by R. E. Taylor, pp. 165-172. Noyes Press, Park Ridge, New Jersey.

Findlow, F. J., P. M. Martin, and J. E. Ericson
1982 An Examination of the Effects of Temperature Variation on the Hydration Characteristics of Two California Obsidians. *North American Archaeologist* 3(1):37-49.

Flenniken, J. J.
1984 The Past, Present, and Future of Flintknapping: An Anthropological Perspective. Annual Review of Anthropology 13:187-203.

1985 Stone Tool Reduction Strategies as Cultural Markers. IN *Stone Tool Analysis: Essays in Honor of Don E. Crabtree*, edited by J. C. Woods and M. G. Pavesic, pp. 265-276. University of New Mexico Press, Albequerque.

Flenniken, J. J. and A. W. Raymond
1986 Morphological Projectile Point Typology: Replication, Experimentation, and Technological Analysis. *American Antiquity* 51:603-614.

Flenniken, J. J. And P. J. Wilke
1989 Typology, Technology, and Chronology of Great Basin Dart Points. *American Anthropologist* 91:149-158.

Forbes, H. C., W. R. Ferren, Jr., and J. R. Haller
1988 The Vegetation and Flora of Fish Slough and Vicinity, Inyo and Mono Counties, California. IN *Plant Biology of Eastern California: Natural History of the White-Inyo Range Symposium, Volume 2*, edited by C. A. Hall, Jr. and V. Doyle-Jones, pp. 99-138. University of California, Los Angeles.

Fowler, D. D.
1966 Great Basin Social Organization. IN *The Current Statue of Anthropological Research in the Great Basin:1964*, pp. 57-73. University of Nevada Desert Research Institute Publications in the Social Sciences 1. Reno.

Fowler, C. A. and S. Liljeblad
1986 Northern Paiute. IN *Handbook of North American Indians, Great Basin*, Volume 11, edited by W. L. d'Azevedo, pages 435-465. Smithsonian Institution Press, Washington, D.C.

Fredrickson, D. A.
1985 Cultural Resources Management Plan for Northern California's Geysers Geothermal Region (Prehistoric Archaeology). Manuscript on file at the Bureau of Land Management, Ukiah, California.

1989 *Obsidian Hydration in the Borax Lake Basin, Lake County, California.* Paper presented at the 23rd Annual Meeting of the Society for California Archaeology, Marina Del Rey.

1991 *Archaeological Evaluation of CA-MNO-2456, -2488, and -564, Near Bridgeport, Mono County, California.* Report submitted to California Department of Transportation, District 09, Bishop.

1998 *An Archaeological Evaluation of CA-MNO-566 and -2466, Huntoon Valley, Mono County, California.* Report submitted to California Department of Transportation, District 09, Bishop.

Friedman, I.
1976 Calculation of Obsidian Hydration Rates from Temperature Measurements. IN *Advances in Obsidian Glass Studies*, edtied by R. E. Taylor, pp. 173-180. Noyes Press, Park Ridge, New Jersey.

Friedman, I., and C. Evans
1968 Obsidian Dating Revisited. *Science* 152:813-814.

Friedman, I. and W. Long
1976 Hydration Rate of Obsidian. *Science* 191:347-352.

Friedman, I. and J. Obradovich
1981 Obsidian Hydration Dating of Volcanic Events. *Quaternary Research* 16:37-47.

Friedman, I. and R. L. Smith
1958 The Deuterium Content of Water in Some Volcanic Glasses. *Geochimica et Cosmochimica Acta* 15:218-228.

1960 A New Dating Method Using Obsidian, I: The Development of the Method. *American Antiquity* 25(4):476-522.

Friedman, I., R. L. Smith, and D. L. Clark
1969 Obsidian Dating. IN Science and Archaeology, edited by D. Brothwell and E. Higgs, Thames and Hudson, London.

Friedman, I., R. L. Smith, and W. D. Long
1966 The Hydration of Natural Glass and the Formation of Perlite. *Geological Society of America Bulletin* 77:323-360.

Friedman, I., F. W. Trembour, F. I. Smith, and G. I. Smith
1994 Is Obsidian Hydration Dating Affected by Relative Humidity? *Quaternary Research* 41:185-190.

Garfinkel, A. P.
1980a *An Initial Archaeological Evaluation of CA-INY-2146, Inyo County, California.* California Department of Transportation, Environmental Studies Branch Archaeological Reports.

1980b *An Archaeological Survey Along Highway 395 and Excavation of CA-MNO-389.* California Department of Transportation, Environmental Studies Branch Archaeological Reports.

Garfinkel, A. P. and R. A. Cook
1979 *Aspects of Prehistoric Culture Change in Central Eastern California: The Sherwin Grade Site (09-MNO-395).* California Department of Transportation Occasional Papers in Archaeology 1.

Garfinkel, A. P., C. A. Schiffman, and K. R. McGuire
1980 *Archaeological Investigations in the Southern Sierra Nevada: The Lamont Meadow and Morris Peak Segments of the Pacific Crest Trail.* Bureau of land Management, Cultural Resources Publications in Archaeology. Bakersfield.

Giambastiani, M. A.
1995 *Site Variability and Wetland Occupation at Fish Slough: Changing Land-Use Patterns and Continuous Exploitation of a Reliable Microenvironment on the Volcanic Tableland, Mono and Inyo Counties, California.* Paper presented at the 29th Annual Meeting of the Society for California Archaeology, Eureka.

1996 *A Current Assessment of the Early Holocene Archaeology of Fish Slough.* Paper presented at the 25th Annual Great Basin Anthropological Conference, Kings Beach, California.

1998a *Phase II Evaluation of Archaeological Site CA-MNO-3018, near Sonora Pass, Mono County, California.* Report submitted to California Department of Transportation, District 06.

1998b *Phase II Evaluation of Archaeological Site CA-MNO-894 Near Benton, Mono County, California.* Report submitted to California Department of Transportation, District 06.

1998c *A Brief Review of Toolstone Procurement at Some Mojave Desert Cryptocrystalline Quarries.* Paper presented at the 26th Great Basin Anthropological Conference, Bend, Oregon.

i.p. Understanding Pavement Quarries in the Mojave Desert. IN *Avocados to Millingstones: Papers in Honor of D. L. True*, edited by G. Waugh and M. E. Basgall. Monographs in California and Great Basin Anthropology 3.

n.d. The Spatial Distribution and XRF Source Signature of Obsidian Nodules on the Volcanic Tableland. Manuscript in preparation.

Giambastiani, M. A. and M. E. Basgall

1990 *Temporal and Functional Variation in Great Basin Rock Art: Observations at Three Occupation Sites on the Volcanic Tableland, Mono County, California.* Paper presented at the 23rd Great Basin Anthropology Conference, Reno, Nevada.

2000a An Evaluation of Eighteen Archaeological Sites at Wood Canyon, Quackenbush Lake Training Area, Marine Corps Air Ground Combat Center, Twentynine Palms, California. Report submitted to U.S. Army Corps of Engineers, Sacramento.

2000b *Phase II Cultural Resource Evaluation for Sites CA-KER-4773/H and CA-KER-2016 in the Bissell Basin, Edwards Air Force Base, California.* Prepared for Department of the Army Corps of Engineers, Sacramento.

Giambastiani, M. A., M. G. Delacorte, and M. E. Basgall

2001 *Contextual and Temporal Associations Between Fish Slough Side-notched Points and Keeled Unifaces in Eastern California.* Paper presented at the 35th Annual Meeting of the Society for California Archaeology, Modesto.

Gifford-Gonzalez, D. P., D. B. Damrosch, D. R. Damrosch, J. Pryor, and R. L. Thunen

1985 The Third Dimension in Site Structure: An Experiment in Trampling and Vertical Dispersal. *American Antiquity* 50(4):803-818.

Gilreath, A. J., M. G. Delacorte, T. Burke, and S. A. Waechter

1995 *Final Report on Archaeological Evaluations of Thirteen Sites for the Ashcreek Project.* Report submitted to California Department of Transportation, Sacramento.

Gilreath, A. J.
1987 *Survey and Evaluation of Cultural Resources on a Portion of Federal Lease CA-11402 Lands (Parcel 20) within the Coso K.G.R.A., Inyo County, California.* Report submitted to the Environmental Branch, Naval Air Weapons Station, China Lake, California.

1988 *Survey and Evaluation of Cultural Resources on a Portion of Navy Contract Lands (Navy 2) within the Coso K.G.R.A., Inyo County, California.* Report submitted to the Environmental Branch, Naval Air Weapons Station, China Lake, California.

Gilreath, A. J. and K. R. McGuire
1987 *Preliminary Report of Investigations Conducted at Seven Archaeological Sites in Conjunction with the Placement of Eight California Energy Company, Inc. Drill Pads in the Coso K.G.R.A. BLM Lease CA-11402, Inyo County, California.* Report submitted to the Environmental Branch, Naval Air Weapons Station, China Lake, California.

Gilreath, A. J. and W. R. Hildebrandt
1995 *Prehistoric Use of the Coso Volcanic Field*, Volume 1. Report submitted to California Energy Company, Ridgecrest, California, and Geothermal Program Office, Naval Weapons Center, China Lake, California.

Gilreath, A. J. and W. J. Nelson
1999 *Archaeological Evaluations of Five Sites Near Independence, Inyo County, California.* Report submitted to California Department of Transportation, District 09, Fresno.

Glascock, M. D., G. E. Braswell, and R. H. Cobean
1998 A Systematic Approach to Obsidian Source Characterization. IN *Archaeological Obsidian Studies: Method and Theory*, edited by M. S. Shackley, pp. 15-66. Advances in Archaeological and Museum Science Volume 3, series editors M. J. Aitken, E. V. Sayre, and R. E. Taylor. Plenum Press, New York.

Goldberg, S. K., S. S. Salzman, E. J. Skinner, J. Burton, M. E. Scully, J. J. Holson, and M. J. Moratto
1986 *Cultural Resources of the CraneValley Hydroelectric Project Area, Volume III: Archaeological Testing, Resource Evaluation, Impact Assessment, and Management Planning.* Report submitted to Pacific Gas and Elelctric Company, San Francisco.

Goldberg, S. K., E. J. Skinner, and J. F. Burton
1990 *Archaeological Investigations at Sites CA-MNO-574, -577, -578, and -833: Stoneworking in Mono County, California.* Report submitted to California Department of Transportation, Bishop.

Goodyear, A. C.
1979 *A Hypothesis for the Use of Cryptocrystalline Raw Materials Among Paleo-Indian Groups of North America.* Research Series No. 156. Institute of Archaeology and Anthropology, University of South Carolina, Columbia.

Gould, R. A., D. A. Koster, and A. H. L. Sontz
1971 The Lithic Assemblage of the Western Desert Aborigines of Australia. *American Antiquity* 36:149-169.

Gould, R. A. and S. Saggers
1985 Lithic Procurement in Central Australia: A Closer Look at Binford's Idea of Embeddedness in Archaeology. *American Antiquity* 50(1):117-136.

Govindaraju, K.
1984 Compilation of Working Values and Sample Description for 170 International Reference Samples of Mainly Silicate Rocks and Minerals. *Geostandards Newsletter* 8 (Special Issue).

Gramly, R.M.
1980 Raw Materials Source Areas and "Curated" Tool Assemblages. *American Antiquity* 45:823-833

Grayson, D. K.
1993 *The Desert's Past: A Natural Prehistory of the Great Basin.* Smithsonian Institution Press, Washington and London.

Green, J. P.
1975 McKean and Little Lake Technology: A Problem in Projectile Point Typology in the Great Basin of North America. IN *Lithic Technology: Making and Using Stone Tools*, edited by E. Swanson, pp. 35-46. Mouton Press, The Hague.

1986 Obsidian Hydration Measurement: Are We Getting What We Expect? Paper presented at the 15th Great Basin Anthropological Conference, Las Vegas, Nevada.

Green, R. C.
1998 A 1990s Perspective on Method and Theory in Archaeological Volcanic Glass Studies. IN *Archaeological Obsidian Studies: Method and Theory*, edited by M. S. Shackley, pp. 223-236. Plenum Press, New York.

Green, R. D.
1964 Sources, Ages, and Exploitation of New Zealand Obsidian. *New Zealand Archaeological Association Newsletter* 7(3):134-143.

Halford, F. K.
1997 *Archaeological Evaluations for the Benton Land Exchange Mono County, California CA-017-95-14.* Bureau of Land Management, Bishop, California.

1998 *Archaeology and Environment on the Dry Lakes Plateau, Bodie Hills, California: Hunter-Gatherer Coping Strategies for Holocene Environmental Variability.* Unpublished M.A. thesis, University of Nevada, Reno.

Hall, M. C.

1980 *Surface Archaeology of the Bodie Hills Geothermal Area, Mono County, California.* Report submitted to U.S. Department of the Interior, Bureau of Land Management, Bakersfield.

1982 *Report on an Archaeological Survey of Upper Queen Canyon in the Northern White Mountains, Esmerelda County, Nevada.* Eastern Sierra Archaeological Services Technical Report Series.

1983 *Late Holocene Hunter-gatherers and Volcanism in the Long Valley-Mono Basin Region: Prehistoric Culture Change in the Eastern Sierra Nevada.* Unpublished Ph.D. dissertation, University of California, Riverside.

1984 *Obsidian, Paleoeconomy, and Volcanism in the Eastern Sierra Nevada.* Paper presented at the 19th Great Basin Anthropological Conference, Boise, Idaho.

1986 *Report on a Cultural Resources Survey of a Proposed Electrical Interconnection Route, Mono County, California.* Report on file at Inyo National Forest, Bishop, California.

1987 Report on Archaeological Investigations at CA-MNO-2183 (FS#-05-04-52-870) and a Cultural Resources Survey of Adjacent Properties near Casa Diablo Hot Springs, Mono County, California. Report on file, Inyo National Forest, Bishop, California.

1988 For the Record: Notes and Comments on "Obsidian Exchange in Prehistoric Orange County". *Pacific Coast Archaeological Society Quarterly* 24(4):34-38.

1990 *The OXBOW Archaeological Incident: Investigations at Twenty-three Locations Between Owens Valley, Eastern California, and Walker Basin, Southwestern Nevada.* Report prepared for Oxbow Geothermal Company, Reno, Nevada.

1991 Early Holocene Archaeological Sites in Mono Basin, East-Central California/Southwestern Nevada. *Current Research in the Pleistocene* 8:22-26.

1992 *Final Report on the Archaeology of Tiefort Basin, Fort Irwin, San Bernardino County, California.* Report submitted to U.S. Army Corps of Engineers, Los Angeles.

Hall, M. C. and M. E. Basgall

1988 *Late Quaternary Environments.* IN *The Late Holocene Archaeology of Drinkwater Basin, Fort Irwin, San Bernardino County, California.* Report submitted to U.S. Army Corps of Engineers, Los Angeles.

1994 Lessons to Learn from Newberry/Gypsum Period Archaeology of the Mojave Desert. IN *Kelso Conference papers, 1987-1992: A Collection of Papers and Abstracts from the First Five Kelso Conferences on the Prehistory of the Mojave Desert*, edited by G. D. Everson and J. S. Schneider, pp. 82-94. California State University Museum of Anthropology Occasional Papers in Anthropology 4. Bakersfield.

Hall, M. C. and R. J. Jackson

1989 Obsidian Hydration Rates in California. IN Current Directions in California Obsidian Studies, edited by R. E. Hughes, pp. 31-58. *Contributions of the University of California Archaeological Research Facility* 48. Berkeley.

Haller, J. R.

1991a Study Area. IN *Biotic Inventory and Ecosystem Characterization for Fish Slough,Inyo and Mono Counties, California*, edited by W. R. Ferren, Jr. and F. W. Davis, pp. I-11 to I-14. Report submitted to California Department of Fish and Game.

1991b Phytogeography. IN *Biotic Inventory and Ecosystem Characterization for Fish Slough,Inyo and Mono Counties, California*, edited by W. R. Ferren, Jr. and F. W. Davis, pp. IV-51 to IV-55. Report submitted to California Department of Fish and Game.

Harbottle, G.

1982 Chemical Characterization in Archaeology. IN *Contexts for Prehistoric Exchange*, edited by J. E. Ericson and T. K. Earle, pp. 13-51. Academic Press, New York.

Harrington, M. R.

1948 An Ancient Site at Borax Lake, California. *Southwest Museum Papers* 16. Los Angeles.

1957 A Pinto Site at Little Lake. *Southwest Museum Papers* 17. Los Angeles.

Harry, K. G.

1992 *Lithic Procurement and Rock Varnish Dating: Investigations at CA-Ker-140, a Small Quarry in the Western Mojave Desert.* Statistical Research, Technical Series 36.

Hayden, B. (Ed.)

1979 *Paleolithic Reflections: Lithic Technology and Excavations Among the Australian Aborigines.* Australian Institute of Aboriginal Studies, Canberra

Heizer, R. F.

1951 Preliminary Report on the Leonard Rockshelter Site, Pershing County, Nevada. *American Antiquity* 17(2):89-98.

1966 *Languages, Territories, and Names of California Indian Tribes*. University of California Press, Berkeley.

Heizer, R. F. and M. A. Baumhoff

1961 The Archaeology of Two Sites at Eastgate, Church County, Nevada: Wagon Jack Shelter. *University of California Anthropological Records* 20(4):119-149. Berkeley.

1962 *Prehistoric Rock Art of Nevada and Eastern California*. University of California Press, Berkeley.

Heizer, R. F. and C. W. Clewlow, Jr.

1973 *Prehistoric Rock Art of California*. Ballena Press, Ramona, California.

Heizer, R. F. and A. E. Treganza

1944 Mines and Quarries of the Indians of California. *California Journal of Mines and Geology* 40(3):291-359.

Heizer, R. F. and M. A. Whipple (Eds.)

1951 *The California Indians: A Source Book*. University of California Press, Berkeley and Los Angeles.

Hester, T.R., M. P. Mildner, and L. Spencer

1974 *Great Basin Atlatl Studies*. Ballena Press Publications in Archaeology, Ethnology, and History 2. Ramona, California.

Hildebrandt, W. R. and A. J. Gilreath

1988 *Survey and Evaluation of Cultural Resources on a Portion of the Navy/C.L.J.V. Contract (Residual Navy 2) Lands Within the Coso K.G.R.A., Inyo County, California*. Report submitted to the Environmental Branch, Naval Air Weapons Station, China Lake, California.

Holmes, W. H.

1890 A Quarry Workshop of the Flaked-stone Implement Makers in the District of Columbia. *American Anthropologist* 3:1-26.

1919 Handbook of Aboriginal American Antiquities, Part 1: Introductory - The Lithic Industries. *Bureau of American Ethnology Bulletin* 60. Smithsonian Institution, washington, D. C.

Hughes, R. E.

1977 *The Archaeology of the Burrell Site (CA-MOD-293), a Lowland Occupation Site in the Goose Lake Basin, Northeat California*. Final Report to the National Endowment for the Humanities on Youthgrant in the Humanities AY-7287-72-379, the Goose Lake Basin Archaeological Project.

1978 Aspects of Prehistoric Wiyot Exchange and Social Ranking. *Journal of California Anthropology* 5(1):53-66.

1981 Sources of Obsidian at Lee Vining (CA-MNO-446), Mon County, California. IN *Archaeology of the Lee Vining Site, FS-05-04-51-219 (CA-MNO-446), Mono County, California*, by R. L. Bettinger. Manuscript on file at Inyo National Forest, Bishop, California.

1983a X-ray Fluorescence Characterization of Obsidian. IN The Archaeology of Monitor Valley: 2. Gatecliff Shelter. *American Museum of Natural History Anthropological Papers* 59(1):401-408.

1983b *Exploring Diachronic Variability in Obsidian Procurement Patterns in Northeast California and Southcentral Oregon: Geochemical Characterization of Obsidian Sources and Projectile Points by Energy Dispersive X-ray Fluorescence*. Ph.D. dissertation, University of California, Davis.

1984a (Ed.) Obsidian Studies in the Great Basin. *Contributions of the University of California Archaeological Research Facility* 45. Berkeley.

1984b Obsidian Sourcing Studies in the Great Basin: Problems and Prospects. IN Obsidian Studies in the Great Basin, edited by R. E. Hughes, pp. 1-19. *Contributions of the University of California Archaeological Research Facility* 45. Berkeley.

1985a Obsidian Source Use at Hidden Cave. IN The Archaeology of Hidden Cave, Nevada, by D. H. Thomas. *American Museum of Natural History Anthropological Papers* 61(1):332-353.

1985b *X-ray Fluorescence Analysis of Obsidian from Five Localities Along the Sycan and Sprague Rivers, Winema National Forest, Klamath County, Oregon.* Manuscript on file, Winema National Forest, Klamath Falls, Oregon.

1986a *Exploring Diachronic Variability in Obsidian Procurement Patterns in Northeast California and Southcentral Oregon. University of California Publications in Anthropology* 17. Berkeley.

1986b Trace Element Composition of Obsidian Butte, Imperial County, California. *Bulletin of the Southern California Academy of Sciences* 85(1):35-45.

1986c Energy Dispersive X-ray Fluorescence Analysis of Obsidian from Dog Hill and Burns Butte, Oregon. *Northwest Science* 60(2):73-80.

1988 The Coso Volcanic Field Re-examined: Implications for Obsidian Sourcing and Hydration Dating Research. *Geoarchaeology* 3:253-265.

1989a (Ed.) Current Directions in California Obsidian Studies. *Contributions of the University of California Research Facility* 48. Berkeley.

1989b A New Look at Mono Basin Obsidians. IN Current Directions in California Obsidian Studies, edited by R. E. Hughes, pp. 1-12. *Contributions of the University of California Research Facility* 48. Berkeley.

1991 *Geochemical Description of the Various Flows of the Casa Diablo Obsidian Source, Inyo National Forest, Mono County, California.* Report on file at Inyo National Forest, Bishop, California.

1994 Intrasource Chemical Variability of Artefact-Quality Obsidians from the Casa Diablo Area, California. *Journal of Archaeological Science* 21:263-271.

Hughes, R. E. and R. L. Bettinger

1984 Obsidian and Prehistoric Sociocultural Systems in California. IN Exploring the Limits: Frontiers and Boundaries in Prehistory, edited by S. P. DeAtley and F. Findlow, pp. 153-172. *British Archaeological Reports, International Series* 223. Oxford.

Hughes, R. E. and R. L. Smith

1993 Archaeology, Geology, and Geochemistry in Obsidian Source Provenance Studies. IN *Scale on Archaeological and Geoscientific Perspectives*, edited by J. K. Stein and A. R. Linse, pp. 79-91. Geological Society of America Special Paper 283.

Hull, K.

1988 Obsidian Studies in Yosemite National Park: Preliminary Observations. *Proceedings of the Society for California Archaeology* 1:169-187.

2001 Reasserting the Utility of Obsidian Hydration Dating: A Temperature-Dependent Empirical Approach to Practical Temporal Resolution with Archaeological Obsidians. *Journal of Archaeological Science* 28:1025-1040.

Hunt, A. P.

1960 Archaeology of the Death Valley Salt Pan. *University of Utah Anthropological Papers* 47. University of Utah Press, Salt Lake City.

Hunt, A. P. and D. R. Mabey

1966 Stratigraphy and Structure, Death Valley, California. *United States Geological Survey Professional Paper* 494-A.

Hutchinson, P. W.

1988 The Prehistoric Dwellers at Lake Hubbs. IN Early Human Occupation in Far Western North America: The Clovis-Archaic Interface, edited by J. A. Willig, C. M. Aikens, and J. L. Fagan, pp. 303-318. *Nevada State Museum Anthropological Papers* 21. Carson City.

Izett, G. A., J. D. Obradovich, and H. H. Mehnert
1988 The Bishop Ash Bed (Middle Pleistocene) and some Older (Pliocene and Pleistocene) Chemically and Mineralogically Similar Ash Beds in California, Nevada, and Utah. *United States Geological Survey Bulletin* 1675.

Jack, R. N.
1971 The Source of Obsidian Artifacts in Arizona. *Plateau* 43:101-114

1976 Prehistoric Obsidian in California I: Geochemical Aspects. IN *Advances in Obsidian Glass Studies*, edited by R. E. Taylor, pp. 183-217. Noyes Press, Park Ridge, New Jersey.

Jack, R. N. and I. S. E. Carmichael
1969 The Chemical "Fingerprinting" of Acid Volcanic Rocks. *California Journal of Mines and Geology, Short Contributions to California Geology.* Series Report 100, pp. 17-32.

Jack, R. N. and R. F. Heizer
1968 "Finger-Printing" of Some Mesoamerican Obsidian Artifacts. *Contributions of the University of California Archaeological Research Facility* 5:81-100. Berkeley.

Jackson, R. J.
1984a Current Problems in Obsidian Hydration Analysis. IN Obsidian Studies in the Great Basin, edited by R. E. Hughes, pp. 103-115. *Contributions of the University of California Archaeological Research Facility* 45. Berkeley.

1984b Obsidian Hydration: Applications in the Western Great Basin. IN Obsidian Studies in the Great Basin, edited by R. E. Hughes, pp. 173-192. *Contributions of the University of California Archaeological Research Facility* 45. Berkeley.

1985 *An Archaeological Survey of the Wet, Antelope, Railroad, and Ford Timber Sale Compartments in the Inyo National Forest.* Report submitted to U.S. Forest Service, Inyo National Forest, Bishop.

1986 *Archaeological Investigations at the Triple R Site (CA-MNO-714).* Report submitted to U.S. Forest Service, Inyo National Forest, Bishop.

Jackson, T. L.
1974 *The Economics of Obsidian in Central California Prehistory: Application of X-ray Fluorescence Spectrography in Archaeology.* Unpublished M.A. thesis, San Francisco State University.

1984 A Reassessment of Obsidian Production Analyses for the Bodie Hills and Casa Diablo Quarry Areas. IN Obsidian Studies in the Great Basin, edited by R. E. Hughes, pp. 117-134. *Contributions of the University of California Archaeological Research Facility* 45. Berkeley.

1986 *Late Prehistoric Obsidian Exchange in Central California.* Unpublished Ph.D. dissertation, Stanford University.

1989 Late Prehistoric Obsidian Production and Exchange in the North Coast Ranges, California. IN Current Directions in California Obsidian Studies, edtied by R. E. Hughes, pp. 79-94. *Contributions of the University of California Archaeological Research Facility* 48. Berkeley.

Jackson, T. L. and J. H. Hampel

1992 *Size Effects in the Energy-Dispersive X-ray Fluorescence (EDXRF) Analysis of Archaeological Obsidian Artifacts.* Paper presented at the 28th International Symposium on Archaeometry, Los Angeles.

Jenkins, D. L.

1985 *Ceramic Analysis.* IN *Bits and Pieces of Prehistory at Fort Irwin: Testing of KD-25, the Knoll Site, the Crossroads Site, Garlic Spring and Bitter Spring; and Survey of Areas 12A and 12H, Fort Irwin, San Bernardino County, California,* edited by E. Skinner, pp. 115-197. Report on file, National Park Service, San Francisco, California.

1987 Dating the Pinto Occupation at Rogers Ridge: A Fossil Spring Site in the Mojave Desert, California. *Journal of California and Great Basin Anthropology* 9:214-231.

Jennings, J. D.

1957 Danger Cave. *University of Utah Anthropological Papers* 27. University of Utah Press, Salt Lake City.

1964 The Desert West. IN *Prehistoric Man in the New World,* edited by J. D. Jennings and E. Norbeck, pp. 149-174. University of Chicago Press, Chicago.

Jennings, J. D. and E. Norbeck (Eds.)

1955 *Prehistoric Man in the New World.* University of Chicago Press, Chicago.

Jennings, S. A.

1988 Late Quaternary Vegetation Change in the White Mountain Region. IN *Plant Biology of Eastern California: Natural History of the White-Inyo Range Symposium, Volume 2,* edited by C. A. Hall, Jr. and V. Doyle-Jones, pp. 139-147. University of California, Los Angeles.

1989 *Late Quaternary Vegetation History of the White Mountains Region, California, as Reconstructed from the Analysis of Packrat Middens.* Unpublished Ph.D. dissertation; University of California, Davis.

Jennings, S. A., and D. L. Elliott-Fisk
1991 Late Pleistocene and Holocene Changes in Plant Community Composition in the White Mountain Region. In *Natural History of Eastern California and High-Altitude Research*, edited by C. A. Hall, Jr., V. Doyle-Jones, and B. Widawski, pp. 1-17. White Mountain Research Station Symposium, Volume 3. University of California, Los Angeles.

Jochim, M. A.
1981 *Strategies for Survival: Cultural Behavior in an Ecological Context*. Academic Press, New York.

Johnson, D. L.
1989 Subsurface Stone Lines, Stone Zones, Artifact-Manuport Layers, and Biomantles Produced by Bioturbation via Pocket Gophers (*Thomomys bottae*). *American Antiquity* 54:370-389.

Johnson, L.
1969 Obsidian Hydration Rate for the Klamath Basin of California and Oregon. *Science* 165:1354-1356.

Johnson, L.
1999 An Update on Obsidian Sources in the Saline Range, Inyo County, California. *International Association For Obsidian Studies Bulletin* 23:8-10.

2002 *Imposter No More: Obsidian Studies in Death Valley National Park*. Paper presented at the 28th Great Basin Anthropological Conference, Elko, Nevada.

Johnson, L., D. L. Wagner, and R. E. Hughes
1999a *Geochemical Variability of Archaeologically Significant Obsidians in the Saline Range, Inyo County, California*. Poster presented at the Geological Society of America Cordilleran Section Annual Meeting, Berkeley, California.

Johnson, L., D. L. Wagner, and C. E. Skinner
1999b Geochemistry of Archeological Obsidian Sources in the Saline Range, Death Valley National Park, California. IN Proceedings of Conference on Status and Geologic Research and Mapping, Death Valley National Park, edited by J. L. Slate, pp. 118-120. *U. S. Geological Survey Open-File Report* 99-153.

Johnson, N. K. and C. Cicero
1991 Breeding Birds. IN *Natural History of the White-Inyo Range, Eastern California*, edited by C. A. Hall, Jr., pp.361-436. University of California Press, Berkeley.

Jones, D. A.
1991 Flaked Stone Artifacts. IN *The Archaeology of Nelson Basin and Adjacent Areas, Fort Irwin, San Bernardino County, California*, by M. E. Basgall, pp. 315-410. Report submitted to U. S. Army Corps of Engineers, Los Angeles.

1992 Flaked Stone (from SBR-5250). IN *Final Report on the Archaeology of Tiefort Basin, Fort Irwin, San Bernardino County, California*, by M. C. Hall, pp. 136-147. Report submitted to U.S. Army Corps of Engineers, Los Angeles.

Jones, G. T., C. Beck, E. E. Jones, and R. E. Hughes
2003 Lithic Source Use and Paleoarchaic Foraging Territories in the Great Basin. *American Antiquity* 68(1):5-38.

Jurich, D., J. M. Farquhar, and M. E. Basgall
1998 *Current Research in Long Valley Caldera, Mono County, California: Two Early Holocene Adaptations in the Western Great Basin.* Paper presented at the Northern California Data Sharing Meeting, Society for California Archaeology, Sacramento.

Katsui, Y. And Y. Kondo
1965 Dating of Stone Implements by Using Hydration Layer of Obsidian. Japanese Journal of Geology and Geography 46(2-4):45-60.

Keeley, L. H.
1982 Hafting and Retooling: Effects on the Archaeological Record. *American Antiquity* 47:798-809.

Kelly, I. T.
1964 Southern Paiute Ethnography. *University of Utah Anthropological Papers* 69. University of Utah Press, Salt Lake City.

Kelly, R. L.
1978 *Paleo-Indian Settlement Patterns at Pleistocene Lake Tonopah, Nevada.* Unpublished M.A. thesis, Cornell University, Ithaca, New York.

1983 Hunter-Gatherer Mobility Strategies. *Journal of Anthropological Research* 39:277-306.

1988 The Three Sides of a Biface. *American Antiquity* 53(4):717-734.

1990 Marshes and Mobility in the Western Great Basin. IN *Wetland Adaptations in the Great Basin*, edited by J. C. Jentski and D. B. Madsen, pp. 259-276. Museum of Peoples and Cultures Occasional Papers 1. Brigham Young University, Provo, Utah.

Kelly, R. L. and L. C. Todd
1988 Coming into the Country: Early Paleoindian Hunting and Mobility. *American Antiquity* 53: 231-244.

Kidder, A. V.
1924 *An Introduction to the Study of Southwestern Archaeology.* Phillips Academy Southwestern Expedition Papers 1. New Haven, Connecticut. Reprinted 1962, Yale University Press.

Kimberlin, J.
1971 *Obsidian Chemistry and the Hydration Dating Technique.* Unpublished M.A. thesis, University of California, Los Angeles.

King, J. H.
2000 *Re-Examining Coso Obsidian Hydration Rates.* Paper presented at the 34th Annual Meeting of the Society for California Archaeology, Riverside.

King, J. H., K. R. McGuire, and W. R. Hildebrandt
2001 *Data Recovery Excavations at Three Arcaheological Sites Near Big Pine, Inyo County, California.* Report submitted to California Department of Transportation District 09, Fresno.

King, T. F.
1973a *Archaeological Impact Evaluation: Control Casa Diablo Transmission Line, Southern California Edison Company, Phase I Survey.* Manuscript on file at the Archaeological Research Unit, University of California, Riverside.

1973b *Archaeological Impact Evaluation: Control Casa Diablo Transmission Line, Southern California Edison Company, Phase II Survey.* Manuscript on file at the Archaeological Research Unit, University of California, Riverside.

1976 *Political Differentiation among Hunter-Gatherers: An Archaeological Test.* Unpublished Ph.D. dissertation, University of California, Riverside.

Klecka, W. R.
1975 Discriminant Analysis. IN *Statistical Package for the Social Sciences*, edited by N. H. Nie, C. H. Hull, J. G. Jenkins, K. Steinbrenner, and D. H. Bent, pp. 434-476. Second Edition, McGraw-Hill, New York.

1980 *Discriminant Analysis.* Sage University Paper, Quantitative Applications in the Social Sciences, Series No. 07-019. Sage Publications, Beverly Hills.

Koerper, H. C., J. E. Ericson, C. E. Drover, and P. E. Langenwalter II
1986 Obsidian Exchange in Prehistoric Orange County. *Pacific Coast Archaeological Society Quarterly* 22(1):33-69.

Koldehoff, B.
1987 The Cahokia Flake Tool Industry: Socioeconomic Implicationsfor Late Prehistory in the Central Mississippi Valley. IN *The Organization of Core Technology*, edited by J. K. Johnson and C. A. Morrow, pp. 151-185. Westview Press, Boulder, Colorado.

Kratz, K. W., T. M. Jenkins, and S. D. Cooper
1991 Aquatic Biota. IN *Biotic Inventory and Ecosystem Characterization for Fish Slough, Inyo and Mono Counties, California*, edited by W. R. Ferren, Jr. and F. W. Davis, pp. V-3 to V-27. Report submitted to California Department of Fish and Game.

Kroeber, A. L.
1916 Zuñi Culture Sequences. *Proceedings of the National Academy of Sciences* 2:42-45. Baltimore, Maryland.

1925 *Handbook of the Indians of California.* Smithsonian Institution, Bureau of American Ethnology Bulletin 78, Berkeley. Reprinted 1976, Dover Publications, Inc., New York.

1939 Cultural and Natural Areas of Native North America. *University of California Publications in American Archaeology and Ethnology* 38(1):1-242. Berkeley.

1959 Ethnographic Interpretations, 7-11. *University of California Publications in American Archaeology and Ethnology* 47(3):235-319. Berkeley.

Kuhn, S. L.
1994 A Formal Approach to the Design and Assembly of Mobile Toolkits. *American Antiquity* 59:426-442

LaMarche, V. C. Jr.
1973 Holocene Climatic Variations as Inferred from Treeline Fluctuations in the White Mountains of California. *Quaternary Research* 3:632-660.

1974 Paleoclimatic Inferences from Long Tree-Ring Records. *Science* 183:1043-1048.

Lamb, S. N.
1958 Linguistic Prehistory in the Great Basin. *International Journal of American Linguistics* 24 (2):95-100.

Lanning, E. P.
1963 Archaeology of the Rose Spring Site, Iny-372. *University of California Publications in American Archaeology and Ethnology* 49(3):237-366. Berkeley.

Latham, T. S., P. A Sutton, and K. L. Verosub
1992 Non-Destructive XRF Characterization of Basaltic Artifacts from Truckee, California. *Geoarchaeology* 7(2):81-101.

Lawton, H. W., P. J. Wilke, M. DeDecker, and W. M. Mason
1976 Agriculture among the Paiute of Owens Valley. *Journal of California Anthropology* 3:13-50.

Layton, T. N.
1970 *High Rock Archaeology: An Interpretation of the Prehistory of the Northwestern Great Basin.* Unpublished Ph. D. dissertation, Harvard University, Cambridge.

1972 A 12,000 Year Obsidian Hydration Record of Occupation, Abandonment, and Lithic Change from the Northwestern Great Basin. *Tebiwa* 15(2):22-28.

1973 Temporal Ordering of Surface-collected Obsidian Artifacts by Hydration Measurement. *Archaeometry* 15:129-132.

1979 Archaeology and Paleoecology of Pluvial Lake Parman, Northwestern Great Basin. Journal of New World Archaeology 3(3):41-56.

1985 Invaders from the South? Archaeological Discontinuities in the Northwestern Great Basin. *Journal of California and Great Basin Anthropology* 7:183-201.

1990 *Western Pomo Prehistory: Excavations at Albion Head, Nightbirds' Retreat, and Three Chop Village, Menodcino County, California.* U.C.L.A. Institute of Archaeology Monograph 32.

Leach, B. F. and G. E. Hamel
1984 The Influence of Archaeological Soil Temperature on Obsidian Dating in New Zealand. *New Zealand Journal of Science* 27:399-408.

Leakey, L. S. B., R. D. Simpson, T. Clements, R. Berger, and J. Witthoft
1972 *Pleistocene Man at Calico: A Report on the International Conference on the Calico Mountains Excavations, San Bernardino County, California.* San Bernardino County Museum Association, Redlands.

Lee, R. B. and I. DeVore (Eds.)
1968 *Man The Hunter.* Aldine Publishing Company, Chicago.

Lerch, M. K., R. M. Yohe, and R. E. Reynolds
1996 *Quarries Along the Sidewinder Trail: Cultural Resources Inventory and Evaluation of the P&V Enterprises Phase IV Land Exchange, Parcels PV-10E, -56, and -62, Barstow, San Bernardino, California.* Report prepared for P&V Enterprises, Sherman Oaks, California.

Lightfoot, K. G., T. A. Wake, and A. M. Schiff
1991 The Archaeology and Ethnohistory of Fort Ross, California. *Contributions of the University of California Archaeological Research Facility* 49. Berkeley.

Long, A. and B. Rippeteau
1974 Testing Contemporaneity and Averaging Radiocarbon Dates. *American Antiquity* 39(2):205-215.

Macey, J. R. and T. J. Papenfuss
1991 Reptiles. IN *Natural History of the White-Inyo Range, Eastern California*, edited by C. A. Hall, Jr., pp. 291-360. University of California Press, Berkeley.

Madsen, D. B. and D. Rhode (Eds.)
1994 *Across the West: Human Population Movement and the Expansion of the Numa.* University of Utah Press, Salt Lake City.

Mallery, G.
1886 Pictographs of the North American Indians: A Preliminary Paper. *Bureau of American Ethnology, Annual Report* 4:3-256. Washington, D.C.

1893 Picture-writing of the American Indians. *Bureau of American Ethnology, Annual Report* 10:3-807. Washington, D.C.

Martinez, J. E.
2000 *Testing Explanations for the Temporal Trends of Obsidian Production in the Western Great Basin at Mt. Hicks, Mineral County, Nevada.* Paper presented at the 27th Annual Great Basin Anthropological Conference, Ogden, Utah.

Mazer, J. J., C. M. Stevenson, W. L. Ebert, and J. K. Bates
1991 The Experimental Hydration of Obsidian as a Function of Relative Humidity and Temperature. *American Antiquity* 56:504-513.

McGrail, B.P., L. R. Pederson, D. M Strachan, R. C. Ewing, and L. S. Cordell
1988 Obsidian Hydration Dating - Field, Laboratory, and Modeling Results. IN *Material Issues in Art and Archaeology*, edited by E. V. Sayre, P. B. Vandiver, J. Druzik, and C. M. Stevenson, pp. 263-269. Materials Research Society Symposium Proceedings.

McGuire, K. R.
1994 *Archaeological Resources Evaluation at CA-MNO-2743, CA-MNO-2744, CA-MNO-2747, and CA-MNO-2763H, Mono County, California.* Report submitted to California Department of Transportation, Sacramento.

McGuire, K. R. and A. P. Garfinkel
1980 *Archaeological Investigations in the Southern Sierra Nevada: The Bear Mountain Segment of the Pacific Crest Trail.* Bureau of Land Management Cultural Resources Publication.

Meggers, B. J., C. Evans, and E. Estrada
1965 *Early Formative Period of Coastal Ecuador: The Valdivia and Machalilla Phases.* Smithsonian Contributions to Anthropology 1. Washington, D.C.

Mehringer, P. J., Jr.

1977 Great Basin Late Quaternary Environments and Chronology. IN *Models and Great Basin Prehistory: A Symposium*, edited by D. Fowler, pp. 113-167. University of Nevada Desert Research Institute Publications in the Social Sciences 12. Reno.

1985 Late-Quaternary Pollen Records from the Interior Pacific Northwest and Northern Great Basin of the United States. IN *Pollen Records of Late-Quaternary North American Sediments*, edited by V. M. Bryant, Jr., and R. G. Holloway, pp. 167-190. American Association of Stratigraphic Palynologists, Dallas.

1986 Prehistoric Environments. IN *Handbook of North American Indians, Great Basin*, Volume 11, edited by W.L. d'Azevedo, pp. 31-50. Smithsonian Institution, Washington, D.C.

Mehringer, P. J. and J. C. Sheppard

1978 Holocene history of Little Lake, Mojave Desert, California. IN *The Ancient Californians Rancholabrean Hunters of the Mojave Lakes Country*, edited by E. L. Davis, pp. 153-166. Natural History Museum of Los Angeles County Science Series 29.

Meighan, C. W.

1953 The Coville Rockshelter, Inyo County, California. *University of California Anthropological Records* 12(5). Berkeley.

1955 Notes on the Archaeology of Mono County, California. *University of California Archaeological Survey Reports* 28:6-29. Berkeley.

1978 Obsidian Dating of the Malibu Site. IN *Obsidian Dates II: A Compendium of the Obsidian Hydration Determinations Made at the U.C.L.A. Obsidian Hydration Laboratory*, edited by C. W. Meighan and P. I. Vander hoeven, pp. 158-161. University of California Institute of Archaeology Monograph 6. Los Angeles.

Meighan, C.W. and V. C. Bennett

1976 *Obsidian Dates II: A Compendium of the Obsidian Determinations Made at the UCLA Obsidian Hydration Laboratory*. UCLA Institute of Archaeology Monograph 6.

Meighan, C. W., L. J. Foote, and P. V. Aiello

1968 Obsidian Dating in West Mexican Archaeology. *Science* 160:1069-1075.

Meighan, C. W. and C. V. Haynes

1968 New Studies on the Age of the Borax Lake Site. *The Masterkey* 42(1):4-9.

1970 The Borax Lake Site Revisited: Reanalysis of the Geology and Artifacts Gives Evidence of an Early Man Location in California. *Science* 167:1213-1221.

Meltzer, D. J.

1985 On Stone Procurement and Settlement Mobility in Eastern Fluted Point Groups. *North American Archaeologist* 6:1-27.

1993 Pleistocene Peopling of the Americas. *Evolutionary Anthropology* 1(5):157-169.

Metcalfe, D. and K. R. Barlow

1992 A Model for Exploiting the Optimal Tradeoff Between Field Processing and Transport. *American Anthropologist* 94:340-356.

Michels, J. W.

1965 *Lithic Serial Chronology through Obsidian Hydration Dating.* Unpublished Ph.D. dissertation, University of California, Los Angeles.

1971 The Colonial Obsidian Industry of the Valley of Mexico. IN *Science in Archaeology*, edited by R. H. Brill, pp. 251-271. MIT Press, Cambridge, Massachusetts.

1973 *Dating Methods in Archaeology.* Seminar Press, New York.

1982a The Hydration Rate for Casa Diablo Obsidian at Archaeological Sites in the Mammoth Junction Area of Mono County, California. *MOHLAB Technical Report* 6. State College, Pennsylvania.

1982b The Hydration Rate for Bodie Hills Obsidian at Archaeological Sites in the Oakland Area of California. *MOHLAB Technical Report* 13. State College, Pennsylvania.

1983a The Hydration Rate for Coso (Sugarloaf) Obsidian at Archaeological Sites in the China Lake Area of California. *MOHLAB Technical Report* 23. State College, Pennsylvania.

Michels, J. W. and I. S. T. Tsong

1980 Obsidian Hydration Dating: A Coming of Age. IN *Advances in Arhcaeological Method and Theory* Vol. 3, edited by M. B. Schiffer, pp. 405-445. Academic Press, New York.

Michels, J. W., I. S. T. Tsong, and G. A. Smith

1983 Experimentally Derived Hydration Rates in Obsidian Dating. *Archaeometry* 25(2):107-117.

Miksicek, C. H., C. K. R. Wickstrom, and T. L. Jackson

1993 *Overview of the Prehistory of the Stanislaus National Forest, Draft Report.* Report submitted to U.S. Forest Service, Eldorado National Forest.

Miller, W. R.
1966 Anthropologi cal Linguistics in the Great Basin. IN *The Current Status of Anthropological Research in the Great Basin: 1964*, edited by W. L. d'Azevedo et al., pp. 75-112. University of Nevada, Desert Research Institute Social Sciences and Humanities Publications 1. Reno.

Mone, S. L.
1986 *CA-MNO-574, A Secondary Reduction Site in Long Valley, Mono County, California.* Report submitted to California Department of Transportation, Sacramento.

Moratto, M. J.
1972 A Study of Prehistory in the Southern Sierra Nevada Foothills, California. Unpublished Ph.D. dissertation, University of Oregon, Eugene.

Motz, L. and P. D. Schulz
1980 European Trade Beads from Old Sacramento. IN *Papers on Old Sacramento Archaeology*, edited by P. D. Schulz and B. J. Rivers, pp. 49-68. California Department of Parks and Recreation, Cultural Resource Management Unit, California Archaeological Reports 19.

Mueller, J. W. (Ed.)
1974 *Sampling in Archaeology.* University of Arizona Press, Tuscon.

1975 The Use of Sampling in Archaeological Survey. *Society for American Archaeology Memoir* 28. *American Antiquity* 39(2), Part 2.

Mundy, W. J., Jr.
1981 An Analysis of the Chalfant Canyon Rock Art Site, Mono County, California. IN Messages From the Past: Studies of California Rock Art, edited by C. W. Meighan, pp. 123-140. *Institute of Archaeology Monograph* 20.

Muto, G. R.
1971 *A Technological Analysis of the Early Stages in the Manufacture of Lithic Artifacts.* Unpublished M.A. thesis, Idaho State University.

Nelson, M. C.
1991 The Study of Technological Organization. In Archaeological Method and Theory, Volume 3, edited by M. B. Schiffer, pp. 57-100. University of Arizona Press, Tucson.

Nelson, N. C.
1914 Pueblo Ruins of the Galisteo Basin, New Mexico. *Anthropological Papers of the American Museum of Natural History* 15(1). New York.

1916 Chronology of the Tano Ruins, New Mexico. *American Anthropologist* 18(2):159-180. Lancaster, New York.

Nelson, W. J.
1999 *A Paleodietary Approach to Late Prehistoric Hunter-gatherer Settlement-subsistence Change in Northern Owens Valley, Eastern California: the Fish Slough Cave Example.* Unpublished Ph.D. dissertation, University of California, Davis.

Nielsen, A. E.
1991 Trampling the Archaeological Record: An Experimental Study. *American Antiquity* 56(3):483-503.

Norton, D. R. and I. Friedman
1981 Ground Temperature Measurements, Part 1. *U.S. Geological Survey Professional Paper* 1203:7-11.

Norwood, R. H.
1990 Overview of Archaeology at Edwards AFB, California: 1984 to 1989. *Proceedings of the Society for California Archaeology* 3.

O'Connell, J. F.
1967 Elko Eared/Elko Corner-notched Projectile Points as Time Markers in the Great Basin. *University of California Archaeological Survey Reports* 70:129-140. Berkeley.

1971 *The Archaeology and Cultural Ecology of Surprise Valley, Northeast California.* Unpublished Ph. D. dissertation, University of California, Berkeley.

1977 Aspects of Variation in Central Australian Lithic Assemblages. IN *Stone Tools as Cultural Markers: Change, Evolution, and Complexity*, edited by R. V. S. Wright, pp. 269-281. Australian Institute of Aboriginal Studies, Canberra.

Odion, D., R. Callaway, W. R. Ferren, Jr. and F. W. Davis
1990 Vegetation. IN *Biotic Inventory and Ecosystem Characterization for Fish Slough,Inyo and Mono Counties, California*, edited by W. R. Ferren, Jr. and F. W. Davis, pp. IV-3 to IV-32. Report submitted to California Department of Fish and Game.

Onken, J.
1990 *The Effect of Site Microclimate on Hydration Rates of Mono-Inyo Ash: Implications for Archaeological Dating.* Paper presented at the 22nd Great Basin Anthropological Conference, Reno, Nevada.

Origer, T. M.
1982 *Temporal Control in the Southern North Coast Ranges of California: The Application of Obsidian Hydration Analysis.* Unpublished M.A. thesis, California State University, San Francisco.

Overly, S. A.
2003 *Using a Comparative Approach to Investigate a Persistently Used Landscape: Site and Off-Site Archaeology at Little Hot Creek, Mono County, California.* Unpublished M.A. thesis, California State University, Sacramento.

Parker, J.
1993 Ethnographic and Prehistoric Settlement Systems in the Clear Lake Basin. IN *There Grows a Green Tree: Papers in Honor of David A. Fredrickson*, edited by G. White, P. Mikkelsen, W. R. Hildebrandt, and M. E. Basgall, pp. 303-325. Center For Archaeological Research at Davis Publication 11.

Parry, W. J. and R. L. Kelly
1987 Expedient Core Technology and Sedentism. IN *The Organization of Core Technology*, edited by J. K. Johnson and C. A. Morrow, pp. 285-304. Westview Press, Boulder, Colorado.

Peak, A. S.
1975 *Archaeological Investigations in Inyo and Mono Counties, California.* Unpublished M.A. thesis, California State University, Sacaramento.

Pendleton, L. S. A
1979 *Lithic Technology in Early Nevada Assemblages.* Unpublished M.A. thesis, California State University, Long Beach.

Pendleton, L. S. A., A. McLane, and D. H. Thomas
1982 *Cultural Resource Overview, Carson City District, West Central Nevada.* Bureau of Land Management Cultural Resource Series 5. Reno.

Pianka, E. R.
1974 *Evolutionary Ecology.* Harper and Row, New York.

Pierce, C.
1992 Effects of Pocket Gopher Burrowing on Archaeological Deposits: A Simulation Approach. *Geoarchaeology* 7(3):185-208.

Pinter, N. and E. A. Keller
1991 Geological Setting. IN *Biotic Inventory and Ecosystem Characterization for Fish Slough,Inyo and Mono Counties, California*, edited by W. R. Ferren, Jr. and F. W. Davis, pp. III-3 to III-10. Report submitted to California Department of Fish and Game.

Pippin, L. C.
1995 *Establishing a Cultural Chronology for Paiute and Rainier Mesas in the Southern Great Basin.* Report submitted to U. S. Department of Energy, Nevada Operations Office, Las Vegas, Nevada.

Plog, F. T.
1974 *The Study of Prehistoric Change*. Academic Press, New York.

Pond, A.
1930 *Primitive Methods of Working Stone Based on Experiments of Halvor K. Skavlem*. Logan Museum Bulletin 2(1). Beloit College.

Powell, D. R. and H. E. Klieforth
1991 Weather and Climate. IN *Natural History of the White-Inyo Range, Eastern California*, edited by C. A. Hall, Jr., pp.3-26. University of California Press, Berkeley.

Price, B. A. and S. E. Johnston
1988 A Model of Late Pleistocene and Early Holocene Adaptation in Eastern Nevada. IN Early Human Occupation in Far Western North America: The Clovis-Archaic Interface, edited by J.A. Willig, C. M. Aikens and J. L. Fagan, pp. 231-250. *Nevada State Museum Anthropological Papers* 21. Carson City.

Ramos, B. A.
2000 *Prehistoric Obsidian Quarry Use and Technological Change in the Western Great Basin: Examining Lithic Procurement at the Truman/Queen Obsidian Source, California and Nevada*. Unpublished Ph.D. dissertation, University of California, Davis.

Raven, C.
1986 Rock Art North of Bishop: A Graphic Record. *Great Basin Foundation Occasional Paper* 1. San Diego, California.

1994 Invisible From the West: Numic Expansion from the Perspective of the Carson Desert. IN Across the West: Human Population Movement and the Expansion of the Numa, edited by D. B. Madsen and D. Rhode, pp. 152-156. University of Utah Press, Salt Lake City.

Raven, C. and R. G. Elston (Eds.)
1988 *Preliminary Investigations in Stillwater Marsh: Human Prehistory and Geoarchaeology*. U.S. Fish and Wildlife Service Cultural Resource Series 1. Portland, Oregon.

Raven, C. and R. G. Elston
1989 *Prehistoric Human Geography in the Carson Desert, Part I: A Predictive Model of Land-Use in the Stillwater Wildlife Management Area*. U.S. Fish and Wildlife Service Cultural Resource Series 3. Portland, Oregon.

Reynolds, L. A.
1996 *In the Dwelling of a Great Spirit: The Prehistory of the Pinon-Juniper of the Inyo-White Mountain Range, Eastern California*. Unpublished Ph.D. dissertation, University of Nevada, Reno.

Reynolds, L. A., N. A. Faust, and W. B. Woolfenden
1992 *Programmatic Treatment Plan for Prehistoric Obsidian Quarries, Inyo National Forest.* Report on file at Inyo National Forest, Bishop, California.

Rhode, D.
1990 Settlement Patterning and Residential Stability at Walker Lake, Nevada: The View from Above. IN *Wetland Adaptations in the Great Basin*, edited by J. C. Jentski and D. B. Madsen, pp. 107-120. Museum of Peoples and Cultures Occasional Papers 1. Brigham Young University, Provo, Utah.

Richman, J. R. and M. E. Basgall
1998 *Spatial and Temporal Variability in Obsidian Use Within the Western Great Basin: Results from the Analysis of 600 Artifacts From 94 Sites in Inyo and Mono Counties, California.* Paper presented at the 26th Great Basin Anthropological Conference, Bend, Oregon.

Riddell, H. S., Jr.
1951 The Archaeology of a Paiute Village Site in Owens Valley, California. *University of California Archaeological Survey Reports* 12(15):14-28. Berkeley.

Riddell, F. A.
1958 The Eastern California Border: Cultural and Temporal Affinities. *University of California Archaeological Survey Reports* 42:41-48. Berkeley.

Riddell, F. A. and W. H. Olsen
1969 An Early Man Site in the San Joaquin Valley, California. American Antiquity 34(2):121-130.

Riddell, H. S. and F. A. Riddell
1956 The Current Status of Archaeological Investigations in Owens Valley. *University of California Archaeological Survey Reports* 33:28-33. Berkeley.

Ridings, R.
1991 Obsidian Hydration Dating: The Effects of Mean Exponential Ground Temperature and Depth of Artifact Recovery. *Journal of Field Archaeology* 18:77-85.

Rogers, M. J.
1939 Early Lithic Industries of the Lower Basin of the Colorado River and Adjacent Desert Areas. *San Diego Museum of Man Papers* 3.

Roper-Wickstrom, K. C.
1992 *A Study of High Altitude Obsidian Distribution in the Southern Sierra Nevada, California.* Unpublished M.A. thesis, California State University, Sonoma.

Ross, C. S. and R. L. Smith
1955 Water and Other Volatiles in Volcanic Glasses. *American Mineralogist* 40:1071-1089.

Roth, B. J.
2000 Obsidian Source Characterization and Hunter-gatherer Mobility: an Example from the Tuscon Basin. *Journal of Archaeological Science* 27:305-314.

Rusco, M. K. and J. O. Davis
1987 Studies in Archaeology, Geology, and Paleontology at Rye Patch Reservoir, Pershing County, Nevada. *Nevada State Museum Anthropological Papers* 20. Carson City.

Scheetz, B. E. and C. M. Stevenson
1988 The Role of Resolution and Sample Preparation in Hydration Rim Measurement: Implications for Experimentally Determined Hydration Rates. *American Antiquity* 53:110-117.

Schroth, A. B.
1994 *The Pinto Point Controversy in the Western United States*. Unpublished Ph.D. Dissertation, University of California, Riverside.

Schuiling, W. C. (Ed.)
1979 *Pleistocene Man at Calico: A Report on the Calico Mountains Excavations, San Bernardino County, California.* San Bernardino County Museum Association, Redlands, California.

Shackley, M. S.
1988 Sources of Archaeological Obsidian in theSouthwest: An Archaeological, Petrological, and Geochemical Study. *American Antiquity* 53:752-777.

1990 *Early Hunter-Gatherer Procurement Ranges in the Southwest: Evidence for Obsidian Geochemistry and Lithic Technology*. Unpublished Ph.D. dissertation, Arizona State University.

1994 Intersource and IntrasourceGeochemical Variability in Two Newly Discovered Archaeological Obsidian Sources in the Southern Great Basin. *Journal of California and Great Basin Anthropology* 16(1):118-129.

1995 Sources of Archaeological Obsidian in the Greater American Southwest: An Update and Quantitative Analysis. *American Antiquity* 60:531-551.

1996 Range and Mobility in the Early Hunter-gatherer Southwest. IN *Early Formative Adaptations in the Southern Southwest*, edited by B. J. Roth, pp. 5-16. Prehistory Press, Madison, Wisconsin.

1998 Intrasource Chemical Variability and Secondary Depositional Processes: A Lesson from the American Southwest. IN *Archaeological Obsidian Studies: Method and Theory*, edited by M. S. Shackley, pp. 83-102. Advances in Archaeological and Museum Science Volume 3, series editors M. J. Aitken, E. V. Sayre, and R. E. Taylor. Plenum Press, New York.

Shackley, M. S. and J. H. Hampel

1992 Surface Effects in the Energy Dispersive X-ray Fluorescence (EDXRF) of Archaeological Obsidian. Paper presented at the 28th International Symposium on Archaeometry, Los Angeles.

Sheridan, M. F.

1975 Tectonic Displacement of the Bishop Tuff. *California Geology*, May Issue:107-110

Shott, M. J.

1986 Technological Organization and Settlement Mobility: An Ethnographic Examination. *Journal of Anthropological Research* 42:15-51.

1989 Diversity, Organization, and Behavior in the Material Record. *Current Anthropology* 30: 283-315.

Simms, S. R.

1988 Conceptualizing the Paleoindian and Archaic in the Great Basin. IN Early Human Occupation in Far Western North America: The Clovis-Archaic Interface, edited by J.A. Willig, C. M. Aikens and J. L. Fagan, pp. 41-52. *Nevada State Museum Anthropological Papers* 21. Carson City.

Simpson, R. D.

1958 The Manix Lake Archaeological Survey. *The Masterkey* 32:4-10

1980 The Calico Mountains Site: Pleistocence Archaeology in the Mojave Desert, California. IN *Early Native Americans: Prehistoric Demography, Economy, and Technology*, edited by D. L. Browman, pp. 7-20. Mouton Publishers, The Hague.

Singer, C. A. and J. E. Ericson

1977 Quarry Analysis at Bodie Hills, Mono County, California: A Case Study. IN *Exchange Systems in Prehistory*, edited by T. K. Earle and J. E. Ericson, pp. 171-190. Academic Press, New York.

Singleton, W. L.

1983 Appendix 6: Obsidian Hydration Dating, Introduction. *New Melones Archeological Project, Volume IV, Part 2*. Manuscript on file, Bureau of Reclamation, Sacramento.

Skinner, C.
1983 *Obsidian Studies in Oregon: An Introduction to Obsidian and an Investigation of Selected Methods of Obsidian Characterization Utilizing Obsidian Collected at Prehistoric Quarry Sites in Oregon.* Unpublished M.A. thesis, University of Oregon, Eugene.

Skinner, E. J.
1984 *Data Recovery of a Portion of Bow Willow Wash North, Fort Irwin, San Bernardino County, California.* Fort Irwin Archaeological Project Research Report. Prepared by Wirth Environmental Services, San Diego.

Skinner, E. J. and P. W. Ainsworth
1990 *Unifacial Bifaces: More Than One Way to Thin a Biface.* Paper presented at the 43rd Northwest Anthropological Conference, Eugene, Oregon.

Smith, G. I.
1967 Field Guide to Examples of Later Quaternary Geology, Searles Valley, California. IN *Guidebook for Friends of the Pleistocene, Pacific Coast Section*, pp. 1-51. United States Geological Survey, Menlo Park, California.

1968 Late-Quaternary Geologic and Climatic History of Searles Lake, Southeastern California. IN *Means of Correlation of Quaternary Successions*, edited by R. B. Morrison and H. E. Wright, pp. 293-310. University of Utah Press, Salt Lake City.

Sorenson, C. Jr. and C. R. LeRoy
1968 Trade Beads: The Powerful Companion of the Explorer. *Corral of the Westerners, Brand Book* 1:92-129. San Diego.

Spaulding, W. G.
1990 Vegetational and Climatic Development of the Mojave Desert: The Last Glacial Maximum to the Present. IN *Packrat Middens: The Last 40,000 Years of Biotic Change*, edited by J. L. Betancourt, T. R. Van Devender, and P. S. Martin, pp. 166-199. University of Arizona Press, Tucson.

1991 A Middle Holocene Vegetation Record from the Mojave Desert of North America and Its Paleoclimatic Significance. *Quaternary Research* 35:427-437.

Spira, T. P.
1991 Plant Zones. In: *Natural History of the White-Inyo Range, Eastern California*, edited by C.A. Hall, Jr., pp. 77-86. University of California Press, Berkeley.

Stevens, N.
2001 *A Minor Source at Major Elevation: Fish Springs on the Sierra Crest.* Paper presented at the 35th Annual Meeting of the Society for California Archaeology, Modesto.

Stevenson, C. M.
1987 *Hydration Rate Development for Selected Obsidians from the Coso Volcanic Field, Inyo County, California.* Report prepared for Dames and Moore, San Diego.

Stevenson, C. M., J. J. Mazer, and B. E. Scheetz
1998 Laboratory Obsidian Hydration Rates: Theory, Method, and Application. IN *Archaeological Obsidian Studies: Method and Theory*, edited by M. S. Shackley, pp. 181-204.

Stevenson, C. M. and M. O. McCurry
1990 Chemical Characterization and Hydration Development for New Mexican Obsidian Sources. *Geoarchaeology* 5:149-170.

Stevenson, C. M. and B. E. Scheetz
1989 Induced Hydration Rate Development of Obsidians from the Coso Volcanic Field: A Comparison of Experimental Procedures. IN Current Directions in California Obsidian Studies, edited by R. E. Hughes, pp. 23-30. *Contributions of the University of California Archaeological Research Facility* 48. Berkeley.

Stevenson, C. M., J. Carpenter, and B. E. Scheetz
1989 Obsidian Dating: Recent Advances in the Experimental Determination and Application of Hydration Rates. *Archaeometry* 31:193-206.

Stevenson, C. M., E. Knaus, J. J. Mazer, and J. K. Bates
1993 Homogeneity of Water Content in Obsidian From the Coso Volcanic Field: Implications for Obsidian Hydration Dating. *Geoarchaeology* 8(5):371-384.

Stevenson, C. M., P. J. Sheppard, D. G. Sutton, and W. R. Ambrose
1996 Advances in the Hydration Dating of New Zealand Obsidian. *Journal of Archaeological Science* 23:233-242.

Steward, J. H.
1929 Petroglyphs of California and Adjoining States. *University of California Publications in American Archaeology and Ethnology* 24:47-238. Berkeley.

1933 Ethnography of the Owens Valley Paiute. *University of California Publications in American Archaeology and Ethnology* 33:233-350. Berkeley.

1934 Two Paiute Autobiographies. *University of California Publications in American Archaeology and Ethnology* 33:423-439. Berkeley.

1938 Basin-Plateau Aboriginal Sociopolitical Groups. *Bureau of American Ethnology, Bulletin* No 120. Washington, D.C.

1955 *Theory of Culture Change*. University of Illinois Press, Urbana.

Steward, J. H. and E. Wheeler-Voeglin
1974 The Northern Paiute Indians. IN Paiute Indians III [1954], pp. 9-328. American Indian Ethnohistory: California and Basin-Plateau Indians. Garland Press, New York.

Stine, S.
1990 Late Holocene Fluctuations of Mono Lake, Eastern California. *Palaeogeography, Palaeoclimatology, Palaeoecology* 78:333-381.

1994 Extreme and Persistent Drought in California and Patagonia during Mediaeval Time. *Nature* 369:546-549.

Stockton, E.
1973 Shaw's Creek Shelter: Human Displacement of Artifacts and Its Significance. *Mankind* 9:112-117.

Storer, T. I. And R. L. Usinger
1963 *Sierra Nevada Natural History*. University of California Press, Berkeley and Los Angeles.

Streuver, S.
1968 Problems, Methods, and Organization: A Disparity in the Growth of Archaeology. IN *Anthropological Archaeology in the Americas*, edited by B. J. Meggars, pp. 131-151. Anthropological Society of Washington, D.C.

Stross, F. H., J. R. Weaver, G. E. A. Wyld, R. F. Heizer, and J. A. Graham
1968 Analysis of American Obsidians by X-Ray Fluorescence and Neutron Activation Analysis. *Contributions of the University of California Archaeological Research Facility* 5:59-79. Berkeley.

Summerhayes, G. R., J. R. Bird, R. Fullagar, C. Gosden, J. Specht, and R. Torrence
1998 Application of PIXE-PIGME to Archaeological Analysis of Changing Patterns of Obsidian Use in West New Britain, Papua New Guinea. IN *Archaeological Obsidian Studies: Method and Theory*, edited by M. S. Shackley, pp. 129-158. Advances in Archaeological and Museum Science Volume 3, series editors M. J. Aitken, E. V. Sayre, and R. E. Taylor. Plenum Press, New York.

Sutton, M. Q.
1986 Warfare and Expansion: An Ethnohistoric Perspective on the Numic Spread. *Journal of California and Great Basin Anthropology* 8(1):65-82.

1988 An Introduction to theArchaeology of theWestern Mojave Desert, California. *Coyote Press Archives of California Prehistory* 14.

Suzuki, M.
1973 Chronology of Prehistoric Human Activity in Kanto, Japan. *Journal of the Faculty of Science* 5(4):241-318. University of Tokyo.

Tadlock, W. L.
1966 Certain Crescentic Stone Objects as Time Markers in the Western United States. *American Antiquity* 31:662-675.

Taylor, D. W.
1981 Freshwater Molluscs of California: A Distributional Checklist. *California Fish and Game* 67:140-163.

Taylor, R. E. (Ed.)
1976 *Advances in Obsidian Glass Studies: Archaeological and Geochemical Perspectives*. Noyes Press, Park Ridge, New Jersey.

Thomas, D. H.
1971a *Prehistoric Subsistence-settlement Pattern of the Reese River Valley, Central Nevada*. Unpublished Ph.D. dissertation, University of California, Davis.

1971b Historic and Prehistoric Land-Use Patterns at Reese River. *Nevada Historical Society Quarterly* 14(4):2-9. Reno.

1972 Western Shoshone Ecology: Settlement Patterns and Beyond. IN *Great Basin Cultural Ecology: A Symposium*, edited by D. Fowler, pp. 135-153. University of Nevada , Desert Research Institute Social Sciences and Humanities Publications 8. Reno.

1973 An Empirical Test for Steward's Model of Great Basin Settlement Patterns. *American Antiquity* 38(1):155-176.

1975 Nonsite Sampling in Archaeology: Up the Creek Without a Site? IN *Sampling in Archaeology*, edited by J. W. Mueller, pp. 61-81. University of Arizona Press, Tuscon.

1978 Arrowheads and Atlatl Darts: How the Stones Got the Shaft. *American Antiquity* 43(3):461-472.

1981 How to Classify the Projectile Points from Monitor Valley, Nevada. *Journal of California and Great Basin Anthropology* 3:7-43.

1982 An Overview of Central Great Basin Prehistory. IN *Man and Environment in the Great Basin*, edited by D. B. Madsen and J. F. O'Connell, pp. 156-171. Society for American Archaeology Papers 2. Washington, D. C.

1983 *The Archaeology of Monitor Valley 2. Gatecliff Shelter*. Anthropological Papers of the American Museum of Natural History 59(1). New York.

1985 The Archaeology of Hidden Cave. *Anthropological Papers of the American Museum of Natural History* 61(1). New York.

1986 Points on Points: A Reply to Flenniken and Raymond. *American Antiquity* 51(3):619-627.

1988 The Archaeology of Monitor Valley 3. Survey and Additional Excavations. *Anthropological Papers of the American Museum of Natural History* 66(2). New York.

Thompson, R. S.

1990 Late Quaternary Vegetation and Climate in the Great Basin. In *Packrat Middens: The Last 40,000 Years of Biotic Change*, edited by J. L. Betancourt, T. R. Van Devender, and P.S. Martin, pages 200-239. University of Arizona Press, Tucson.

Torrence, R.

1983 Time Budgeting and Hunter-Gatherer Technology. IN *Hunter-Gatherer Economy in Prehistory*, edited by G. Bailey, pp. 11-22. Cambridge University Press, Cambridge.

1986 *Production and Exchange: The Prehistoric Obsidian Trade in the Aegean.* Cambridge University Press, New York.

1989 Retooling: Towards a Behavioral Theory of Stone Tools. IN *Time, Energy, and Stone Tools*, edited by R. Torrence, pp. 57-66. Cambridge University Press, Cambridge.

Tremaine, K. J.

1987 *Variability in the Effect of Temperature on Obsidian Hydration Rates.* Paper presented at the 21st Annual Meeting of the Society for California Archaeology, Foster City.

1989 *Experimentally Derived Comparison Constants for Hydration Analysis of North Coast Ranges Obsidians: A Relative Dating Approach.* Paper presented at the Annual Meeting of the Society for California Anrchaeology, Marina Del Rey.

1991 A Relative Dating Approach for Bodie Hills and Casa Diablo Obsidian Derived from Accelerated Hydration Experiments. IN *Archaeological Evaluation of CA-MNO-2456, -2488, and -564, Near Bridgeport, Mono County, California*, by D. A. Fredrickson. Report submitted to California Department of Transportation, District 09, Bishop.

1998 Soil Temperature and Relative Humidity Investigation As Relevant to Obsidian Hydration Studies. IN *An Archaeological Evaluation of CA-MNO-566 and -2466, Huntoon Valley, Mono County, California.* Report submitted to California Department of Transportation, District 09.

1993 Temporal Ordering of Artifact Obsidians: Relative Dating Enhanced Through the Use of Accelerated Hydration Experiments. IN *There Grows a Green Tree: Papers in Honor of David A. Fredrickson*, edited by G. White, P. Mikkelsen, W. R. Hildebrandt, and M. E. Basgall, pp. 265-276. Center For Archaeological Research at Davis Publication 11.

Tremaine, K. J. and D. A. Fredrickson
1988 Induced Obsidian Hydration Experiments: An Investigation in Relative Dating. *Proceedings of the Materials Research Society Symposium* 123:271-278.

Trembour, F. and I. Friedman
1984 Obsidian Hydration Dating and Field Site Temperatures. IN Obsidian Studies in the Great Basin, edited by R. E. Hughes, pp. 79-90. *Contributions of the University of California Research Facility* 45. Berkeley.

Tsong, I. S. T., C. A. Houser, N. A. Yusuf, R. F. Messier, W. B. White, amd J. W. Michels
1978 Obsidian Hydration Profiles Measured by Sputter-Induced Optical Emission. *Science* 201:339-341.

Tuohy, D. R.
1968 Some Early Lithic Sites in Western Nevada. *Eastern New Mexico University Contributions in Anthropology* 43(1):27-38.

1969 A Brief Note on Additional Fluted Points from Nevada: Appendix. IN Miscellaneous Papers on Nevada Archaeology, edited by D. L. Rendall and D. R. Tuohy, pp. 154-178. *Nevada State Museum Anthropological Papers* 14. Carson City.

1974 A Comparative Study of Late Paleo-Indian Manifestations in the Western Great Basin. IN A Collection of Papers on Great Basin Archaeology, edited by R. Elston and L. Sabini, pp. 90-116. *Nevada Archaeological Survey Research Paper* 5. Reno.

Van Devender, T. R.
1990 Late Quaternary Vegetation and Climate of the Sonoran Desert, United States and Mexico. IN *Packrat Middens: The Last 40,000 Years of Biotic Change*, edited by J. L. Betancourt, T. R. Van Devender, and P.S. Martin, pp. 134-165. University of Arizona Press, Tucson.

Vann, J. R. and M. G. Cline
1975 Estimating the Mean Annual Soil Temperature of Areas Correlated as the Same Soil Series Where Both Elevation and Latitude Vary. *Journal of Soil and Water Conservation* 30:85-87.

Villa, P.
1982 Conjoinable Pieces and Site Formation Processes. *American Antiquity* 47:276-290.

Von Werlhof, J. C.
1965 Rock Art of Owens Valley, California. *University of California Archaeological Survey Reports* 65. Berkeley.

Wardle, H. N.
1913 Stone implements of surgery from San Miguel Island, California. *American Anthropologist* 15(4):656-660.

Warren, C. N.
1980 Pinto Points and Problems in Mojave Desert Archaeology. In: *Anthropological Papers in Memory of Earl H. Swanson, Jr.*, edited by L. B. Harten, C. N. Warren, and D. R. Tuohy, pp. 67-76. Idaho Museum of Natural History Special Publication. Pocatello, Idaho.

1984 The Desert Region. IN *California Archaeology*, by M. J. Moratto, pp. 339-430. Academic Press, New York.

1990 *Archaeological Investigations at Nelson Wash, Fort Irwin California.* Report submitted to Interagency Archaeological Services, National Park Service, San Francisco.

Warren, C. N., K. A. Bergin, G. Coombs, D. D. Ferraro, J. D. Kent, M. L. Lyneis, and E. J. Skinner
1989 *Archaeological Investigations at Nelson Wash, Fort Irwin, California.* Fort Irwin Archaeological Project Research Report 14. Prepared by Dames and Moore, Inc., San Diego.

Warren, C. N., and R. H. Crabtree
1986 Prehistory of the Southwestern Area. In *Handbook of the North American Indians, Volume 11: Great Basin*, edited by W. L. d'Azevedo, pp. 183-193. Smithsonian Institution, Washington, D.C.

Warren, C. N. and T. H. Hearne
1974 *Preliminary Report on Archaeological Investigations, Route 09-INY-395-118.3/129.4.* Submitted to California Department of Transportation, Sacramento.

Warren, C. N., M. M. Lyneis, and J. H. Cleland
1984 *Historic Preservation Plan, Fort Irwin, California.* Report submitted to Interagency Archaeological Services, National Park Service, San Francisco.

1986 *Historic Preservation Plan, Fort Irwin, California.* Report submitted to Interagency Archaeological Services, National Park Service, San Francisco.

Warren, C. N. and C. Phagan
1988 Fluted Points in the Mojave Desert: Their Technology and Cultural Context. IN Early Human Occupation in Far Western North America: The Clovis-Archaic Interface, edited by J. A. Willig, C. M. Aikens and J. L. Fagan, pp. 121-130. *Nevada State Museum Anthropological Papers* 21. Carson City.

Waters, M. R.
1988 Geomorphology of Drinkwater Basin. In *The Late Holocene Archaeology of Drinkwater Basin, Fort Irwin, San Bernardino County, California,* by M. E. Basgall, M. C. Hall, and W. R. Hildebrandt, pp. 24-33. Report submitted to U.S. Army Corps of Engineers, Los Angeles.

1991 The Geomorphology of Nelson Basin and Adjacent Areas. In: *The Archaeology of Nelson Basin and Adjacent Areas, Fort Irwin, San Bernardino County, California,* by M. E. Basgall, pp. 15-20. Report submitted to U.S. Army Corps of Engineers, Los Angeles.

Weaver, R. A.
1992 *Development and Assessment of Empirically Derived Hydration Rates for the Truman-Queen Obsidian Source, California and Nevada.* Unpublished M.A. thesis, California State University, Sacramento.

Weisler, M. I. and D. A. Clague
1998 Characterization of Archaeological Volcanic Glass from Oceania: The Utility of Three Techniques. IN *Archaeological Obsidian Studies: Method and Theory,* edited by M. S. Shackley, pp. 103-128. Advances in Archaeological and Museum Science Volume 3, series editors M. J. Aitken, E. V. Sayre, and R. E. Taylor. Plenum Press, New York.

Wheat, M. M.
1967 *Survival Arts of the Primitive Paiutes.* University of Nevada Press, Reno.

Wickstrom, B., R. Jackson, and T. Jackson
1994 *Archaeological Resources Evaluation at CA-INY-384, CA-INY-3790, CA-INY-4547, CA-INY-4549/H, and CA-INY-4550, Inyo County, California.* Report submitted to California Department of Transportation, District 09, Bishop.

Wigand, P. E.
1987 Diamond Pond, Harney County, Oregon: Vegetation History and Water table in the Eastern Oregon Desert. *Great Basin Naturalist* 47:427-458.

Wilke, P. J.
1983 *An Archaeological Assessment of Certain Sites on Lower Cottonwood Creek, Inyo County, California.* Manuscript on file at the Archaeological Research Unit, University of California, Riverside.

Willey, G. R. (Ed.)
1956 *Prehistoric Settlement Patterns in the New World.* Viking Fund Publications in Anthropology 23. New York.

Willig, J. A.
1984 Geoarchaeological Research at the Dietz Site and the Question of Clovis Lake/Marsh Adaptation in the Northern Great Basin. *Tehiwa* 21:56-69.

1988 Paleo-Archaic Adaptations and Lakeside Settlement Patterns in the Northern Alkali Basin, Oregon. IN Early Human Occupation in Far Western North America: The Clovis-Archaic Interface, edited by J. A. Willig, C. M. Aikens, and J. L. Fagan, pp. 417-482. *Nevada State Museum Anthropological Papers* 21. Carson City.

1990 Western Clovis Occupation at the Dietz Site, North Alkali Lake Basin, Oregon. *Current Research in the Pleistocene* 7:52-56.

Willig, J. A. and C. M. Aikens
1988 The Clovis-Archaic Interface in Far Western North America. IN Early Human Occupation in Far Western North America: The Clovis-Archaic Interface, edited by J. A. Willig, C. M. Aikens, and J. L. Fagan, pp. 1-40. *Nevada State Museum Anthropological Papers* 21. Carson City.

Winterhalder, B. and E. A. Smith (Eds.)
1981 *Hunter-Gatherer Foraging Strategies: Archaeological and Ethnographic Analyses.* University of Chicago Press, Chicago, Illinois.

Woldseth, R.
1973 *X-ray Spectrometry.* Kevex Corporation, Burlingame, California.

Wood, S. H.
1975 *Holocene Stratigraphy and Chronology of Mountain Meadows, Sierra Nevada,* California. Unpublished Ph. D. dissertation, California Institute of Technology, Pasadena.

Wood, W. R. and D. L. Johnson
1978 A Survey of Disturbance Processes in Archaeological Site Formation. IN *Advances in Archaeological Method and Theory* Vol. 1, edited by M. B. Schiffer, pp. 315-381. Academic Press, Orlando.

Yellen, J.
1977 *Archaeological Approaches to the Present: Models for Reconstructing the Past.* Academic Press, New York.

Yohe, R. M.
1992 *A Reevaluation of Western Great Basin Cultural Chronology and Evidence for the Timing of the Introduction of the Bow and Arrow to Eastern California Based on New Excavations at the Rose Spring Site (CA-INY-372).* Unpublished Ph.D. dissertation, University of California, Riverside.

Yokel, D. A.
1991 An Avian Survey of the Fish Slough Area, Inyo and Mono Counties, California. IN *Natural History of Eastern California and High-Altitude Research*, edited by C. A. Hall, Jr., V. Doyle-Jones, and B. Widawski, pp. 191-202. White Mountain Research Station Symposium, Volume 3, University of California.

York, A.
1988 *An Evaluation of Fifteen Archaeological Sites on the Bishop Creek Hydroelectric Project, Inyo County, California.* Report prepared for Southern California Edison Company, Roasemead, California.

Young, D. A. and R. L. Bettinger
1992 The Numic Spread: A Computer Simulation. *American Antiquity* 57(1):85-99.

Young, J. A., R. A. Evans, and J. Major
1977 Sagebrush Steppe. IN *Terrestrial Vegetation of California*, edited by M. G. Barbour and J. Major, pp. 763-796. Wiley and Sons, New York.

Zancanella, J.K.
1988 Early Lowland Prehistory in South-central Nevada. IN Early Occupation in Far Western North America: The Clovis-Archaic Interface, edited by J. A. Willig, C. M. Aikens, and J. L. Fagan, pp. 251-271. *Nevada State Museum Anthropological Papers* 21. Carson City.

Zeanah, D. W. and A. T. Leigh
2002 *Results of Phase II Investigations at 26 Archaeological Sites for the Aberdeen-Blackrock Four-Lane Project on Highway 395, Inyo County, California.* Draft report submitted to California Department of Transportation, Central Region, Fresno.

Zeier, C. D. and R. G. Elston
1984 *An Anlysis of Obsidian Hydration Processes at the Sugarloaf Obsidian Quarry, Inyo County, California.* Report submitted to the Environmental Branch, Naval Air Weapons Station, China Lake, California.

APPENDIX A - XRF DATA

APPENDIX A - XRF DATA CODING SHEET

ITEM, primary key number; SITE, state trinomial, Enfield site number, or temporary survey number; ACC, catalogue accession number; CAT, artifact catalogue number; DESCRIP, artifact description category; RB, rubidium parts per million (ppm); SR, strontium parts per million (ppm); ZR, zirconium parts per million (ppm); FE, counts for iron oxide (Fe_2O_3); MN, counts for manganese; SOURCE, final obsidian source classification; BIFACE, biface; CORE, core; DBTG, debitage; DRILL, drill; FLKTL, simple flake tool; FRMFLKTL, formed flake tool; PRJPT, projectile point; PTBLNK, point blank; BO, Bodie Hills; CD, Casa Diablo; CO, Coso; FS, Fish Springs; MC, Mono Craters; MGM, Mono Glass Mountain; MH, Mt. Hicks; QI, Queen Impostor; SV, Saline Valley; TQ, Truman-Queen. Multiple abbreviations in SOURCE column divided by / indicates indeterminate assignment.

ITEM	SITE	ACC	CAT	DESCRIP	RB	SR	ZR	FE	MN	SOURCE
1	MNO-2189	392	21	BIFACE	64.1	2.6	54.8	3750	218.6	MH
2	MNO-2189	392	114	BIFACE	92.6	6.4	42.4	2970	62.5	MGM
3	MNO-2189	392	115	BIFACE	56.9	5.4	22.8	1950	99.9	MH
4	MNO-2189	392	143	BIFACE	8.7	3.7	11.6	660	65.6	TQ
5	MNO-2189	392	144	BIFACE	79.8	38.6	49.7	4740	58.4	MH
6	MNO-2189	392	419	BIFACE	103.6	2.6	50.1	2670	69.2	MGM
7	MNO-2189	392	420	BIFACE	97.9	0.9	32.9	3530	47.2	MGM
8	MNO-2189	392	441	BIFACE	22.4	27	72.4	2210	29.3	SV
9	MNO-2189	392	493	BIFACE	34.7	14.3	41.5	3220	23.5	MH
10	MNO-2189	392	494	BIFACE	90.7	5.3	15.2	1890	236.3	TQ
11	MNO-2190	392	780	BIFACE	105.8	7.5	61.4	3470	285.7	TQ/MH
12	MNO-2190	392	781	BIFACE	52.5	36.4	82	3500	50.5	SV
13	MNO-2190	392	818	BIFACE	112.9	75.1	149	6220	98.5	SV/CD
14	MNO-2190	392	821	BIFACE	75.7	2.5	64.6	2660	201.9	TQ
15	MNO-2190	392	823	BIFACE	135.1	1.7	42.7	2990	86	MGM
16	MNO-2190	392	855	BIFACE	147.7	1.2	33.2	4120	80.1	MGM
17	MNO-2190	392	856	BIFACE	44.9	11.8	29.3	2420	19.7	MH/MGM
18	MNO-2190	392	857	BIFACE	110	58.5	118	5970	38.1	SV
19	MNO-2190	392	859	BIFACE	107.7	59.2	123	6160	92.8	SV
20	MNO-2190	392	860	BIFACE	115.9	9.2	93.1	3990	280.9	TQ
21	MNO-2190	392	898	BIFACE	92.6	4	40.4	2910	221.4	MH
22	MNO-2190	392	933	BIFACE	93.8	5.5	96.7	3570	317.8	TQ
23	MNO-2190	392	937	BIFACE	146.9	5.6	91.9	3650	275.1	TQ/QI
24	MNO-2190	392	981	BIFACE	132	81.4	200.5	8950	122.1	CD
25	MNO-2190	392	984	BIFACE	140.9	0.2	36.4	3780	74.4	MGM
26	MNO-2190	392	1015	BIFACE	138.3	16.2	33.9	4350	292.4	MH
27	MNO-2190	392	1018	BIFACE	121.3	5.4	93	3250	147.2	QI
28	MNO-2190	392	1019	BIFACE	14.2	1.7	2.9	690	39.2	MH
29	MNO-2190	392	1024	BIFACE	163.2	0.6	48.3	5170	129.1	MGM
30	MNO-2190	392	1030	BIFACE	132.3	0.7	34.6	3410	56.6	MGM
31	MNO-2190	392	1032	BIFACE	82.5	3.5	49	3210	96.4	MH
32	MNO-2190	392	1034	BIFACE	160.7	1.2	57.2	3460	51.6	MGM
33	MNO-2190	392	1085	BIFACE	206.1	1.6	83.8	5150	191.3	MGM/MC
34	MNO-2190	392	1088	BIFACE	88.9	109.3	161.1	6610	37.8	CD
35	MNO-2190	392	1126	BIFACE	101.4	84.1	143.7	6180	86.2	SV
36	MNO-2190	392	1127	BIFACE	64.7	7.3	41.5	1240	67.8	MH
37	MNO-2190	392	1186	BIFACE	26.4	11.8	42.9	2310	63.6	MH
38	MNO-2190	392	1187	BIFACE	185.3	0.1	38.3	4810	196	MGM
39	MNO-2190	392	1188	BIFACE	135.5	77.2	171.7	8570	171.9	CD
40	MNO-2190	392	1226	BIFACE	130	4.6	83.3	3900	374.8	TQ
41	MNO-2190	392	1232	BIFACE	63.8	1.6	8.2	1920	43.8	MH
42	MNO-2190	392	1233	BIFACE	102.8	3.5	71.8	2980	151.8	MH
43	MNO-2190	392	1238	BIFACE	44.3	21.1	70.3	2940	32	SV/MH
44	MNO-2190	392	1240	BIFACE	56.6	3	5	830	57.9	MH
45	MNO-2190	392	1246	BIFACE	4.3	5.4	3.2	60	48.6	FS
46	MNO-2190	392	1247	BIFACE	45	2.7	11	1290	122.6	MH/TQ
47	MNO-2190	392	1248	BIFACE	137.3	3.9	83	3890	376.5	TQ
48	MNO-2190	392	1250	BIFACE	66.5	40.7	116.8	4060	70.8	SV
49	MNO-2190	392	1254	BIFACE	16.8	3.6	6.4	690	29.5	MH
50	MNO-2190	392	1257	BIFACE	98.1	1.4	21.2	2470	66.9	MGM/MH
51	MNO-2190	392	1259	BIFACE	104.8	50.5	160.3	6780	94.6	CD
52	MNO-2190	392	1263	BIFACE	122.4	68.6	163.3	8830	134.6	CD
53	MNO-2190	392	1346	BIFACE	120	74.2	173.4	8510	152.3	CD
54	MNO-2190	392	1347	BIFACE	57.1	42.8	100	5310	48.3	SV
55	MNO-2190	392	1352	BIFACE	69	67	93	5190	55.7	SV
56	MNO-2190	392	1448	BIFACE	136.1	66.3	161.3	7690	99.6	CD
57	MNO-2190	392	1451	BIFACE	1.9	14	0	1170	101.2	MH/TQ

ITEM	SITE	ACC	CAT	DESCRIP	RB	SR	ZR	FE	MN	SOURCE
58	MNO-2190	392	1477	BIFACE	15.7	18.3	36.3	2670	26.3	MH
59	MNO-2190	392	1479	BIFACE	53	4.1	32.7	1590	62.7	MH
60	MNO-2190	392	1480	BIFACE	69.4	54.8	130.9	6930	78	SV
61	MNO-2190	392	1481	BIFACE	67.1	49.6	55.3	4280	50	SV
62	MNO-2190	392	1482	BIFACE	61.6	39.2	82.2	4290	69.8	SV
63	MNO-2190	392	1487	BIFACE	155.8	133.9	208.3	9710	176.7	CD
64	MNO-2190	392	1489	BIFACE	119	0.8	37.7	3000	43.4	MGM
65	MNO-2190	392	1491	BIFACE	21.5	8.6	59.7	2560	61.1	MH
66	MNO-2190	392	1600	BIFACE	66.5	56.5	99.4	4630	36.5	SV
67	MNO-2190	392	1601	BIFACE	18.3	24.9	38	3180	32.7	MH
68	MNO-2190	392	1602	BIFACE	79.2	30.5	126.3	5300	104.1	SV
69	MNO-2190	392	1603	BIFACE	88.8	43.6	107.3	4860	45.7	SV
70	MNO-2190	392	1605	BIFACE	37	32.7	33.1	2790	62.4	MH
71	MNO-2190	392	1716	BIFACE	142.7	117.2	179.9	8850	203.5	CD
72	MNO-2190	392	1719	BIFACE	33.4	14.1	59.8	3770	33.9	MH
73	MNO-2190	392	1722	BIFACE	36.2	20.7	69.7	3350	44.1	SV
74	MNO-2190	392	1723	BIFACE	60.7	31.4	92.2	4550	48.6	SV
75	MNO-2190	392	1724	BIFACE	96.3	0.7	51.7	2780	32	MGM
76	MNO-2190	392	1794	BIFACE	110	79.5	140	6970	49	CD/SV
77	MNO-2190	392	1830	BIFACE	49.7	21	47.5	2910	49.4	MH
78	MNO-2190	392	1833	BIFACE	167.6	2	51.5	3600	633.6	FS
79	MNO-2190	392	1887	BIFACE	145.3	97.8	188.1	8960	112.8	CD
80	MNO-2190	392	1926	BIFACE	148.4	77.9	178.8	7640	151.7	CD
81	MNO-2190	392	2117	BIFACE	134.1	7.1	105.9	4320	456.6	TQ
82	MNO-2190	392	2119	BIFACE	85.4	4.8	55	3190	253.9	TQ/MH
83	MNO-2190	392	2153	BIFACE	15.7	15.8	10.1	1740	73	MH
84	MNO-2190	392	2167	BIFACE	127.9	0.8	32.7	3050	32.3	MGM
85	MNO-2190	392	2155	BIFACE	116.4	2.4	53.6	2570	81.6	MGM
86	MNO-2190	392	2180	BIFACE	27	4.8	6.3	600	32	MH
87	MNO-2190	392	2181	BIFACE	18	1.7	7.6	470	36.3	MH
88	MNO-2190	392	2189	BIFACE	164.9	5	120.3	4720	395.9	TQ/QI
89	MNO-2190	392	2215	BIFACE	43.8	27.4	78.2	3830	47.1	SV
90	MNO-2190	392	2230	BIFACE	116.9	4.4	59.7	3240	248.8	MH
91	MNO-2190	392	2244	BIFACE	92.4	78.5	138.8	6370	42.2	SV/CD
92	MNO-2190	392	2313	BIFACE	75.8	27	95.4	4810	89.5	SV
93	MNO-2190	392	2320	BIFACE	66.3	44.1	72.7	4460	64	SV
94	MNO-2190	392	2321	BIFACE	101	4.2	74.7	4040	358.6	TQ
95	MNO-2190	392	2322	BIFACE	93.1	51.3	149.2	6510	122.3	SV
96	MNO-2190	392	2324	BIFACE	79.7	43.8	155.2	5220	56.8	CD/SV
97	MNO-2190	392	2326	BIFACE	8.6	4.6	7.3	330	27.4	MH
98	MNO-2190	392	2422	BIFACE	23.3	4.8	3	400	49.4	TQ
99	MNO-2190	392	2431	BIFACE	17.6	3.5	6.6	860	50	MH
100	MNO-2190	392	2486	BIFACE	105.9	2.5	30.8	3000	35.6	MGM
101	MNO-2190	392	2487	BIFACE	125.1	1.9	74.2	4060	71.5	MGM
102	MNO-2190	392	2556	BIFACE	103.8	66.6	143.4	7610	98.6	SV
103	MNO-2190	392	2610	BIFACE	125.3	10.8	49.9	3350	127.5	MH
104	MNO-2190	392	2611	BIFACE	152.5	3.5	77.2	3990	277.1	MH
105	MNO-2190	392	2813	BIFACE	158.1	83.7	88.4	3760	219	BH
106	MNO-2190	392	2814	BIFACE	17.4	30	34	2170	34.5	MH/SV
107	MNO-2189	392	3008	BIFACE	5.2	8.2	12.2	1630	21.3	MH
108	MNO-2189	392	3029	BIFACE	109.4	3.6	29.5	3260	44.7	MGM
109	MNO-2189	392	3040	BIFACE	6.1	2.9	6.4	660	15.8	MH
110	MNO-2189	392	3368	BIFACE	125.5	121.5	222.1	11360	218.5	CD
111	MNO-1992	392	5004	BIFACE	172.6	0.4	78.3	4570	206.3	MGM
112	MNO-1992	392	5005	BIFACE	138.2	81.9	155.7	7700	129	CD
113	MNO-1992	392	5006	BIFACE	139.8	91.6	186.4	7880	97.2	CD
114	MNO-1992	392	5018	BIFACE	123.7	76	167.9	7130	138	CD

ITEM	SITE	ACC	CAT	DESCRIP	RB	SR	ZR	FE	MN	SOURCE
115	MNO-1992	392	5030	BIFACE	99.4	5.7	69.9	2840	222.1	TQ
116	MNO-1992	392	5032	BIFACE	125.4	1.4	56	2720	326.2	TQ
117	MNO-1992	392	5045	BIFACE	12.7	5.5	5.4	240	54.7	FS
118	MNO-1992	392	5171	BIFACE	64.2	85.3	131	4940	52.2	SV
119	MNO-1992	392	5172	BIFACE	96.6	6.7	24.3	2030	46.6	MGM/MH
120	MNO-1992	392	5199	BIFACE	76	3.6	75.7	2480	123.2	MH
121	MNO-1992	392	5202	BIFACE	74.5	9.6	23.8	2150	42.6	MH
122	MNO-1992	392	5203	BIFACE	68.6	1.8	13.4	1580	41.3	MH
123	MNO-1992	392	5263	BIFACE	100	6.9	123.9	4460	412.6	TQ
124	MNO-1992	392	5434	BIFACE	187.2	154.7	215	11820	313.5	CD
125	MNO-1992	392	5437	BIFACE	144.2	92.7	153.8	8020	145.6	CD/SV
126	MNO-1992	392	5466	BIFACE	86.8	1.3	23	2890	33.2	MGM
127	MNO-1992	392	5483	BIFACE	57.3	3	9.3	1270	31	MH
128	MNO-1992	392	5604	BIFACE	52.1	2.3	16.7	2030	38.4	MH
129	MNO-1992	392	5605	BIFACE	70.8	4.5	21.7	1570	118.1	MH
130	MNO-1992	392	5651	BIFACE	65.8	0.8	32.2	3140	52.5	MGM/MH
131	INY-399	392	6015	BIFACE	105.2	2.6	91.4	3750	342.2	TQ
132	INY-399	392	6016	BIFACE	104.8	2.7	59.4	2820	43.5	MGM
133	INY-399	392	6158	BIFACE	119.4	5.1	64.9	4150	133.3	MGM
134	MNO-2464	392	8012	BIFACE	104.9	6.9	29.3	2710	118.6	MH
135	MNO-2464	392	8057	BIFACE	205.3	1.3	94.4	6570	127.2	MC
136	MNO-2464	392	8107	BIFACE	159.9	5	126	5560	666.2	TQ
137	MNO-2464	392	8108	BIFACE	127	131	211.5	10090	252.4	CD
138	MNO-2464	392	8110	BIFACE	162.9	5.9	119.6	4410	349.7	QI/TQ
139	MNO-2464	392	8113	BIFACE	153.1	8.2	87.9	4130	393.7	TQ
140	MNO-2464	392	8118	BIFACE	154.3	78.3	195	10620	166.8	CD
141	MNO-2465	392	9019	BIFACE	14.2	1.7	5.5	750	33.4	MH
142	MNO-2465	392	9221	BIFACE	166.7	0.6	78.6	4180	171.9	MGM
143	MNO-2465	392	9281	BIFACE	28.6	9.8	38.3	2430	70.8	MH
144	MNO-2465	392	9331	BIFACE	90.4	1.1	40.5	2470	52.9	MGM
145	MNO-2465	392	9377	BIFACE	40.9	18	43.6	3540	60.2	MH
146	MNO-2465	392	9378	BIFACE	45.5	19.7	50.8	2780	36.5	MH
147	MNO-2465	392	9379	BIFACE	115	6.6	87.2	2680	234.2	TQ
148	MNO-2465	392	9380	BIFACE	124.8	86.8	145.7	5520	88.2	SV
149	MNO-2465	392	9383	BIFACE	167.8	1.3	38.5	3520	524.5	FS
150	MNO-2465	392	9386	BIFACE	162	12	93.2	3810	313.8	TQ
151	MNO-2465	392	9392	BIFACE	65.5	33.9	111.4	4290	87	SV
152	MNO-2465	392	9393	BIFACE	123.2	115.4	203.5	8580	136.8	CD
153	MNO-2465	392	9399	BIFACE	55.1	2.6	23.3	1750	46.9	MH
154	MNO-2465	392	9401	BIFACE	129.4	83.7	153.7	7290	105.1	CD
155	MNO-2465	392	9402	BIFACE	48.1	42	114.7	3630	59.7	SV
156	MNO-2465	392	9514	BIFACE	114.2	2.7	11.4	2620	64.8	MGM
157	MNO-2465	392	9600	BIFACE	57.7	34.3	81.4	2910	31.8	SV
158	MNO-2465	392	9609	BIFACE	65.1	73.3	113.8	5400	63.7	SV
159	MNO-2465	392	9647	BIFACE	59.7	60.8	122.5	4870	61.2	SV
160	MNO-2465	392	9657	BIFACE	17.7	10.7	9.9	980	30.5	MH
161	MNO-2465	392	9672	BIFACE	99.3	48.8	148.3	6630	133.5	SV
162	MNO-2465	392	9792	BIFACE	75.6	7.1	42	2640	118.8	MH
163	MNO-2465	392	9835	BIFACE	18.9	7.6	4	930	17.6	MH
164	MNO-2465	392	9904	BIFACE	134.8	105.6	181.4	7360	149.2	CD
165	MNO-2465	392	9966	BIFACE	39	17.2	47	3200	29.2	MH
166	MNO-2465	392	9968	BIFACE	121	1.2	23.1	2340	166.9	MH
167	MNO-2465	392	10001	BIFACE	94	1.5	45.4	2460	67.1	MGM/MH
168	MNO-2189	392	508	FLKTL	191.8	9.2	108.3	6020	726.9	TQ
169	MNO-2189	392	376	FLKTL	119.2	10.7	77.7	3970	425.2	TQ
170	MNO-2189	392	197	FLKTL	153.1	11.9	63.4	5100	413.1	MH
171	MNO-2189	392	84	FLKTL	10	4.2	7.7	660	62.7	TQ

ITEM	SITE	ACC	CAT	DESCRIP	RB	SR	ZR	FE	MN	SOURCE
172	MNO-2189	392	83	FLKTL	189	5.3	130	4840	450.7	TQ/QI
173	MNO-2189	392	591	FLKTL	120.1	7.4	32.3	5570	420.7	MH
174	MNO-2189	392	645	FLKTL	126.3	5	72.3	3860	439.1	TQ
175	MNO-2190	392	806	FLKTL	165.7	3.2	50.9	3620	142	MGM
176	MNO-2190	392	828	FLKTL	144.5	7.9	92.7	4120	393.9	TQ
177	MNO-2190	392	834	FLKTL	150.7	8.2	85.4	4260	470.1	TQ
178	MNO-2190	392	865	FLKTL	114.7	82.8	164	8310	131	CD
179	MNO-2190	392	867	FLKTL	74.3	49.6	84	4100	38.9	SV
180	MNO-2190	392	868	FLKTL	85.8	42.7	126.8	5590	40	SV
181	MNO-2190	392	943	FLKTL	145.7	0.8	51.6	3480	84.2	MGM
182	MNO-2190	392	945	FLKTL	127.1	67.5	138.7	6650	123.4	SV
183	MNO-2190	392	946	FLKTL	108.7	96.8	175.3	6230	152.3	CD
184	MNO-2190	392	987	FLKTL	61.7	58.2	116.2	5890	63.8	SV
185	MNO-2190	392	988	FLKTL	59.4	32.8	85.7	5680	44.2	SV
186	MNO-2190	392	1040	FLKTL	146	6.1	117.5	4780	393	TQ
187	MNO-2190	392	1042	FLKTL	59.6	16.1	83.2	4800	60	MGM/MH
188	MNO-2190	392	1046	FLKTL	172.5	5.8	111.5	4390	384.1	TQ/QI
189	MNO-2190	392	1047	FLKTL	41.1	24.5	49.9	2260	68.3	MH
190	MNO-2190	392	1049	FLKTL	144.1	3.2	69.7	4640	482.5	TQ
191	MNO-2190	392	1050	FLKTL	118.6	63.9	171.7	6800	58.1	CD
192	MNO-2190	392	1093	FLKTL	223.3	0.6	91.9	6000	190.2	MC/MGM
193	MNO-2190	392	1095	FLKTL	39.3	3.8	41	1830	118.9	MH
194	MNO-2190	392	1193	FLKTL	151.2	1.8	45.6	3950	75.2	MGM
195	MNO-2190	392	1271	FLKTL	148.9	5.3	29.6	3500	50.7	MGM
196	MNO-2190	392	1272	FLKTL	89	58.8	154.7	6650	83.1	CD/SV
197	MNO-2190	392	1273	FLKTL	114.6	60	141.9	6840	97	SV
198	MNO-2190	392	1358	FLKTL	102.2	76.5	137	6760	76.7	SV
199	MNO-2190	392	1359	FLKTL	121.3	2	44.4	3720	78.7	MGM
200	MNO-2190	392	1424	FLKTL	133	1.6	63.1	3100	61.2	MGM
201	MNO-2190	392	1455	FLKTL	34.4	20.5	38.7	3000	54.6	MH
202	MNO-2190	392	1492	FLKTL	171.9	0.1	54.7	3870	115.6	MGM
203	MNO-2190	392	1494	FLKTL	184.9	1	58	4510	160.4	MGM
204	MNO-2190	392	1497	FLKTL	115.9	107.6	162.7	6740	98.1	CD
205	MNO-2190	392	1587	FLKTL	197.9	0.5	77.3	5130	158.6	MGM/MC
206	MNO-2190	392	1606	FLKTL	59.6	19.3	92.7	4070	75.7	SV
207	MNO-2190	392	1607	FLKTL	117.3	0.2	34.7	2910	140.9	MH
208	MNO-2190	392	1608	FLKTL	190.3	0.9	78.3	4650	160.6	MGM/MC
209	MNO-2190	392	1629	FLKTL	74.7	58.2	104.5	5130	50.8	SV
210	MNO-2190	392	1630	FLKTL	219.6	1	58.9	5860	188.2	MGM
211	MNO-2190	392	1631	FLKTL	132.2	0.3	53.1	3930	96.2	MGM
212	MNO-2190	392	1725	FLKTL	180.3	0.6	89.6	4560	240.8	MGM/MC
213	MNO-2190	392	1728	FLKTL	112	46.3	118.6	5950	144.9	SV
214	MNO-2190	392	1729	FLKTL	108.8	90.7	180.7	7240	120.2	CD
215	MNO-2190	392	1761	FLKTL	127.5	2.7	83.3	3660	328.8	TQ
216	MNO-2190	392	1796	PTBLNK	96.8	103.4	155.8	6100	39.7	CD
217	MNO-2190	392	1799	FLKTL	71.9	68.4	113.4	5610	47.2	SV
218	MNO-2190	392	1800	FLKTL	131.3	2.6	88.3	3800	279.1	TQ/MH
219	MNO-2190	392	1835	FLKTL	85.8	60.3	122.8	6030	108.5	SV
220	MNO-2190	392	1836	FLKTL	165.5	1.1	63.6	3380	128	MGM
221	MNO-2190	392	1840	FLKTL	79.6	100.8	176.5	6160	76.8	CD
222	MNO-2190	392	1841	FLKTL	119.7	2.1	32.1	2830	40.9	MGM
223	MNO-2190	392	1868	FLKTL	154.1	81.6	185.1	7210	94.6	CD
224	MNO-2190	392	1891	FLKTL	123.2	64.4	186.5	7920	105.2	CD
225	MNO-2190	392	1929	FLKTL	184	0.4	57.8	4870	162.1	MGM
226	MNO-2190	392	1930	FLKTL	66.4	60.1	125.7	5190	46.4	SV
227	MNO-2190	392	2101	FLKTL	63.2	5.8	32.4	2330	76.8	MH
228	MNO-2190	392	2191	FLKTL	125.7	3.2	79.4	3360	282.7	TQ

ITEM	SITE	ACC	CAT	DESCRIP	RB	SR	ZR	FE	MN	SOURCE
229	MNO-2190	392	2232	FLKTL	49.8	1.6	19.1	1710	33.1	MH
230	MNO-2190	392	2331	FLKTL	109.7	85.9	156.7	6300	74	CD
231	MNO-2190	392	2413	FLKTL	189.3	5	135.5	4800	509.4	TQ
232	MNO-2190	392	2450	FLKTL	19.6	4.4	23.5	1300	103.5	TQ/MH
233	MNO-2190	392	2476	FLKTL	116.4	84	111.2	7290	92.7	SV
234	MNO-2190	392	2488	FLKTL	142.5	1.9	67.1	3940	120.9	MGM
235	MNO-2190	392	2529	FLKTL	138.4	76.1	199.4	9470	210.3	CD
236	MNO-2190	392	2585	FLKTL	140.6	106.9	188.5	6150	122.5	CD
237	MNO-2190	392	2818	FLKTL	169.2	97	161.5	9590	191.9	CD
238	MNO-2190	392	2819	FLKTL	168.6	3.4	138.4	5110	496.3	TQ
239	MNO-2190	392	2820	FLKTL	125	1.5	62.4	4100	136	MGM
240	MNO-2190	392	2821	FLKTL	104.2	42.3	120.5	6770	76.7	SV
241	MNO-2190	392	2893	FLKTL	184.2	2.1	81.8	4720	102.5	MGM/MC
242	MNO-2190	392	2894	FLKTL	9.2	3.8	7.1	900	35.4	MH
243	MNO-2190	392	2895	FLKTL	22.2	3.1	9.9	1040	45.6	MH
244	MNO-2190	392	2916	FLKTL	139.6	74.9	149.8	7970	152.1	SV/CD
245	MNO-2190	392	2978	FLKTL	188.6	5.6	119.3	5890	633.4	TQ
246	MNO-2190	392	3030	FLKTL	183.1	11.9	99.8	4290	436.2	TQ
247	MNO-2190	392	3042	FLKTL	175.5	9	126.3	4070	426.8	TQ
248	MNO-2190	392	3043	FLKTL	190.2	4.4	145.1	5960	659.5	TQ
249	MNO-2189	392	3370	FLKTL	175.6	0.9	60.3	3900	126.8	MGM
250	MNO-2190	392	3371	FLKTL	84.7	3.3	74.5	3370	303.9	TQ
251	MNO-2190	392	3382	FLKTL	107.6	5.4	109.7	3140	206.9	TQ/QI
252	MNO-2190	392	3383	FLKTL	154.1	109.2	159.8	8690	123.6	CD
253	MNO-2190	392	3384	FLKTL	169.8	88.5	216.4	9690	262.6	CD
254	MNO-2190	392	3390	FLKTL	77.4	60.9	134.6	6670	60.3	SV
255	MNO-1992	392	5008	FLKTL	128.7	32.3	92	3450	238	TQ/MH
256	MNO-1992	392	5009	FLKTL	160.3	53.6	90.4	5430	350.7	BH
257	MNO-1992	392	5020	FLKTL	172.7	114	200.7	8420	173.6	CD
258	MNO-1992	392	5023	FLKTL	181.8	6.5	108.8	4530	420.5	TQ
259	MNO-1992	392	5186	FLKTL	122	3.7	62.6	3650	191.2	MH
260	MNO-1992	392	5187	FLKTL	117.9	3.1	89.4	3380	228.7	TQ/QI
261	MNO-1992	392	5189	FLKTL	109.1	1.7	24.8	2930	78	MGM
262	MNO-1992	392	5190	FLKTL	21.3	3.2	8.4	1010	39.1	MH
263	MNO-1992	392	5214	FLKTL	129.2	2.6	42.1	3320	66.1	MGM
264	MNO-1992	392	5216	FLKTL	63.1	60.3	139.3	5360	57.3	SV
265	MNO-1992	392	5233	FLKTL	153.8	116.7	217.4	12880	221.4	CD
266	MNO-1992	392	5256	FLKTL	27	12.3	23.4	1420	40	MH
267	MNO-1992	392	5261	FLKTL	106.7	68.1	101.5	4830	74.3	SV
268	MNO-1992	392	5322	FLKTL	78.1	1.9	32.7	3030	44.6	MGM
269	MNO-1992	392	5406	FLKTL	108.3	0.8	33.1	3590	98.4	MGM
270	MNO-1992	392	5418	FLKTL	90.3	5.5	70	4140	220.5	MH
271	MNO-1992	392	5470	FLKTL	165.2	1.8	59	4910	165.4	MGM
272	MNO-1992	392	5484	FLKTL	164	133.4	222.4	11290	105.7	CD
273	MNO-1992	392	5573	FLKTL	202.4	96	91.6	5940	462.5	BH
274	MNO-1992	392	5664	FLKTL	128.8	79.8	53.4	2590	95.7	BH/PG
275	INY-399	392	6003	FLKTL	138.2	2.4	80.4	3650	304.1	TQ
276	INY-399	392	6063	FLKTL	8	6.1	4.7	200	48.8	FS
277	INY-399	392	6200	FLKTL	117.7	119.7	191.7	6580	54.6	CD
278	MNO-2464	392	8005	FLKTL	156.3	156.2	193.1	8360	99.4	CD
279	MNO-2464	392	8037	FLKTL	192.7	0.5	79.9	3860	109.5	MGM/MC
280	MNO-2464	392	8041	FLKTL	31.5	5.1	6.9	1220	58.2	MH
281	MNO-2464	392	8060	FLKTL	207.3	0.9	62.6	4830	141	MGM
282	MNO-2464	392	8062	FLKTL	111.5	81.1	149.7	6440	92.8	SV/CD
283	MNO-2464	392	8063	FLKTL	69.8	54.9	133.5	5220	45.6	SV
284	MNO-2464	392	8064	FLKTL	130.9	1	29.6	3690	98.6	MGM
285	MNO-2464	392	8126	FLKTL	142.3	103.9	218	9910	96.2	CD

ITEM	SITE	ACC	CAT	DESCRIP	RB	SR	ZR	FE	MN	SOURCE
286	MNO-2464	392	8130	FLKTL	188.7	1.1	91.9	4510	110.4	MC/MGM
287	MNO-2464	392	8131	FLKTL	203.2	1.1	97.6	5380	187.6	MC/MGM
288	MNO-2464	392	8132	FLKTL	184.3	0.5	67.1	4500	168.9	MGM
289	MNO-2464	392	8217	FLKTL	39.7	6.4	6	910	108.1	TQ
290	MNO-2465	392	9007	FLKTL	143.8	0.3	48.6	3180	39.3	MGM
291	MNO-2465	392	9008	FLKTL	162.9	2.2	51.4	3030	44.6	MGM
292	MNO-2465	392	9012	FLKTL	144.5	0.3	53.4	3470	104.5	MGM
293	MNO-2465	392	9013	FLKTL	91.3	55.6	118.3	3990	41.6	SV
294	MNO-2465	392	9014	FLKTL	96.5	1.9	38.4	2500	79	MH
295	MNO-2465	392	9024	FLKTL	46.8	41.2	103.5	3500	41.6	SV
296	MNO-2465	392	9032	FLKTL	193.4	1.3	85.2	4620	84.3	MC/MGM
297	MNO-2465	392	9041	FLKTL	173.6	0.8	65.6	3540	36.2	MGM
298	MNO-2465	392	9042	FLKTL	142.5	1.3	66.1	3240	54.1	MGM
299	MNO-2465	392	9077	FLKTL	80.8	60.9	112.8	6910	50.2	SV
300	MNO-2465	392	9078	FLKTL	124.2	105.3	193	8190	75.2	CD
301	MNO-2465	392	9081	FLKTL	73.7	82.5	121.5	6590	88.8	SV
302	MNO-2465	392	9082	FLKTL	50.6	26.6	64.2	4500	44.7	SV
303	MNO-2465	392	9096	FLKTL	63.8	1.5	30.2	2380	29.7	MGM
304	MNO-2465	392	9108	FLKTL	94.3	2.3	27.4	2710	38.4	MGM
305	MNO-2465	392	9115	FLKTL	174.7	0.7	65.8	4390	127	MGM
306	MNO-2465	392	9122	FLKTL	121.5	102.4	144	7690	82.6	CD/SV
307	MNO-2465	392	9123	FLKTL	134.2	1.6	32.2	2880	41.8	MGM
308	MNO-2465	392	9124	FLKTL	45.7	25.2	73.7	4420	55	SV
309	MNO-2465	392	9138	FLKTL	87.7	43.6	149.7	5950	43.2	CD/SV
310	MNO-2465	392	9140	FLKTL	160.4	2.4	47.7	3130	433.8	FS
311	MNO-2465	392	9144	FLKTL	51.2	50.4	96	4090	45.4	SV
312	MNO-2465	392	9157	FLKTL	163.7	1.5	73.5	3940	44.8	MGM
313	MNO-2465	392	9160	FLKTL	47.3	9	5.3	670	26.5	MH
314	MNO-2465	392	9161	FLKTL	6.8	2.1	2.6	410	22.8	MH
315	MNO-2465	392	9170	FLKTL	105.9	1.6	22.7	2550	64.4	MGM
316	MNO-2465	392	9174	FLKTL	142	1.8	51	2860	52.2	MGM
317	MNO-2465	392	9195	FLKTL	91.4	78.5	94.6	6000	120.8	SV
318	MNO-2465	392	9210	FLKTL	124.2	57.7	156.7	6040	86	CD
319	MNO-2465	392	9284	FLKTL	138.6	1.4	43.5	3400	59.7	MGM
320	MNO-2465	392	9314	FLKTL	65.8	43.4	116	4590	63.4	SV
321	MNO-2465	392	9539	FLKTL	207.7	1.4	75.5	4770	196.5	MGM
322	MNO-2465	392	9572	FLKTL	47.1	8.4	99.8	4030	50.8	QI
323	MNO-2465	392	9585	FLKTL	166.2	0.7	60.3	3590	74.7	MGM
324	MNO-2465	392	9601	FLKTL	102	77.3	148.5	6210	73.6	CD/SV
325	MNO-2465	392	9631	FLKTL	128.3	2	22.9	2840	63.4	MGM
326	MNO-2465	392	9675	FLKTL	80.5	62.6	118.2	4440	39.4	SV
327	MNO-2465	392	9676	FLKTL	170.3	2.4	51.7	3710	69.6	MGM
328	MNO-2465	392	9688	FLKTL	77.2	51.5	69.7	5450	27	SV
329	MNO-2465	392	9690	FLKTL	98.4	3.9	17.2	2720	65.5	MGM/MH
330	MNO-2465	392	9708	FLKTL	154	1.2	47.3	4640	89.7	MGM
331	MNO-2465	392	9709	FLKTL	11.3	9.8	19.4	1120	73.6	MH
332	MNO-2465	392	9710	FLKTL	24.6	10.2	35.3	2150	65	MH
333	MNO-2465	392	9727	FLKTL	103.5	60	129.9	6470	83.9	SV
334	MNO-2465	392	9744	FLKTL	57.5	47.8	97.6	5260	49.8	SV
335	MNO-2465	392	9817	FLKTL	13.8	5.6	8.1	850	50.3	MH
336	MNO-2465	392	9818	FLKTL	61.5	28.2	115.2	5320	73.4	SV
337	MNO-2465	392	9875	FLKTL	128	1.1	30.8	3140	60.7	MGM
338	MNO-2465	392	9914	FLKTL	85.4	26.7	90.7	3790	56.2	SV/MGM
339	MNO-2465	392	9915	FLKTL	79.8	31	128.6	5770	66	SV
340	MNO-2465	392	9916	FLKTL	51	18.4	82	2440	40.6	SV
341	MNO-2465	392	9920	FLKTL	98	73.7	139.5	5830	52.9	SV/CD
342	MNO-2465	392	9921	FLKTL	85.3	36.9	103.2	4930	81.7	SV

ITEM	SITE	ACC	CAT	DESCRIP	RB	SR	ZR	FE	MN	SOURCE
343	MNO-2465	392	9922	FLKTL	144.8	1	38.3	3750	156.7	MGM/MH
344	MNO-2465	392	9927	FLKTL	112.5	1.8	25.4	2830	58.1	MGM
345	MNO-2465	392	9928	FLKTL	49.7	13.8	112.6	4210	51.1	SV/QI
346	MNO-2465	392	9929	FLKTL	106.5	53.2	138.7	4830	118.5	SV
347	MNO-2465	392	9931	FLKTL	57.1	2.6	14	1530	47.3	MH
348	MNO-2465	392	9974	FLKTL	95.5	3.6	25.2	2220	40	MGM
349	MNO-2465	392	9980	FLKTL	72.1	30.6	85.3	4530	37.9	SV
350	MNO-2465	392	10003	FLKTL	93.9	2.7	34.8	1690	28.5	MGM
351	MNO-2465	392	10004	FLKTL	18.7	5.2	26.2	1810	40.5	MH
352	MNO-2465	392	10018	FLKTL	181.6	168.4	229.2	11590	225.7	CD
353	MNO-2465	392	10070	FLKTL	80	30.2	104.9	4820	87.1	SV
354	MNO-1992	392	5174	BIFACE	87.7	76.6	132.3	5670	57.3	SV
355	MNO-1992	392	5176	BIFACE	58.8	3	9.9	830	56.4	MH
356	MNO-1992	392	5275	BIFACE	35.4	4.4	7.7	1100	62.9	MH
357	MNO-1992	392	5279	BIFACE	98	0.7	43.7	3200	36.1	MGM
358	MNO-1992	392	5303	BIFACE	109.6	3.1	27.5	2580	42	MGM
359	MNO-1992	392	5313	BIFACE	61.1	2.3	22.8	2290	50.3	MH
360	MNO-1992	392	5321	BIFACE	147.4	1.6	60.9	2960	376.8	TQ
361	MNO-1992	392	5373	BIFACE	61.6	2.7	7.7	1580	225	TQ
362	MNO-1992	392	5410	BIFACE	77.8	1.3	18.3	2940	49.3	MGM
363	MNO-1992	392	5579	BIFACE	147.3	1.6	71.9	3670	101.4	MGM
364	MNO-1992	392	5772	BIFACE	95.3	61.1	48.3	3380	166.1	PG
365	MNO-2189	392	518	FRMFLKTL	191.5	15.6	130.7	5600	571.5	TQ
366	MNO-2189	392	588	FRMFLKTL	175.9	8.5	101.7	5260	576.2	TQ
367	MNO-2190	392	733	FRMFLKTL	100.9	1.9	88.5	4580	81.5	MGM
368	MNO-2190	392	743	FRMFLKTL	136.6	54	166.8	8610	284.9	SV
369	MNO-2190	392	939	FRMFLKTL	100.1	2.8	19.9	2150	245.8	TQ/MH
370	MNO-2190	392	940	FRMFLKTL	103.4	46	104.4	5670	60.7	SV
371	MNO-2190	392	1191	FRMFLKTL	121.2	60.8	179.5	6980	92.2	CD
372	MNO-2190	392	1403	FRMFLKTL	179	0.4	39	5550	265.2	MGM
373	MNO-2190	392	1834	FRMFLKTL	89.3	62.3	90	5970	105.6	SV
374	MNO-2190	392	2214	FRMFLKTL	144.2	1.5	59.1	3430	81	MGM
375	MNO-2190	392	2470	FRMFLKTL	152	3.6	98	3330	207.2	QI
376	MNO-2190	392	2677	FRMFLKTL	88	4.2	59.7	2800	127.5	MH
377	MNO-2190	392	2815	FRMFLKTL	132	0.8	53.3	7580	325.2	MH/MGM
378	MNO-2189	392	3186	FRMFLKTL	51.9	2.9	6.5	1250	38.9	MH
379	MNO-2189	392	3224	FRMFLKTL	182.4	4.1	131.1	4850	522.6	TQ
380	MNO-2190	392	3338	FRMFLKTL	146.5	0.5	66.2	2760	63.1	MGM
381	MNO-1992	392	5027	FRMFLKTL	191.2	1.7	100.2	3600	56.2	MC
382	MNO-1992	392	5179	FRMFLKTL	165.2	0.9	58.8	3050	322.9	MH/TQ
383	MNO-1992	392	5182	FRMFLKTL	123.2	2.7	94	3270	270.7	TQ
384	MNO-1992	392	5225	FRMFLKTL	152.9	1.3	56.6	3260	55.8	MGM
385	MNO-1992	392	5242	FRMFLKTL	111.8	8.5	40.8	2400	59	MGM
386	MNO-1992	392	5411	FRMFLKTL	104.6	1.6	57.7	3010	188.7	MH
387	MNO-1992	392	5441	FRMFLKTL	146.9	53.1	101.5	3720	346.2	TQ/PG
388	MNO-2465	392	9156	FRMFLKTL	43.4	23.7	54.4	1260	36.7	MH
389	MNO-2465	392	9405	FRMFLKTL	149.4	103.9	192.9	11370	276.2	CD
390	MNO-2465	392	9406	FRMFLKTL	77.8	1.6	42.2	1950	42.9	MGM/MH
391	MNO-2465	392	9674	FRMFLKTL	67.3	3.8	17	1370	41.6	MH
392	MNO-1992	392	5656	CORE	175.5	4.6	70.8	3980	74.6	MGM
393	MNO-2189	392	81	CORE	129	7.6	107	4000	275.5	TQ/QI
394	MNO-2189	392	119	CORE	112	2.3	86	2980	161.1	QI/MH
395	MNO-2189	392	160	CORE	120.6	4.1	94.4	3790	157.5	QI
396	MNO-2190	392	1052	CORE	141.7	1.2	82.4	3490	44.9	MGM/MC
397	MNO-2190	392	1053	CORE	182.8	0.6	62.1	4460	124.6	MGM
398	MNO-2190	392	1278	CORE	147.6	3.5	110	3930	376.6	TQ
399	MNO-2190	392	1534	CORE	213.4	2.5	41.4	5890	253	MGM

ITEM	SITE	ACC	CAT	DESCRIP	RB	SR	ZR	FE	MN	SOURCE
400	MNO-2190	392	1889	CORE	162.6	0.9	95.6	5710	96.2	MC/MGM
401	MNO-2190	392	1890	CORE	53.4	2.6	14.2	1930	65.3	MH
402	MNO-2189	392	3235	CORE	165.5	4.1	111.6	3950	365.3	TQ
403	MNO-2189	392	3236	CORE	164.6	6.1	118.3	5570	612.3	TQ
404	MNO-1992	392	5015	CORE	38.8	32.5	91.7	3520	29.1	SV
405	MNO-1992	392	5314	CORE	144	3.4	57.6	2990	61.1	MGM
406	MNO-1992	392	5556	CORE	97.5	42.3	104.2	5720	60.6	SV
407	MNO-2464	392	8136	CORE	191.7	0	77.2	6590	198.7	MGM/MC
408	MNO-2465	392	9691	FLKTL	49.3	33.3	85.7	3730	39.3	SV
409	MNO-2190	392	1011	PTBLNK	136.6	1.2	79.8	3140	40.7	MGM
410	MNO-2190	392	1026	PTBLNK	56.1	23.5	106.1	4070	72.5	SV
411	MNO-2190	392	1086	PTBLNK	96.9	67	156.8	5780	49.8	CD
412	MNO-2190	392	1229	PTBLNK	146.3	5.1	102.3	2900	192.1	QI
413	MNO-2190	392	1230	PTBLNK	106.8	73.5	159	5560	122.9	SV/CD
414	MNO-2190	392	1231	PTBLNK	167.7	1.3	30.7	2530	348.3	FS
415	MNO-2190	392	2853	PTBLNK	101.3	96.1	151.5	4740	63.1	CD/SV
416	MNO-2189	392	3007	PTBLNK	33.1	4.3	21.4	1380	41	MH
417	MNO-1992	392	5325	PTBLNK	25	90.2	0	3360	30.4	PG
418	MNO-1992	392	5628	PTBLNK	60.8	2.6	63.6	1750	45.6	MH
419	MNO-2465	392	9739	PTBLNK	58.8	31.5	68	3960	69	SV
420	MNO-2465	392	9740	PTBLNK	53.9	23.5	33.5	3820	47.3	MH
421	MNO-2465	392	10038	PTBLNK	53.9	34.9	75.6	3620	69.7	SV
422	MNO-2465	392	10044	PTBLNK	7.8	14.1	25	1570	74.7	MH
423	MNO-1992	455	555	BIFACE	11.1	4	6.1	820	73.3	MH/TQ
424	MNO-1992	455	556	BIFACE	20.1	5.1	35.6	1190	87.1	TQ/MH
425	MNO-1992	455	566	FLKTL	56.2	6.6	58.9	1710	50.9	MH
426	533	455	594	BIFACE	75.9	35.3	124.3	5800	99.2	SV
427	533	455	655	BIFACE	23.7	23.8	31.1	2420	53.4	MH
428	533	455	670	BIFACE	205.2	1.6	79.6	5140	194.8	MGM/MC
429	533	455	853	BIFACE	79.1	1.5	13.7	1720	26.3	MGM
430	533	455	855	BIFACE	72.6	48.7	99.4	4410	51.4	SV
431	533	455	879	BIFACE	112.5	107.9	170.3	6650	120.3	CD
432	533	455	882	BIFACE	145.8	4.5	77.2	4150	420	TQ
433	533	455	902	BIFACE	176.1	1.9	63.3	3820	466.8	FS
434	533	455	905	BIFACE	83.2	3	41.2	2260	53.2	MGM/MH
435	533	455	907	BIFACE	172.5	0.2	61.8	5280	172.7	MGM
436	533	455	908	BIFACE	106.2	84.8	170.6	6440	42.4	CD
437	MNO-1992	455	19	BIFACE	115.9	73.7	142	5830	40.6	CD/SV
438	MNO-1992	455	29	BIFACE	164.6	0.6	73.5	3630	133.5	MGM
439	MNO-1992	455	80	BIFACE	9.5	11.9	10.2	680	45.8	MH
440	MNO-1992	455	134	BIFACE	86.9	4.2	85.1	3460	228.9	TQ
441	MNO-1992	455	233	BIFACE	60.1	8.2	41	2290	77.7	MH
442	MNO-1992	455	303	BIFACE	14	8.3	7	480	52.9	TQ
443	MNO-1992	455	361	BIFACE	30.5	22.9	39	3490	48.3	MH
444	MNO-1992	455	400	BIFACE	24.2	4.4	14.8	1060	101.9	TQ
445	MNO-1992	455	420	BIFACE	19.6	43.6	51.6	2830	73.1	SV
446	MNO-1992	455	423	BIFACE	17.2	4.2	6.5	610	36.1	MH
447	MNO-1992	455	424	BIFACE	94	4.1	52.6	2560	188.3	MH
448	MNO-1992	455	444	BIFACE	13.3	2.8	16.5	350	51.8	TQ
449	MNO-1992	455	492	BIFACE	5	5.2	3.1	350	39.6	TQ
450	MNO-1992	455	542	BIFACE	5.3	4	5.8	220	35.4	TQ
451	MNO-1992	455	352	FLKTL	101.5	96.7	160.3	6150	59	CD
452	533	455	634	FLKTL	157.3	105.2	182.1	12590	324.8	CD
453	533	455	642	FLKTL	52.5	2	17.4	1980	47.7	MH
454	533	455	725	FLKTL	96.6	93.7	21.8	2880	112.7	PG
455	533	455	785	FLKTL	45.1	22.3	90.3	3900	47.3	SV
456	533	455	800	FLKTL	156	137.5	250.4	9390	109.4	CD

ITEM	SITE	ACC	CAT	DESCRIP	RB	SR	ZR	FE	MN	SOURCE
457	MNO-1992	455	13	FRMFLKTL	158.6	83.5	155.2	8970	276.8	SV
458	MNO-1992	455	16	FRMFLKTL	106.8	1.6	58.1	2890	45.4	MGM
459	MNO-1992	455	109	FRMFLKTL	145.5	8.8	57.3	3280	84.1	MGM
460	MNO-1992	455	560	FRMFLKTL	147.3	9.3	62.7	3980	51.3	MGM
461	MNO-1992	455	43	PRJPT	59.7	0.9	18.3	1350	25.9	MH
462	MNO-1992	455	548	FLKTL	192	1.2	73.6	4060	79.6	MGM/MC
463	MNO-1992	455	561	FLKTL	119.2	84.7	139.7	5820	93.8	SV
464	MNO-1992	455	565	FLKTL	120.8	70.4	131.7	7060	97.5	SV
465	MNO-1992	455	576	FLKTL	110.2	5.5	34.5	3520	65.5	MGM
466	MNO-1992	455	577	FLKTL	130	95.4	136	6770	73.6	SV/CD
467	14D-1	455	941	BIFACE	144.6	100	187.8	9520	271.8	CD
468	18C-1	455	959	BIFACE	88.4	59.7	143	5950	50.5	SV/CD
469	18D-1	455	963	BIFACE	144.7	77.5	189.8	9590	179.5	CD
470	26B-1	455	987	BIFACE	157.8	1	62.9	4330	120.3	MGM
471	26B-1	455	988	BIFACE	70.5	2	47	1630	101.1	MH
472	20C-1	455	893	FRMFLKTL	189.9	1	34	5310	110.5	MGM
473	20C-1	455	895	FRMFLKTL	114.2	3.3	36.7	2770	42.6	MGM
474	22B-1	455	978	FRMFLKTL	119.7	84.3	144.9	6880	85	SV/CD
475	12C-2	455	923	FLKTL	182.4	1.6	79	5730	179.4	MGM/MC
476	12C-2	455	925	FLKTL	201.3	3.4	92.3	6560	766	TQ/FS
477	14D-1	455	943	FLKTL	76.6	48.7	146.1	5370	53.1	SV/CD
478	14D-1	455	944	FLKTL	88.2	54	148.6	6030	168	SV
479	14D-1	455	946	FLKTL	133.4	87.6	169.4	7900	93.3	CD
480	14D-1	455	947	FLKTL	97.5	74.9	118.9	7400	100.7	SV
481	18D-1	455	966	FLKTL	172.5	9.6	113.1	7330	788.6	TQ
482	18D-1	455	967	FLKTL	408.4	0.6	64.8	9440	263.9	CO
483	18D-1	455	969	FLKTL	138.8	147.3	226.1	15340	374.7	CD
484	20C-1	455	974	FLKTL	99.2	45.8	146.3	5840	83.2	SV
485	20C-1	455	975	FLKTL	88.4	75.9	153.8	6790	165	SV
486	22C-1	455	983	FLKTL	67	41	94.4	3770	44.6	SV
487	22C-1	455	984	FLKTL	196.1	0.5	45.3	4690	672.6	FS
488	26B-1	455	990	FLKTL	127.4	2.2	58.6	2890	44.9	MGM
489	26B-1	455	991	FLKTL	210.8	1	43.2	5270	166.8	MGM
490	MNO-1992	455	85	PRJPT	143.8	18.2	61.2	3230	252.7	MH
491	MNO-1992	455	335	PRJPT	154.7	4.1	57.4	3180	71.2	MGM
492	MNO-1992	455	347	PRJPT	176.4	97	217.3	10830	146.3	CD
493	14D-1	455	885	PRJPT	184.6	2	92.4	4790	184.5	MC/MGM
494	18C-1	455	891	PRJPT	45.4	9.7	88.1	2880	45.9	QI/SV
495	18C-3	455	892	PRJPT	266.6	1.8	52.4	5870	857.4	FS
496	24A-1	455	897	PRJPT	211.3	0.6	45	3800	527.8	FS
497	12C-2	455	920	PRJPT	25.7	17.8	41.7	3430	52	MH
498	22C-1	455	981	PRJPT	42.6	4.8	13	1450	57.7	MH
499	MNO-1992	455	182	PRJPT	135.5	1.4	25.8	2640	212.7	MH
500	MNO-1992	455	346	PRJPT	53.8	2.7	33.7	2670	86.1	MH
501	MNO-1992	455	537	PRJPT	130.6	12.6	35.9	3600	263.8	MH
502	MNO-1992	455	540	PRJPT	115.5	3.6	73	3230	269.4	TQ
503	MNO-1992	455	541	PRJPT	152.5	101.3	95.9	4330	243	BH/PG
504	533	455	654	PRJPT	102.8	4.6	73.6	2970	209.4	TQ/MH
505	16B-1	455	888	PRJPT	103.7	122.8	223	8600	186.7	CD
506	MNO-1992	392	10080	PRJPT	167.3	8.1	129.1	4500	391.6	TQ
507	22B-1	455	896	PRJPT	198.7	5.8	148.2	5780	518.6	QI
508	ISO	474	1	PRJPT	236.9	2.7	66.8	5440	867.2	FS
509	ISO	474	2	PRJPT	186.2	7.4	103.5	5800	547.5	TQ
510	ISO	474	3	PRJPT	183.4	8.1	120.9	6400	563.9	TQ/QI
511	ISO	474	4	PRJPT	196.2	0.7	45.8	5790	241.7	MGM
512	ISO	474	5	PRJPT	133.1	79.1	149.2	8550	154.8	SV/CD
513	ISO	474	6	PRJPT	163	7.5	134.3	5210	614.9	TQ

ITEM	SITE	ACC	CAT	DESCRIP	RB	SR	ZR	FE	MN	SOURCE
514	ISO	474	7	PRJPT	162	1.8	18	3290	432.7	FS
515	ISO	474	8	PRJPT	175.5	1.7	102	4550	121	MC
516	ISO	474	9	PRJPT	161.6	1.2	57.1	3400	493.8	FS
517	ISO	474	10	PRJPT	179.6	7.2	133.6	5000	578	TQ
518	6-A	474	11	PRJPT	101.8	1.6	29.5	3500	135.4	MH
519	8-A	474	12	PRJPT	156.5	1.9	72.7	4660	115.6	MGM
520	8-A	474	13	PRJPT	77.9	5.5	31.1	2580	76.6	MH
521	8-A	474	14	PRJPT	104.8	3.7	59.8	3580	204.6	MH
522	16-A	474	15	FRMFLKTL	158	3	100.8	6250	630.1	TQ
523	20-A	474	16	PRJPT	94.2	114	200.4	6590	52.4	CD
524	20-A	474	17	PRJPT	93.1	0.2	47.4	4680	86.5	MGM
525	24-A	474	18	PRJPT	155.1	15.2	47.5	4280	239.4	MH
526	30-A	474	19	PRJPT	109.4	6.8	85.3	3770	302	TQ
527	30-B	474	20	PRJPT	159.1	4.8	99.6	4970	463.6	TQ
528	30-B	474	21	PRJPT	208.5	0.8	90.9	6340	84.2	MC
529	4C-1	455	1023	BIFACE	115	111.4	218.1	8210	66.9	CD
530	10A-2	455	1026	PRJPT	182.1	2.8	51	4450	569.6	FS
531	10A-2	455	1027	FRMFLKTL	114.5	66.4	101	6520	94.8	SV
532	10A-2	455	1040	PRJPT	181.7	0.5	43.9	4010	506.2	FS
533	18C-3	455	1057	FLKTL	122.9	1.9	35	2950	24.5	MGM
534	18C-3	455	1059	PRJPT	146.1	2.7	82.7	3530	56.9	MGM/MC
535	18C-2	455	1063	BIFACE	112.1	120	166.6	7570	47.4	CD
536	18C-2	455	1064	FLKTL	56.8	95.4	105.6	4550	63.9	SV
537	18C-2	455	1065	FLKTL	94.3	169.5	154.7	6200	43.5	CD
538	18C-2	455	1071	BIFACE	119.4	0.9	92.3	3510	47.5	MGM/MC
539	14C-2	455	1072	BIFACE	113	83.4	177.5	6330	90.7	CD
540	14C-2	455	1081	FRMFLKTL	117.3	79.6	129.5	6410	154.7	SV
541	14C-2	455	1082	FRMFLKTL	89.3	78.8	151.9	5910	87.7	SV/CD
542	14C-2	455	1085	FLKTL	160.4	0.8	47.3	4000	67.9	MGM
543	14C-2	455	1086	FLKTL	141.7	1.3	28.7	3470	120.3	MGM
544	14C-2	455	1087	FLKTL	49.8	8.8	21.3	1310	46.1	MH
545	14C-2	455	1094	BIFACE	160.7	6.4	110.6	4160	433.2	TQ
546	14C-2	455	1095	BIFACE	54.2	50.4	74.4	3200	81.9	SV
547	14C-2	455	1098	FLKTL	69.9	2.1	13.8	1530	129.1	MH
548	10B-2	455	1104	PRJPT	149.4	97.6	179.2	7560	221.4	CD
549	10B-2	455	1105	PRJPT	127	92.9	172.5	7650	100.5	CD
550	10B-2	455	1106	PRJPT	91.1	60	134.1	6470	85.5	SV
551	30-B	474	104	PRJPT	45.1	1.3	4.8	1570	32	MH
552	28-A	474	93	FLKTL	60	39.6	108	3660	34.3	SV
553	24-B	474	85	FLKTL	79.2	73.4	117.7	4750	32.2	SV
554	4-A	474	53	FLKTL	127.3	83.2	144.6	7600	215	SV
555	4-A	474	52	FLKTL	107.9	49.4	76.5	8960	151.8	SV
556	22B-1	467	900	FLKTL	171.9	1.6	71.3	3900	53.8	MGM
557	20C-1	467	828	BIFACE	89.4	1.7	33.2	2360	100.7	MH
558	18C-2	467	875	BIFACE	199.3	52.3	70.7	3550	27.5	MGM
559	18C-2	467	883	PRJPT	39.5	28.5	11.4	1400	68	MH
560	14C-2	467	1102	PRJPT	14.6	12.4	7.3	1180	42.6	MH
561	14C-2	467	1126	FLKTL	140.4	0.6	31.8	4070	95.9	MGM
562	26B-1	467	1202	PRJPT	84.9	1.8	19.7	2240	35.6	MGM
563	26B-1	467	1203	PRJPT	220.9	1.4	19.9	3140	473.6	FS
564	14C-1	467	1401	PRJPT	111.2	4.2	17	2820	48.5	MGM
565	14C-1	467	1410	PRJPT	28.9	3.1	3.8	1010	47.8	MH
566	14C-1	467	1411	PRJPT	125.8	118	167.5	6410	99.6	CD
567	14C-1	467	1405	PRJPT	34.3	24.5	83.8	2650	42.6	SV
568	14C-1	467	1408	DRILL	91.6	62	136.7	5750	81	SV
569	14C-1	467	1409	FRMFLKTL	100	10.9	56.6	3010	148.7	MH
570	14C-1	467	1412	FLKTL	90.3	2.6	45.1	2660	73.2	MH/MGM

ITEM	SITE	ACC	CAT	DESCRIP	RB	SR	ZR	FE	MN	SOURCE
571	14C-1	467	1417	BIFACE	164.2	0.6	30.4	3950	74	MGM
572	14C-1	467	1420	FLKTL	208.6	8.5	112.7	6200	658.1	TQ
573	14C-1	467	1421	BIFACE	83.1	2.2	34	2180	299.5	TQ
574	14C-1	467	1422	BIFACE	200.3	0.6	71.6	5170	123.9	MGM
575	14C-1	467	1423	BIFACE	29.6	10.7	49.9	2860	46.6	MH
576	14C-1	467	1443	BIFACE	33.5	4.3	9	810	32.5	MH
577	14C-1	467	1452	PTBLNK	182	0.9	61.4	4180	145.2	MGM
578	14C-1	467	1456	BIFACE	58	3.1	20.9	1290	130.7	TQ
579	14C-1	467	1461	PRJPT	57.1	2.3	48.8	2390	73.6	MH
580	14C-1	467	1467	FLKTL	142.5	86.9	171.7	7520	108.7	CD
581	14C-1	467	1472	BIFACE	33	7.7	54.6	2290	127.6	MH/TQ
582	14C-1	467	1474	BIFACE	142.6	12.1	89.5	2950	316.8	TQ
583	14C-1	467	1478	BIFACE	12.4	5.2	5.1	780	18	MH
584	14C-1	467	1479	FLKTL	169.4	4.1	112.6	5410	611.5	TQ
585	14C-1	467	1495	BIFACE	98.7	1.9	20.6	2630	63.4	MGM
586	14C-1	467	1496	FLKTL	87.8	2.2	40	2780	63.8	MGM/MH
587	14C-1	467	1526	BIFACE	80.9	1.6	15.8	2370	24.7	MGM
588	14C-1	467	1527	FRMFLKTL	134.1	0.4	50.1	5460	183.9	MGM
589	14C-1	467	1536	FLKTL	214.2	0.6	65.9	5070	231.6	MGM
590	14C-1	467	1544	BIFACE	99.4	84.3	58.7	6810	72.1	SV/BH
591	14C-1	467	1548	FLKTL	148.3	1.2	53.9	4080	140.1	MGM
592	14C-1	467	1563	FLKTL	149.3	1.2	28.2	3520	60.7	MGM
593	14C-1	467	1564	FLKTL	160.3	72.7	60.9	4260	398	PG
594	14C-1	467	1590	BIFACE	5.9	7.2	2.6	110	38.9	FS
595	14C-1	467	1591	BIFACE	96.1	59.7	101.8	5190	89	SV
596	14C-1	467	1592	BIFACE	73.3	1.8	12.4	2140	35.3	MGM
597	14C-1	467	1631	BIFACE	135.1	1.1	30	3670	80.1	MGM
598	14C-1	467	1640	BIFACE	103.5	77.2	81.8	2770	147.1	PG/SV
599	14D-1	467	2500	BIFACE	125.3	95.9	149	5940	58.9	CD
600	14D-1	467	2502	PRJPT	122.8	67.5	139.7	7120	129.7	SV
601	14D-1	467	2503	PRJPT	165.5	0.8	40.8	3820	28.9	MGM
602	14D-1	467	2506	PRJPT	202.2	16.6	153.1	6120	788.8	TQ
603	14D-1	467	2508	PRJPT	42.1	6.5	48.6	3700	40.9	MH/MGM
604	14D-1	467	2515	FLKTL	185.6	1.6	44.8	3530	85.5	MGM
605	14D-1	467	2521	BIFACE	168.3	0.8	54.9	4410	139.1	MGM
606	14D-1	467	2524	BIFACE	183.6	2.3	63.1	5170	175.5	MGM
607	14D-1	467	2527	FLKTL	89.1	1	59.1	2740	49.4	MGM
608	14D-1	467	2529	PRJPT	119.3	2.2	32.4	2780	55.4	MGM
609	14D-1	467	2531	BIFACE	64.2	2.2	37.6	2610	49.5	MH/MGM
610	14D-1	467	2542	BIFACE	118.8	1.5	62.7	3460	70	MGM
611	14D-1	467	2550	BIFACE	48.6	2.4	10.6	2250	72.2	MH
612	14D-1	467	2552	FLKTL	59.6	1.6	20.4	2300	61.2	MH
613	14D-1	467	2562	BIFACE	120.2	2.6	89.8	3750	372.1	TQ
614	14D-1	467	2583	FLKTL	142.9	94.4	186	7700	129.8	CD
615	14D-1	467	2581	FLKTL	151.8	1.5	47.4	3480	96	MGM
616	14D-1	467	2568	BIFACE	79	1	20	2030	35.8	MGM
617	14D-1	467	2595	BIFACE	8.2	8.6	6.8	700	32	MH
618	14D-1	467	2604	BIFACE	177.5	0.6	63.4	4410	221.7	MGM
619	14D-1	467	2605	BIFACE	37.1	25	36.1	2390	50.6	MH
620	14D-1	467	2648	FLKTL	135.8	2.1	44.8	3140	65.3	MGM
621	14D-1	467	2653	FLKTL	115.9	1.3	36	3430	52.4	MGM
622	14D-1	467	2664	BIFACE	206.8	1.4	61.3	6620	204.7	MGM
623	14D-1	467	2672	BIFACE	95	53.3	117.9	4400	98.4	SV
624	14D-1	467	2694	BIFACE	152.4	6.2	63.8	3100	163.1	MH
625	14D-1	467	2695	BIFACE	11.6	2.4	3.7	500	24.5	MH
626	14D-1	467	2716	BIFACE	28.9	7.5	8	900	35.2	MH
627	14D-1	467	2725	FLKTL	68.9	1.6	19.8	2310	71.5	MH

ITEM	SITE	ACC	CAT	DESCRIP	RB	SR	ZR	FE	MN	SOURCE
628	14D-1	467	2735	BIFACE	4.7	6.5	13.3	650	42.7	MH
629	14D-1	467	2799	FLKTL	88.8	0.8	39.9	3430	91.4	MH/MGM
630	14D-1	467	2778	BIFACE	5.2	5.6	3.8	90	23.9	FS
631	14D-1	467	2817	FLKTL	179.7	1	62.2	4350	99.4	MGM
632	14D-1	467	2855	BIFACE	98	0.7	36.5	2590	41.7	MGM
633	14D-1	467	2867	PRJPT	32.9	36.8	71	2730	48.6	SV
634	14D-1	467	2868	BIFACE	7.8	4.5	6.8	330	28.9	MH/TQ
635	14D-1	467	2888	BIFACE	7	5.5	27.6	1450	56.3	MH
636	14D-1	467	2890	FLKTL	126.2	2.9	64.9	2610	66.2	MGM
637	14D-1	467	2900	BIFACE	51.4	4.2	62	1340	38.6	MH
638	14D-1	467	2919	FLKTL	100.8	1.3	86.4	3170	95.8	MGM/QI
639	14D-1	467	2934	BIFACE	23.7	1.9	5.9	910	28.5	MH
640	10B-2	467	3	PRJPT	113.3	73.7	133	5580	69.8	SV
641	10B-2	467	4	BIFACE	19.7	1.7	15.4	970	38.7	MH
642	10B-2	467	7	BIFACE	103.4	0.8	65.8	3290	50.7	MGM
643	10B-2	467	14	PRJPT	74.7	48.8	45.2	2010	48.9	SV/MH
644	10B-2	467	15	FLKTL	149.9	89.2	143.9	10140	185.3	SV/CD
645	10B-2	467	18	FLKTL	127.9	0.6	72.8	3570	175	MH
646	10B-2	467	26	FLKTL	89	64.9	79.7	6500	62.1	SV
647	10B-2	467	162	PRJPT	2.4	0.8	4.5	380	35.4	TQ
648	10B-2	467	165	FLKTL	130.7	81.2	135.1	7390	157.8	SV
649	10B-2	467	167	FLKTL	85.6	0.9	10.4	2690	63.9	MH/MGM
650	10B-2	467	168	FLKTL	35	13.9	45.2	3550	46.4	MH
651	10B-2	467	180	BIFACE	50.5	3.2	20.8	1680	46.5	MH
652	10B-2	467	182	FLKTL	134.7	125.1	201.6	6740	58.1	CD
653	10B-2	467	184	BIFACE	177.7	3.5	121.2	4560	470.8	TQ
654	10B-2	467	185	FLKTL	113	100.7	161.7	5620	72	CD
655	10B-2	467	192	BIFACE	103.9	2.4	25.7	2230	26.4	MGM
656	10B-2	467	203	FLKTL	109.7	2.6	47.1	3010	56.6	MGM
657	10B-2	467	204	FLKTL	84.4	1.9	22.3	2310	31.6	MGM
658	10B-2	467	207	PRJPT	47.1	43.1	90	3740	57.3	SV
659	10B-2	467	209	BIFACE	45.7	2.3	30.8	1960	27.2	MH/MGM
660	10B-2	467	212	BIFACE	26.9	10.3	16.1	1870	15.4	MH
661	10B-2	467	215	FLKTL	115.3	84	161.1	7880	119.4	CD
662	10B-2	467	216	FLKTL	94.3	1.1	26.1	2980	102.6	MH
663	10B-2	467	217	FLKTL	101.1	86.5	154.2	6330	67	CD
664	10B-2	467	218	FLKTL	50.6	4.1	6.5	1260	32.2	MH
665	10B-2	467	226	FLKTL	195.6	2.3	60.6	6240	172.6	MGM
666	10B-2	467	242	FLKTL	103.5	2	25	2730	60.9	MGM
667	10B-2	467	243	FLKTL	135.1	0.8	49	4160	59.7	MGM
668	10B-2	467	244	FLKTL	168	1.8	99.7	4520	134.5	MC/MGM
669	10B-2	467	259	BIFACE	201.4	0.5	54.9	4650	188.5	MGM
670	10B-2	467	260	FLKTL	65.7	34.3	119	4660	124	SV
671	10B-2	467	261	BIFACE	61.9	13.5	60.8	3250	54.4	MH/MGM
672	10B-2	467	262	BIFACE	8.4	7.6	5.4	250	22.1	MH
673	10B-2	467	269	PRJPT	11.3	2.6	5.6	700	24.1	MH
674	10B-2	467	285	PRJPT	7.2	3.4	15.6	850	31.9	MH
675	10B-2	467	289	FLKTL	162.4	0.3	61.1	3610	86.4	MGM
676	10B-2	467	295	PRJPT	38.8	42.4	59.8	3220	39.8	SV
677	10B-2	467	296	PRJPT	15.2	7	12.1	1900	49.9	MH
678	10B-2	467	298	BIFACE	11.4	3.4	3.9	510	38.6	MH
679	10B-2	467	299	BIFACE	6.6	6.1	19.6	1070	42.1	MH
680	10B-2	467	300	BIFACE	147.6	0.4	53.7	3140	82.1	MGM
681	10B-2	467	312	PRJPT	16.4	16.2	27	2170	18.1	MH
682	10B-2	467	314	FLKTL	197.8	1.4	62.5	4250	43.4	MGM
683	10B-2	467	318	PRJPT	32.6	2.3	3.8	1220	30.6	MH
684	10B-2	467	319	PRJPT	9.7	12.5	10.1	930	26.8	MH

ITEM	SITE	ACC	CAT	DESCRIP	RB	SR	ZR	FE	MN	SOURCE
685	10B-2	467	320	PRJPT	28.7	1.1	11	1250	56.2	MH
686	10B-2	467	321	BIFACE	143.2	2.5	72.4	2880	56.4	MGM
687	10B-2	467	322	BIFACE	118	2.9	55	2720	92.3	MGM/MH
688	10B-2	467	323	BIFACE	15.5	23.1	69.9	1870	49.7	SV
689	10B-2	467	332	FLKTL	147.5	1	65.1	3990	96.1	MGM
690	10B-2	467	337	PRJPT	5.2	5.4	16	1300	41.9	MH
691	10B-2	467	346	PRJPT	16.3	1.6	12.1	940	54.6	MH
692	10B-2	467	355	PRJPT	12.7	2.3	33.8	400	24	MH
693	10B-2	467	357	PRJPT	39.4	4.3	20.4	1250	33.4	MH
694	10B-2	467	366	BIFACE	180.7	1.5	74.8	3660	137.1	MGM
695	10B-2	467	369	FLKTL	97.2	2.4	37.6	2570	50.5	MGM
696	10B-2	467	380	BIFACE	38.7	2.7	6	1130	13.9	MH
697	10B-2	467	383	FLKTL	176.9	2.1	33.8	4420	98.7	MGM
698	10B-2	467	386	FLKTL	36.7	31.8	55.1	2370	54.9	SV
699	10B-2	467	402	BIFACE	123.6	0.6	34	3000	54.6	MGM
700	10B-2	467	403	FLKTL	103.2	11.2	60.7	3540	191.1	MH
701	10B-2	467	410	PRJPT	6	2.6	2.7	340	51.4	TQ
702	10B-2	467	412	BIFACE	140.3	1	61.4	3540	63.3	MGM
703	10B-2	467	419	FLKTL	81.8	75.3	113.4	4570	43.3	SV
704	10B-2	467	430	BIFACE	77.9	1.7	69.8	2400	113.9	MH
705	10B-2	467	432	BIFACE	21	23.6	24.2	1710	28	MH
706	10B-2	467	444	BIFACE	152.1	1	81.4	3530	66	MGM/MC
707	10B-2	467	502	PRJPT	16.3	21.3	13	1800	57.5	MH
708	10B-2	467	504	BIFACE	86.2	1.7	42.8	2300	324.9	TQ
709	10B-2	467	505	BIFACE	158.6	136.2	205.2	8640	101.4	CD
710	10B-2	467	508	FLKTL	59	2.7	6.8	1450	47.5	MH
711	10B-2	467	511	FLKTL	110.9	1.1	29.5	3130	70.6	MGM
712	10B-2	467	512	FLKTL	100.7	1.1	26.5	2360	53.6	MGM
713	10B-2	467	539	BIFACE	30.8	4.3	15.4	1400	55.1	MH
714	10B-2	467	541	FLKTL	196.7	0	36.8	5310	152	MGM
715	10B-2	467	542	FLKTL	87.5	1.8	29.3	2040	25.3	MGM
716	10B-2	467	543	FLKTL	158.2	1.8	49.9	4790	95.3	MGM
717	10B-2	467	554	PRJPT	82.3	1.2	32.6	2190	53.5	MH/MGM
718	10B-2	467	569	FLKTL	162.4	4.8	81.5	4000	290.3	MH
719	10B-2	467	570	FLKTL	125.6	1.3	31	2660	41.5	MGM
720	10B-2	467	582	FLKTL	193.4	0.7	47.9	4010	30.3	MGM
721	10B-2	467	644	FLKTL	138.5	77.2	105.9	8490	195.1	SV
722	10B-2	467	693	FLKTL	53.7	1.4	8.1	1870	50	MH
723	2B-7	ENF	16	PRJPT	79.3	3.7	50.5	2270	186.5	TQ/MH
724	2B-7	ENF	18	PRJPT	71.7	42	75	4740	55.4	SV
725	2B-7	ENF	19	PRJPT	48.6	2	13.1	1340	41.6	MH
726	2B-7	ENF	23	BIFACE	153	119.7	212.2	8720	89.5	CD
727	2B-7	ENF	25	BIFACE	15.9	12.8	38.6	2330	48.4	MH
728	2B-7	ENF	27	BIFACE	72.8	42.7	137.8	5760	75.8	SV
729	2B-7	ENF	28	BIFACE	119.1	123.5	194.7	7530	97.8	CD
730	2B-7	ENF	29	BIFACE	46	2.7	15.1	2000	78.2	MH
731	2B-7	ENF	31	DRILL	50.4	39.6	79.3	3700	41.5	SV
732	2B-7	ENF	38	PRJPT	63.2	70.4	101.8	5240	69.2	SV
733	2B-7	ENF	44	PTBLNK	55.1	25.8	103	4020	39.1	SV
734	2B-7	ENF	47	FLKTL	154.4	0.5	51.4	3970	118.9	MGM
735	2B-7	ENF	49	FLKTL	122.5	83.7	190.5	7840	123.3	CD
736	2B-7	ENF	51	FLKTL	66.2	1	25.2	3550	86.5	MH
737	2B-7	ENF	54	FLKTL	106.1	51.7	136.8	7620	78.2	SV
738	2B-7	ENF	57	DBTG	85.3	12.5	78.2	3580	74.7	MGM/MH
739	2B-7	ENF	59	PRJPT	41.8	31.3	66.1	3860	23.8	SV
740	2B-7	ENF	61	PRJPT	43.5	6.5	9.5	2170	54.9	MH
741	2B-7	ENF	62	PRJPT	26.3	14.4	23.2	1980	33.3	MH

ITEM	SITE	ACC	CAT	DESCRIP	RB	SR	ZR	FE	MN	SOURCE
742	2B-7	ENF	63	FRMFLKTL	179.3	0.7	82.5	4840	77.9	MGM/MH
743	2B-7	ENF	66	FLKTL	193.4	0.1	52.9	5710	172.7	MGM
744	2B-7	ENF	67	FLKTL	183.6	0.9	54.3	6880	378.1	MGM/MH
745	2B-7	ENF	68	FLKTL	190.6	10.9	124.5	5740	582.6	TQ
746	2B-7	ENF	69	FLKTL	187.1	9	140.5	6120	717.3	TQ
747	2B-7	ENF	71	FLKTL	169.9	160.3	217.7	10300	196.9	CD
748	2B-7	ENF	72	FLKTL	207.8	0.8	56.5	4040	94.1	MGM
749	2B-7	ENF	73	BIFACE	185.5	8	112.9	5210	543	TQ
750	2B-7	ENF	75	FLKTL	166.9	7	118.4	4280	493.2	TQ
751	2B-7	ENF	77	FLKTL	62.4	45.3	85.9	3610	49.2	SV
752	2B-7	ENF	78	FLKTL	169.8	0.5	72.5	4220	106.8	MGM
753	2B-7	ENF	79	FLKTL	149.7	115.4	182.8	6460	95.3	CD
754	2B-7	ENF	81	FLKTL	142.4	86.6	181.7	7240	60.3	CD
755	2B-7	ENF	83	FLKTL	132.9	75.6	162.4	9380	230.9	SV/CD
756	2B-7	ENF	85	FLKTL	11.3	2.3	6	550	22.6	MH
757	2B-7	ENF	86	FLKTL	127.5	0.7	27.3	3330	49.6	MGM
758	2B-7	ENF	87	FLKTL	121.3	76.7	174.8	7870	127.7	CD
759	2B-7	ENF	89	FLKTL	39.6	18.4	57	3090	56.4	MH
760	2B-7	ENF	90	FLKTL	114.8	6.8	79.7	3690	364.8	TQ
761	2D-13	ENF	1	PRJPT	112.5	2.3	18.6	1330	67.2	MH
762	2D-13	ENF	2	BIFACE	208.5	4.4	89.7	3780	491.4	FS
763	2D-13	ENF	5	FLKTL	101.4	0.9	41.5	2460	42.3	MGM
764	2D-13	ENF	7	FLKTL	110.6	125.8	195.2	6460	82.1	CD
765	2D-13	ENF	8	FLKTL	86.9	1.5	33.2	2320	35	MGM
766	2D-13	ENF	10	FLKTL	70.5	39.2	132.2	4550	44.6	SV
767	2D-13	ENF	11	FLKTL	146.1	1.3	105.8	3760	407.2	TQ
768	2D-13	ENF	13	FLKTL	13.2	12	74.3	2700	31.2	SV
769	2D-13	ENF	14	FLKTL	87	74.2	138	5710	81.9	SV
770	2D-13	ENF	21	FLKTL	178.2	7.9	125.6	5840	556.6	TQ
771	2D-13	ENF	24	FLKTL	64.2	42.7	136.2	5380	40.9	SV
772	2D-13	ENF	31	BIFACE	96.6	1.9	26.3	1680	201.8	TQ
773	2D-13	ENF	36	FLKTL	25.7	1.4	10.5	1330	46.4	MH
774	2D-13	ENF	37	FLKTL	100.2	106.2	163	5910	42.8	CD
775	2D-13	ENF	38	FLKTL	27	24.6	17.4	2610	31.8	MH
776	2D-13	ENF	39	FLKTL	84.3	43	111.2	4300	49.6	SV
777	3A-2	ENF	2	FLKTL	148.5	1.5	39.8	4900	80.9	MGM
778	3A-2	ENF	3	FLKTL	75.9	83.3	171.8	5840	106.4	CD
779	3A-2	ENF	5	FLKTL	94.4	98.3	160.2	5960	49.1	CD
780	3A-5	ENF	1	PRJPT	127.4	4.5	72.2	3210	189.9	MH
781	3A-5	ENF	4	PRJPT	200.5	2.7	72.2	3540	566.5	FS
782	3A-5	ENF	5	BIFACE	107.7	1.6	35.6	2580	46.7	MGM
783	3A-5	ENF	7	BIFACE	95.4	50.1	130.9	4450	40.2	SV
784	3A-5	ENF	10	BIFACE	158.5	0.3	54.5	2960	52.8	MGM
785	3A-5	ENF	12	BIFACE	52.6	2.2	28	1570	180.3	TQ
786	3A-5	ENF	13	BIFACE	87.4	3.5	16	1790	189.8	MH
787	3A-5	ENF	14	BIFACE	57.5	0.8	18.6	1570	21.5	MGM/MH
788	3A-5	ENF	15	BIFACE	129.3	3.2	38.7	2690	279.6	MH
789	3A-5	ENF	17	BIFACE	3.7	2.4	3.5	140	26.9	FS
790	3A-5	ENF	19	BIFACE	6.3	5.2	11.6	440	38.5	TQ/MH
791	3A-5	ENF	20	PTBLNK	120.6	87.4	133.1	10140	237.6	SV
792	3A-5	ENF	22	FLKTL	222.6	1.1	90.7	6200	210.5	MC/MGM
793	3A-5	ENF	26	FLKTL	84.4	1.5	51.2	3400	56.8	MGM
794	3A-5	ENF	29	FLKTL	77.6	63.7	103	5650	76.4	SV
795	3A-5	ENF	30	BIFACE	138.3	4.1	101.1	3180	297.9	TQ
796	3A-5	ENF	31	FLKTL	144.3	3.8	104.2	4290	403.9	TQ
797	3R-31	ENF	3	FLKTL	137.6	1.3	59	4950	113.8	MGM
798	3R-31	ENF	4	FLKTL	85.3	43.9	124.1	6730	42.1	SV

ITEM	SITE	ACC	CAT	DESCRIP	RB	SR	ZR	FE	MN	SOURCE
799	3R-31	ENF	7	FLKTL	89.8	43.5	137.4	6970	82.6	SV
800	3R-31	ENF	8	FLKTL	174.8	117.5	207.4	9980	246.4	CD
801	4L-11	ENF	1	BIFACE	147	1.2	82.3	3960	118.2	MGM
802	4L-11	ENF	4	BIFACE	68.5	51.1	79.1	4240	59.7	SV
803	4L-11	ENF	6	PRJPT	129.9	3.7	15.3	2370	271.5	MH
804	4L-11	ENF	12	FLKTL	154.6	1.6	82.8	6810	192.9	MGM
805	4L-11	ENF	14	FLKTL	34.5	18.2	52.5	2870	44.4	MH
806	4L-11	ENF	15	FLKTL	73	62.9	106.5	4910	132.3	SV
807	4L-11	ENF	16	FLKTL	69.6	34.1	77	5290	55	SV
808	4L-11	ENF	17	FLKTL	13.9	12.9	17.4	1360	33.8	MH
809	4L-11	ENF	19	FLKTL	98.6	65.7	136.2	7040	91.3	SV
810	4L-11	ENF	21	FLKTL	77.6	1.4	17.1	2220	39.2	MGM
811	4L-11	ENF	23	FLKTL	40.4	27.7	80.7	3160	51.9	SV
812	4L-11	ENF	24	DRILL	25.1	10.7	33.4	2040	30.3	MH
813	4L-11	ENF	25	FLKTL	68.1	54.3	75.5	5260	94.5	SV
814	4L-11	ENF	28	FLKTL	20.8	7.5	65.6	2780	23.6	MH
815	4L-11	ENF	29	FLKTL	46.3	45.3	36.5	2910	53.5	SV/MH
816	4L-11	ENF	30	FLKTL	77.8	7.3	10.8	1380	30.9	MH
817	4L-11	ENF	31	FLKTL	44.6	51.2	50.9	3060	42	SV
818	4L-11	ENF	34	FLKTL	64	48.2	97.6	4790	66.4	SV
819	E-17	ENF	1	PRJPT	169	0.6	41.7	5050	70.8	MGM
820	E-17	ENF	11	FLKTL	168	119.7	223.3	9610	216.8	CD
821	E-17A	ENF	3	FLKTL	133.1	1.6	62.6	5390	121.1	MGM
822	E-17A	ENF	4	FLKTL	175.9	5	135.5	6320	694.5	TQ
823	E-17A	ENF	13	FLKTL	144.1	1	50.1	3490	47.5	MGM
824	E-17A	ENF	15	PRJPT	135.6	122.2	170.8	8050	266.7	SV/CD
825	E-17A	ENF	16	PRJPT	175	0.9	58.8	4620	56.8	MGM
826	E-17B	ENF	6	FLKTL	143.9	1.9	94.1	5860	151.7	MGM/MC
827	E-17B	ENF	11	PRJPT	126.8	2	90.3	3200	279.5	TQ
828	E-17B	ENF	18	FLKTL	183.7	2.7	118.5	4970	530	TQ
829	G-25	ENF	1	PRJPT	153	1.3	78.7	3420	84.4	MGM
830	G-25	ENF	4	FLKTL	183.8	3.5	117.5	6000	669.1	TQ
831	G-25	ENF	8	FLKTL	212.3	1.6	104.6	4860	183.1	MC
832	G-25	ENF	11	PTBLNK	151.7	1.9	69.8	3460	69	MGM
833	G-25	ENF	12	FLKTL	50.7	26.4	57.9	3160	93.3	MH
834	G-32	ENF	11	FLKTL	171	0.6	68.8	3550	77.2	MGM
835	4L-11	ENF	35	FLKTL	99.1	76.4	127.6	6100	41.9	SV
836	4L-11	ENF	36	FLKTL	91.7	58.6	128	6520	125.5	SV
837	4L-11	ENF	38	FLKTL	35.6	30.2	49.7	2950	28.6	SV/MH
838	4L-13A	ENF	2	PRJPT	97.3	95.8	151.1	6170	111.3	SV
839	4L-13A	ENF	5	FLKTL	119.1	57.8	186.5	9040	65.2	CD
840	5A-12	ENF	4	BIFACE	151.3	71.5	182	8900	196.7	CD
841	5A-12	ENF	6	BIFACE	76.8	82.7	129.6	4580	56.1	SV
842	5A-12	ENF	7	BIFACE	171.8	109.9	100.1	3560	139.6	BH
843	5A-12	ENF	8	BIFACE	111.7	72.4	148.6	6370	65.4	CD/SV
844	5A-12	ENF	11	BIFACE	127.3	3.8	91.5	3240	287.7	TQ
845	5A-12	ENF	13	BIFACE	71.2	89.4	154.1	5350	40.4	CD
846	5A-12	ENF	14	BIFACE	88.3	86.4	120.7	4320	40.1	SV
847	5A-12	ENF	17	FRMFLKTL	155.2	4.1	104.6	3840	349.2	TQ
848	5A-12	ENF	21	FLKTL	196.5	0.3	63.6	4630	119	MGM
849	5A-12	ENF	22	FLKTL	154.2	1.8	66	4740	73.5	MGM
850	5A-12	ENF	23	FLKTL	178.9	8.3	135.3	4800	570.2	TQ
851	G-32	ENF	14	FLKTL	50.1	2.5	14.3	1650	64.9	MH
852	H-3	ENF	2	FLKTL	187.2	1.2	66.9	7110	290.3	MGM
853	H-3	ENF	3	FLKTL	188.2	0.3	69.1	6000	225.4	MGM
854	H-5	ENF	1	FLKTL	162.5	100.7	204.9	10000	293.4	CD
855	H-5	ENF	3	FLKTL	141.6	84.1	183.2	9500	111.5	CD

ITEM	SITE	ACC	CAT	DESCRIP	RB	SR	ZR	FE	MN	SOURCE
856	H-21	ENF	1	PRJPT	169.4	0.5	75.5	7710	289.6	MGM
857	K-0	ENF	4	PRJPT	206.1	2.2	69.7	4640	751.3	FS
858	K-0	ENF	9	PRJPT	169.4	0.8	43	2930	468.2	FS
859	K-0	ENF	11	PRJPT	96.9	77.8	104.9	5820	109	SV
860	K-0	ENF	14	PRJPT	79.6	56.3	75.3	4230	54.2	SV
861	K-0	ENF	21	BIFACE	64.9	2.7	13.8	2020	40.6	MH
862	K-0	ENF	22	BIFACE	142.3	97.7	183.9	8580	189.1	CD
863	K-0	ENF	27	BIFACE	132.3	2.2	59.4	3320	267.6	MH
864	K-0	ENF	30	FLKTL	157.9	0.9	33.2	3770	143.6	MGM
865	K-0	ENF	32	FLKTL	148.2	2.2	71.5	3990	414.3	TQ
866	K-0	ENF	35	FLKTL	137.5	0.5	27.5	3460	81.9	MGM
867	K-0	ENF	38	FLKTL	76.8	1	35.4	2220	49.9	MH/MGM
868	K-0	ENF	39	FLKTL	115.2	1.2	50.9	3390	81.2	MGM
869	K-0	ENF	40	FLKTL	160.2	0.8	25.9	3910	67	MGM
870	K-0	ENF	44	FLKTL	120.6	55.9	74	6500	79	SV
871	K-0	ENF	45	FLKTL	45.1	1.8	34.8	2150	42.8	MH
872	K-0	ENF	46	FLKTL	75.7	75	89.8	5220	36.3	SV
873	K-0	ENF	47	FLKTL	104.2	1.6	71.3	3280	224.8	MH/TQ
874	K-0	ENF	48	FLKTL	49.7	20.1	52.9	2920	70.7	MH
875	K-0	ENF	49	FLKTL	82.3	1.8	13	1890	44	MH/MGM
876	K-0	ENF	109	PTBLNK	159.6	0.7	60.8	4810	147.4	MGM
877	K-0	ENF	110	PRJPT	101.4	5.4	60.1	3270	282.2	TQ
878	K-0	ENF	118	BIFACE	104.7	0.6	31.7	3630	41.6	MGM
879	K-0	ENF	121	BIFACE	44.9	30.7	80.9	2890	57.3	SV
880	K-0	ENF	122	BIFACE	86.3	2.4	43.1	2170	131.2	MH
881	K-0	ENF	127	BIFACE	81.9	3.6	44.5	3670	316.3	TQ/MH
882	K-0	ENF	128	BIFACE	138.8	2.1	75.2	4060	296	MH
883	K-0	ENF	129	BIFACE	176.7	0.8	65.1	6320	143.6	MGM
884	K-0	ENF	131	DRILL	90.1	1.8	60.9	2730	92.4	MH
885	K-0	ENF	136	BIFACE	98.6	1	48.5	2830	78.9	MGM/MH
886	K-0	ENF	140	BIFACE	51.7	3.6	29	1750	57.2	MH
887	K-0	ENF	142	BIFACE	70.8	4.7	22.5	1790	67.9	MH
888	K-0	ENF	146	BIFACE	142.8	1.3	34.4	3590	104.9	MGM
889	K-0	ENF	148	BIFACE	47.3	8	60.3	2890	30.3	MGM/MH
890	K-0	ENF	157	FRMFLKTL	85.8	2.6	77.5	2250	93.6	MH
891	K-0	ENF	159	PTBLNK	63.5	42.8	60	3040	32.7	SV
892	K-0	ENF	160	BIFACE	113.2	3.6	86.1	3650	278.9	TQ
893	K-0	ENF	161	FLKTL	133.3	1.5	50.9	4760	468.2	MH/TQ
894	K-0	ENF	162	FLKTL	46.2	1.8	29.3	1950	96.1	MH
895	K-0	ENF	169	FLKTL	96.2	1.3	30.7	2710	74.8	MGM/MH
896	K-0	ENF	172	FLKTL	175.6	1.5	39.5	4300	122.3	MGM
897	K-0	ENF	173	FLKTL	151	8.4	73.5	4560	330.1	MH
898	K-0	ENF	176	FLKTL	220.5	2.7	43.7	5750	168.1	MGM
899	K-0	ENF	178	FLKTL	86.7	108.8	161.9	5520	80.3	CD
900	K-0	ENF	188	FLKTL	99.9	3.4	57.4	3260	177.3	MH
901	K-0	ENF	189	FLKTL	55.4	52.2	81.6	3880	45	SV
902	K-0	ENF	194	FLKTL	160	1.6	61.9	3320	448.5	FS
903	K-0	ENF	197	FLKTL	120.8	1.3	34.5	2550	27.2	MGM
904	K-0	ENF	198	FLKTL	151.7	1.1	49.6	3060	61	MGM
905	K-0	ENF	203	FLKTL	142.9	4.4	71.2	3760	315.4	MH/TQ
906	K-0	ENF	205	FLKTL	156	1.1	42.7	3660	456.5	FS
907	K-0	ENF	208	FLKTL	85.8	2	58.5	2330	195.8	TQ
908	K-0	ENF	210	FLKTL	112.1	1.1	39	3000	43.4	MGM
909	K-0	ENF	212	FLKTL	75.3	5.5	89	2560	206.9	TQ
910	K-0	ENF	215	FLKTL	122.3	0.8	58.3	2550	65.2	MGM
911	K-0	ENF	217	FLKTL	29.5	1.6	4.3	700	26.8	MH
912	K-0	ENF	218	FLKTL	69.3	56	70	3680	31.2	SV

ITEM	SITE	ACC	CAT	DESCRIP	RB	SR	ZR	FE	MN	SOURCE
913	K-0	ENF	219	FLKTL	66.4	14.6	98.7	4680	45.4	MGM/QI
914	K-0	ENF	221	FLKTL	37.1	19.6	17.7	2360	50.2	MH
915	L-14	ENF	3	BIFACE	198	17.2	130.7	6190	650.8	TQ
916	L-14	ENF	7	BIFACE	144.6	4.6	128.5	7450	529.8	QI
917	L-14	ENF	10	BIFACE	200.5	1.7	94.2	4490	593.5	FS
918	L-14	ENF	14	FLKTL	144.9	11.6	105.1	6870	660.2	TQ
919	L-14	ENF	16	FLKTL	174.4	3.8	134.7	6750	567.9	QI
920	L-14	ENF	17	FLKTL	39.2	3.9	70.8	4570	406.6	TQ
921	L-14C	ENF	1	PRJPT	130.3	5.2	101.8	3660	373.7	TQ
922	L-14C	ENF	3	PRJPT	124.7	9.2	76.2	3230	131.7	MH
923	L-14C	ENF	6	FLKTL	133.9	0.5	78.9	4410	108.9	MGM
924	Y-1	ENF	3	PRJPT	109	53.2	144.6	8870	190.3	SV
925	Y-1	ENF	6	BIFACE	164.4	1.1	38.2	2370	195.9	MH
926	Y-1	ENF	9	FLKTL	175.7	2.9	105.5	5500	674.8	TQ
927	Y-1	ENF	10	FLKTL	185.4	4.5	120.9	5050	530.5	TQ
928	Y-1	ENF	13	FLKTL	229.2	0.2	70.1	3440	233.7	MGM
929	Y-1	ENF	15	FLKTL	168.6	3.6	125.4	4580	500.2	TQ
930	Y-1	ENF	16	FLKTL	205.4	0.9	51.1	3450	525.2	FS
931	Y-1	ENF	17	FLKTL	21.1	53.7	108.6	4930	40.8	SV
932	Y-1	ENF	21	FLKTL	237.3	0.8	82.2	3320	142.6	MGM/MC
933	Y-1	ENF	22	FLKTL	156.4	0	72	4500	129.8	MGM
934	Y-1	ENF	25	FLKTL	52	1	12.6	1720	52.1	MH
935	1U-20	ENF	1	BIFACE	182.6	0.2	69.8	4910	208.2	MGM
936	1U-20	ENF	3	FRMFLKTL	168.2	90.1	178.9	10610	227.1	CD
937	1U-20	ENF	5	FLKTL	149.2	100	220.1	10670	127.9	CD
938	1U-20	ENF	7	FLKTL	174.2	0.2	69.6	5710	227.1	MGM
939	1W-3	ENF	18	BIFACE	140.7	8.9	56.6	4860	518	TQ
940	1W-3	ENF	21	BIFACE	106.9	116.5	164.3	6860	72.1	CD
941	1W-3	ENF	23	BIFACE	83.5	81.1	162	6580	103.4	CD/SV
942	1W-3	ENF	24	FLKTL	192.5	0.8	58.5	5320	170.3	MGM
943	1W-3	ENF	26	FLKTL	167.9	3.1	84.3	5660	665.7	TQ
944	1W-3	ENF	28	FLKTL	149.1	93.3	205.5	11110	208.5	CD
945	1W-3	ENF	30	FLKTL	126.6	98.3	151.5	8830	83.6	CD
946	1W-3	ENF	31	FLKTL	188.2	0.2	51.3	4530	105.7	MGM
947	1Z-17	ENF	6	PTBLNK	178.6	4.6	135.4	5840	632.1	TQ
948	2A-1	ENF	1	PRJPT	215.3	0.5	71.8	4400	779.6	FS
949	2A-1	ENF	2	PRJPT	172.9	2.9	126.8	4950	508.2	TQ
950	2A-1	ENF	3	PRJPT	17.7	6.1	20.4	950	31.7	MH
951	2A-1	ENF	5	BIFACE	73.9	4.3	38.2	2230	83.6	MH
952	2A-1	ENF	7	FLKTL	79.5	62.6	132.3	6410	56	SV
953	2A-1	ENF	8	FLKTL	129.7	0.9	63.5	3790	122.9	MGM
954	2A-14	ENF	1	FLKTL	132.5	1	74.1	3900	64.9	MGM
955	2B-7	ENF	2	FLKTL	169.6	5.2	109.8	4640	479.4	TQ
956	2B-7	ENF	3	FLKTL	124.4	0.9	61.4	2370	28.7	MGM
957	2B-7	ENF	4	FLKTL	90.4	2.9	30.8	1870	63.6	MH
958	2B-7	ENF	7	PRJPT	159.4	1.1	70.9	2610	187.2	MH
959	2B-7	ENF	8	PRJPT	147.4	1.2	66.8	2950	56.5	MGM
960	2B-7	ENF	9	PRJPT	109.7	94.3	206.5	6690	48	CD
961	2B-7	ENF	10	PRJPT	74	38.3	103.6	3920	47.2	SV
962	2B-7	ENF	11	PRJPT	61.2	37.7	103.2	4980	76.6	SV
963	2B-7	ENF	12	PRJPT	77.9	8.6	81	2560	112.4	MH
964	2B-7	ENF	13	PRJPT	126.6	2.6	98.1	3810	271.2	TQ/QI
965	2B-7	ENF	14	PRJPT	79.1	1.1	25.5	1780	177.2	MH/TQ
966	5A-12	ENF	25	FLKTL	159.5	72.5	177.9	9150	175.7	CD
967	5A-12	ENF	27	FLKTL	152.3	92.2	207.9	9190	137.8	CD
968	5A-12	ENF	28	FLKTL	206.6	1.6	85	5850	202.7	MGM/MC
969	5A-12	ENF	29	FLKTL	204	0.7	92.2	5060	181.5	MC/MGM

ITEM	SITE	ACC	CAT	DESCRIP	RB	SR	ZR	FE	MN	SOURCE
970	5A-12	ENF	31	FLKTL	125.5	1	45	3730	109	MGM
971	5A-12	ENF	36	FLKTL	95.3	5.1	53.8	2890	169.3	MH
972	5A-12	ENF	39	FLKTL	21.1	5.4	12.5	1650	75.6	MH
973	5A-12	ENF	40	FLKTL	98.6	93.7	179.7	7070	74.6	CD
974	5A-12	ENF	41	FLKTL	62.1	5.3	39.2	2690	132.6	MH
975	5A-12	ENF	42	FLKTL	91.5	70.6	176.7	6000	66.4	CD
976	5A-12	ENF	43	FLKTL	148.9	4.5	112.3	4010	357.3	TQ
977	5A-12	ENF	44	FLKTL	67.3	45.8	104.9	7980	52.4	SV
978	5A-12	ENF	47	FLKTL	129.7	96.1	159.1	6660	61.2	CD
979	5A-12	ENF	49	FLKTL	87.5	2.1	75	2950	223.2	TQ
980	5A-12	ENF	53	FLKTL	154.9	2.4	48.8	3680	83.9	MGM
981	5A-12A	ENF	1	PRJPT	169.1	8.4	76.7	4040	316.7	MH
982	5A-12A	ENF	4	FRMFLKTL	105.3	3	67.5	2670	61.1	MGM
983	5A-12A	ENF	5	FRMFLKTL	152	1.1	112.2	5490	193.6	MC/QI
984	5A-12A	ENF	6	FRMFLKTL	91.3	79.2	150.3	9760	138.8	SV/CD
985	5A-12A	ENF	8	FLKTL	117.1	58.5	163.9	7630	166.5	CD/SV
986	5B-2	ENF	8	FLKTL	46.6	30.1	105.8	4670	58.4	SV
987	5B-5	ENF	17	PRJPT	149.7	91.7	184.1	9690	285.4	CD
988	5B-5	ENF	18	PRJPT	169.1	12.8	141.9	5520	610.5	TQ
989	5B-5	ENF	24	BIFACE	58.8	60.6	132.5	4930	34.4	SV
990	5B-5	ENF	27	FLKTL	123.7	84.9	153	7490	103.9	CD
991	5B-5	ENF	28	FLKTL	143.7	4.5	111.1	4660	504.2	TQ
992	5B-5	ENF	29	FLKTL	136.8	115.7	166.8	9710	179	CD
993	5B-8	ENF	1	FRMFLKTL	122.5	60.8	114.8	7230	147	SV
994	5B-14	ENF	1	FLKTL	165.5	0.1	76.8	5780	207	MGM
995	5B-8	ENF	2	FLKTL	129.6	3.9	111.7	4810	427.4	TQ
996	5B-8	ENF	8	BIFACE	179.4	1.4	83.3	4880	143.5	MGM/MC
997	5B-8	ENF	9	FLKTL	107.6	6.2	92.3	4960	316.5	TQ/QI
998	5B-8	ENF	10	FLKTL	55.3	20.4	71.4	4750	42.1	MGM/MH
999	5B-8	ENF	11	FLKTL	148.4	7.2	120.3	5690	607	TQ
1000	5B-8	ENF	16	BIFACE	157.4	1.2	55.7	4280	131.4	MGM
1001	5B-8	ENF	17	BIFACE	121.8	107	191.4	6760	46.5	CD
1002	5B-8	ENF	18	FLKTL	210.5	0.5	95.4	6210	281.9	MC/MGM
1003	5B-16A	ENF	1	BIFACE	125.5	2.2	73	4940	110.6	MGM
1004	5B-16A	ENF	3	PRJPT	158.4	12.4	79.8	4490	518.2	TQ
1005	5B-16A	ENF	5	FLKTL	197.8	1	83.9	5780	305.5	MGM/MC
1006	5B-18	ENF	4	PRJPT	126.2	86.9	163.6	6730	83.3	CD
1007	5B-18	ENF	5	PRJPT	89.6	2.9	71.5	3090	280.3	TQ
1008	5B-18	ENF	6	PRJPT	82.4	2.1	26.4	2110	41.3	MGM
1009	5B-18	ENF	9	BIFACE	150	92.6	183.8	8020	99.5	CD
1010	5B-18	ENF	10	BIFACE	129.5	85.6	179.7	8020	218.2	CD
1011	5B-18	ENF	22	FLKTL	144	7.7	84.2	5320	327.7	MH
1012	5B-18	ENF	28	FLKTL	113.4	3.1	106.6	3610	408.2	TQ
1013	5B-18	ENF	31	FLKTL	132.9	79.6	134.5	7710	174.5	SV
1014	5B-18	ENF	32	FLKTL	79.3	26.2	131.3	6870	71.3	SV
1015	5B-18	ENF	33	FLKTL	169.8	6.3	91.2	4500	441.8	TQ
1016	5B-18	ENF	34	FLKTL	147.7	102.2	183.6	7770	179.2	CD
1017	5B-18	ENF	35	FLKTL	108.1	0.9	53	2970	45.2	MGM
1018	5B-18	ENF	36	FLKTL	136.8	90	179.4	6720	87.9	CD
1019	5B-18	ENF	37	FLKTL	139.1	0.9	53.2	3500	84.5	MGM
1020	5B-18	ENF	38	FLKTL	89.5	1.8	52.8	2110	70.5	MH
1021	5B-18	ENF	39	FLKTL	66.4	5.4	21	2100	111.1	MH
1022	5B-18	ENF	42	FLKTL	39.6	18.9	29.1	3270	19.7	MH
1023	5B-18	ENF	43	FLKTL	96.9	56.5	147.2	5200	74.7	SV
1024	5B-18	ENF	44	FLKTL	79.4	0.8	32.8	2670	48.8	MGM
1025	5B-18	ENF	45	FLKTL	150.4	1.9	70.1	3870	104.9	MGM
1026	5B-18	ENF	47	FLKTL	132.7	2.7	124.5	3490	341.2	TQ

ITEM	SITE	ACC	CAT	DESCRIP	RB	SR	ZR	FE	MN	SOURCE
1027	5B-18	ENF	50	PTBLNK	48.9	9.6	55.5	2900	43.6	MH
1028	5B-18A	ENF	1	FLKTL	226	0.4	105.2	6250	146.6	MC
1029	5B-18C	ENF	2	BIFACE	229.7	2	136.5	9300	286.9	MC
1030	5B-18C	ENF	3	BIFACE	23.7	10.2	47.8	2670	65	MH
1031	5B-18C	ENF	4	FLKTL	100.5	45.3	129.3	7660	87.1	SV
1032	5B-18C	ENF	6	FLKTL	66.9	57.6	11.6	4640	66.4	MH/PG
1033	5C-16	ENF	3	BIFACE	147.3	1.3	55.8	4030	91.8	MGM
1034	5C-16	ENF	4	BIFACE	139.9	0.9	52.7	3000	52.4	MGM
1035	5C-16	ENF	5	BIFACE	96.2	75.5	162.4	6130	122.9	SV/CD
1036	5C-16	ENF	6	BIFACE	109.5	110.7	199.7	7790	174.9	CD
1037	5C-16	ENF	8	BIFACE	106.8	1.4	21.9	2190	205.1	MH
1038	5C-16	ENF	10	BIFACE	132.6	1.4	29.8	3610	71.9	MGM
1039	5C-16	ENF	11	BIFACE	130.5	0.2	37.7	5120	155.8	MGM
1040	5C-16	ENF	12	DRILL	65.8	3.1	30.2	1540	79	MH
1041	5C-16	ENF	15	FRMFLKTL	111.5	0.4	26.3	2460	27.2	MGM
1042	5C-16	ENF	16	FLKTL	185.8	0.9	68.1	5330	91.1	MGM
1043	5C-16	ENF	17	FLKTL	123.5	65.7	160.9	8570	121.4	CD
1044	5C-16	ENF	18	FLKTL	179.7	5810	84.8	3780	68.2	PG
1045	5C-16	ENF	20	FLKTL	179.5	0.6	62.8	4160	43	MGM
1046	5C-16	ENF	22	FLKTL	183.2	0.8	84.9	3650	82.2	MGM/MC
1047	5C-16	ENF	24	FLKTL	77.7	1.3	16	2220	75.9	MH
1048	5C-16	ENF	25	FLKTL	189.1	1.3	70.9	4240	115.1	MGM
1049	5C-16	ENF	26	FLKTL	124.6	69.8	159	6000	122.4	CD/SV
1050	5C-16	ENF	27	FLKTL	90	2.1	68.7	2870	57.2	MGM
1051	5C-16	ENF	28	FLKTL	145.5	0.8	40.1	3390	39.6	MGM
1052	5C-16	ENF	29	FLKTL	108.5	78.7	188.7	6470	165.8	CD
1053	5C-16	ENF	30	FLKTL	173.4	0.6	84.4	3950	94	MGM/MC
1054	5C-16	ENF	31	FLKTL	64.6	32.2	129.5	3640	56.6	SV
1055	5C-16	ENF	34	FLKTL	60.7	1.4	38.7	1850	50.7	MH
1056	5C-16	ENF	36	FLKTL	38.4	34.4	34.6	2390	42.2	MH
1057	5C-16	ENF	41	FLKTL	105.6	86.6	173.6	5700	57.9	CD
1058	5C-16	ENF	42	FRMFLKTL	99.6	0.8	49.7	2960	32.4	MGM
1059	5C-16	ENF	44	FLKTL	33.4	1.9	4.3	1080	24.3	MH
1060	5C-16	ENF	45	FLKTL	57.6	27.6	96.3	3570	123.3	SV
1061	5C-16A	ENF	1	PRJPT	6.5	11	20.9	1440	27.9	MH
1062	5C-19	ENF	2	FLKTL	112.4	133.2	227.2	9010	129.2	CD
1063	5C-20	ENF	2	PRJPT	113.9	68.4	154.7	6290	120.8	SV/CD
1064	5C-20	ENF	3	BIFACE	53.3	5.9	31.7	1550	35.6	MH
1065	5D-3	ENF	1	PRJPT	173.4	14.9	106.6	3930	453.1	TQ
1066	5D-3	ENF	3	BIFACE	153.4	125	216.3	8070	96	CD
1067	5D-3	ENF	5	BIFACE	109.3	1.8	31.4	2400	42	MGM
1068	5D-3	ENF	9	FLKTL	96.1	78.3	154.9	7110	56.8	CD
1069	5D-3	ENF	10	FLKTL	43.5	23	68	3440	34.2	SV/MH
1070	5D-3	ENF	13	FLKTL	148.1	2.1	29.1	3080	422.3	FS
1071	5R-13A	ENF	2	PRJPT	175.1	1.3	89.4	4930	97.3	MC/MGM
1072	5R-13A	ENF	5	FRMFLKTL	77.4	1.4	43.2	2210	74.5	MH
1073	5R-13A	ENF	7	BIFACE	168.2	0.6	106.7	5580	170.1	MC
1074	5S-4	ENF	1	PRJPT	172.7	1.8	98.2	4820	90	MC/MGM
1075	5S-4	ENF	3	PTBLNK	194.7	118.6	157.9	7790	330.9	BH/SV
1076	5S-6	ENF	2	PRJPT	72.8	64.3	139.1	4740	36.2	SV
1077	5S-6	ENF	3	PRJPT	38.2	21.2	88.4	3470	40	SV
1078	5S-6	ENF	6	BIFACE	57.6	42.6	129.4	3930	33.7	SV
1079	5S-6	ENF	10	BIFACE	148.3	0.7	114.4	4410	55.3	MC
1080	5S-6	ENF	12	FRMFLKTL	169.3	8	152.4	5810	675	TQ
1081	5S-6	ENF	14	FLKTL	182.8	79.2	180.7	11300	168.5	CD
1082	5S-6	ENF	15	FLKTL	73.4	61.5	150.6	8990	188.6	SV
1083	5S-6	ENF	16	FLKTL	94	68.4	162.3	7820	93.7	CD

ITEM	SITE	ACC	CAT	DESCRIP	RB	SR	ZR	FE	MN	SOURCE
1084	5S-6	ENF	18	FLKTL	120.3	69.8	172	9980	226.1	CD
1085	5S-6	ENF	22	FLKTL	196.5	1.3	78.6	5280	147	MGM/MC
1086	5S-6	ENF	23	FLKTL	67.5	33	105.3	4770	51.3	SV
1087	5S-6	ENF	24	FLKTL	64.1	2.7	17.3	2230	34.5	MGM/MH
1088	5S-6	ENF	26	FLKTL	168.2	0.6	55.2	3810	148.9	MGM
1089	5S-6	ENF	28	FLKTL	117.6	1	58.3	3390	75.4	MGM
1090	5S-9	ENF	3	PRJPT	39.8	30	78.3	3280	34.1	SV
1091	5S-9	ENF	5	PTBLNK	159.7	91.6	201.5	10240	162.3	CD
1092	5S-9	ENF	6	BIFACE	104.6	83.7	147.5	5520	97.6	SV
1093	5S-9	ENF	9	BIFACE	147.9	108.5	213.6	10250	137.9	CD
1094	5S-9	ENF	13	PTBLNK	169.9	0.5	86.4	5770	162.1	MGM/MC
1095	5S-9	ENF	14	PTBLNK	137.7	93.4	193.8	11180	282.5	CD
1096	5S-9	ENF	17	FLKTL	146.9	2.9	58.2	5500	138.1	MGM
1097	5S-9	ENF	19	FLKTL	146.1	117.3	166.5	8170	83.1	CD
1098	5S-9	ENF	26	PRJPT	89	72.5	150	4770	39	CD
1099	5S-9	ENF	27	CORE	153.1	118.5	199.8	9190	90.1	CD
1100	5S-9	ENF	30	FLKTL	108.7	82.5	185.8	9600	95.7	CD
1101	5S-9	ENF	31	FLKTL	145.7	117	196.2	7150	77.7	CD
1102	5S-9	ENF	35	FLKTL	102.2	1	37.7	3630	63.5	MGM
1103	5S-10	ENF	1	FLKTL	122.1	94.6	198.9	10010	174	CD
1104	5S-10	ENF	2	FLKTL	134.3	116.9	191.2	6110	57.7	CD
1105	5S-11	ENF	3	PRJPT	26.5	9.1	29.5	1910	47.7	MH
1106	5S-11	ENF	4	PRJPT	82.1	53.9	163.6	6900	73	CD
1107	5S-11	ENF	8	BIFACE	117.6	92.5	186.7	7650	176.4	CD
1108	5S-11	ENF	9	BIFACE	129.2	96.2	154.6	7330	96	CD
1109	5S-11	ENF	12	BIFACE	101.8	4.5	32.6	3190	142.4	MH
1110	5S-11	ENF	15	BIFACE	136.3	2.3	24.5	3990	64.1	MGM
1111	5S-11	ENF	16	BIFACE	179.3	1.2	71.9	4420	189	MGM
1112	5S-11	ENF	17	BIFACE	44.9	25.4	44.1	3310	59.7	MH
1113	5S-11	ENF	19	BIFACE	151.6	3.3	89.8	5100	548.9	TQ
1114	5S-11	ENF	20	PTBLNK	121.8	107.4	215.1	9780	173	CD
1115	5S-11	ENF	22	FLKTL	129.7	95.3	179	7790	147.4	CD
1116	5S-11	ENF	23	FLKTL	86.7	1.7	19.8	2250	30.1	MGM
1117	5S-11	ENF	24	FLKTL	140.3	1.2	42.7	3110	49.5	MGM
1118	5S-11	ENF	25	FLKTL	98.7	57.9	175.9	10170	153.5	CD
1119	5S-14	ENF	1	FLKTL	159.2	84.8	184.3	9340	88.7	CD
1120	5S-14	ENF	2	FLKTL	78.9	5	64.9	3820	249.6	MH/TQ
1121	5S-14	ENF	3	FLKTL	118	82.4	133.7	6740	52.4	SV/CD
1122	5S-14	ENF	4	FLKTL	132.8	81.6	175	10060	206.1	CD
1123	5S-14	ENF	5	FLKTL	200.6	0.3	87.3	4900	131.8	MC/MGM
1124	5S-14	ENF	6	FLKTL	39	19.8	71.5	3560	55	SV
1125	5T-16	ENF	2	BIFACE	151.2	4.6	119.8	4230	388.7	TQ
1126	5T-16	ENF	6	FLKTL	62.9	3.7	19.7	4850	121.2	MH
1127	5T-16	ENF	7	FLKTL	113.2	60.3	124	6180	48.6	SV
1128	5T-16	ENF	8	FLKTL	174.8	123.8	211.7	9110	217.7	CD
1129	5S-15	ENF	1	PRJPT	129.4	59.3	165.1	6740	85.7	CD
1130	5T-18	ENF	3	FLKTL	12.6	1.2	20	860	66.6	MH/TQ
1131	5T-19	ENF	3	PRJPT	206.5	5.5	107.5	5300	770.3	FS
1132	5T-19	ENF	4	PRJPT	183.6	0.9	79.4	5010	95.6	MGM/MC
1133	5T-19	ENF	6	PRJPT	63.8	3.2	30	2400	49.3	MH
1134	5T-19	ENF	8	PRJPT	169.3	4.8	124	4370	444.4	TQ
1135	5T-19	ENF	10	PRJPT	71.3	4.9	15.8	1860	29.5	MGM/MH
1136	5T-19	ENF	18	BIFACE	162.7	0.8	80.9	3890	95.3	MGM/MC
1137	5T-19	ENF	19	BIFACE	177	7.2	120	5870	646.2	TQ
1138	5T-19	ENF	22	BIFACE	20.8	4.6	14.8	1070	73	MH
1139	5T-19	ENF	23	BIFACE	116.7	1.2	48.7	3000	37.9	MGM
1140	5T-19	ENF	24	BIFACE	163.5	2.1	98.3	5370	81.1	MC/MGM

ITEM	SITE	ACC	CAT	DESCRIP	RB	SR	ZR	FE	MN	SOURCE
1141	5T-19	ENF	27	PTBLNK	127.7	0.6	65.8	3910	53.9	MGM
1142	5T-19	ENF	35	BIFACE	99.1	2.1	40.3	3430	83.7	MGM
1143	5T-19	ENF	38	FLKTL	152.7	11.3	73	6510	637.1	TQ
1144	5T-19	ENF	40	FLKTL	157.4	114.8	211.1	10040	214.1	CD
1145	5T-19	ENF	41	FLKTL	203.5	0.7	75	5260	88.4	MGM/MC
1146	5T-19	ENF	43	FLKTL	130.6	118.9	183.7	9480	177.9	CD
1147	5T-19	ENF	48	FLKTL	161	2	85.9	5550	131.9	MGM/MC
1148	5T-19	ENF	51	FLKTL	143.6	10	95	5610	411.2	TQ/QI
1149	5T-19	ENF	52	FLKTL	170.6	2.4	73.5	5770	150.3	MGM
1150	5T-19	ENF	53	FLKTL	102.5	6.4	17.9	3780	71.3	MGM
1151	5T-19	ENF	56	FLKTL	142.6	2	37.2	5010	236	MH
1152	5T-19	ENF	57	FLKTL	150.9	87.6	162.4	11900	141.5	CD
1153	5T-19	ENF	62	PTBLNK	163.3	0.9	17.7	5050	107.2	MGM
1154	5T-19	ENF	65	FLKTL	109.6	0.7	18.6	3040	46	MGM
1155	5T-19	ENF	67	FLKTL	188.5	0.8	18.4	4070	103.4	MGM
1156	5T-19	ENF	68	PTBLNK	171	2.2	19.5	3970	137.2	MGM
1157	5T-19	ENF	69	FLKTL	196.3	0.7	54.3	4320	115.6	MGM
1158	5T-19	ENF	72	FLKTL	161.1	0.6	35.9	3820	102.8	MGM
1159	5T-19	ENF	74	FLKTL	152.6	1.5	24.8	3460	83.6	MGM
1160	5T-19	ENF	76	FLKTL	136.4	81.7	167.1	8380	105	CD
1161	5T-19	ENF	78	FLKTL	79.1	73.4	118.6	5390	37.8	SV
1162	5T-19	ENF	79	FLKTL	139.4	1.6	20	3080	61	MGM
1163	5T-19	ENF	84	FLKTL	164.4	0.8	40.4	3910	107.1	MGM
1164	5T-19	ENF	86	FLKTL	126.7	4.2	82.9	4130	449	TQ
1165	5T-19	ENF	89	FLKTL	70.6	22.3	71.4	3790	46.7	MGM/MH
1166	5T-19	ENF	90	FLKTL	188	0.6	43.6	4100	96	MGM
1167	5T-19	ENF	92	FLKTL	136.5	0.9	45.6	3690	85.5	MGM
1168	5T-19	ENF	95	FLKTL	113.8	43.5	118.3	8030	211.1	SV
1169	5T-19	ENF	70	FLKTL	129.2	102.1	166	6850	103.5	CD
1170	5T-19	ENF	97	FLKTL	122.8	1.3	37.2	3030	96	MGM
1171	5T-19	ENF	98	FLKTL	194.4	1.6	96.6	4880	61.3	MC
1172	5T-19	ENF	99	FLKTL	58.4	6.6	20.4	1430	27.8	MH
1173	5T-19	ENF	100	FLKTL	130.8	1.4	52.5	3560	68.4	MGM
1174	5T-19	ENF	101	FLKTL	73.5	42.6	120.5	5290	58	SV
1175	5T-19	ENF	102	FLKTL	131.1	1.2	33.5	3010	26	MGM
1176	5T-19	ENF	105	FLKTL	135.1	79.5	158.7	7160	84.2	CD
1177	5T-19	ENF	108	FLKTL	159.4	4	50.6	3020	63.3	MGM
1178	5T-19	ENF	110	PTBLNK	122	0.9	48.2	2730	49.5	MGM
1179	5T-19	ENF	112	FLKTL	123.5	72.7	178	6090	101.7	CD
1180	5T-19	ENF	113	FLKTL	194.4	0.4	77.6	4030	95.8	MGM/MC
1181	5T-19	ENF	115	FLKTL	175.9	0.8	93.2	5040	184.1	MC/MGM
1182	5T-19	ENF	119	FLKTL	116.7	71.4	168.3	6730	128.2	CD
1183	5T-19	ENF	121	FLKTL	155.1	1.5	74.5	4460	134.7	MGM
1184	5T-19	ENF	124	FLKTL	168.1	0.4	87.8	3660	141.6	MGM/MC
1185	5T-19	ENF	125	PTBLNK	148.9	1.2	61.8	4050	62.6	MGM
1186	5U-4B	ENF	1	PRJPT	244.7	1.2	115	6080	78.1	CO
1187	5U-4B	ENF	3	BIFACE	31.7	30.9	44.9	2170	31.6	MH/SV
1188	5U-4F	ENF	2	FLKTL	196.6	0.9	91.9	6080	239	MC/MGM
1189	5U-4G	ENF	1	PRJPT	90.3	80.3	160.8	6620	183.3	SV
1190	5U-4G	ENF	3	FLKTL	103.4	3.4	104.1	3820	309.6	TQ
1191	5U-4G	ENF	4	FLKTL	183.8	4	123.2	6640	789.5	TQ
1192	5U-4G	ENF	5	FLKTL	173.1	97.2	203.4	11330	174.7	CD
1193	5U-6	ENF	1	FLKTL	119.1	80.1	123	11110	122.7	SV
1194	5U-8	ENF	3	BIFACE	150.5	1.3	59.3	2910	332.1	TQ
1195	5U-8	ENF	4	PRJPT	78.2	87.4	143.7	4890	75.5	SV
1196	5U-8	ENF	5	FLKTL	112.7	64	171.2	7270	131	CD
1197	5U-8	ENF	8	PRJPT	86	74.2	156.6	6200	41.2	CD

ITEM	SITE	ACC	CAT	DESCRIP	RB	SR	ZR	FE	MN	SOURCE
1198	5U-8	ENF	9	BIFACE	138.7	0.9	50.1	3270	68.8	MGM
1199	5U-8A	ENF	1	PRJPT	181	0.7	69.4	3910	104.6	MGM
1200	5U-8A	ENF	2	FRMFLKTL	172	0.7	61	4700	234.5	MGM
1201	5U-10	ENF	9	CORE	191.6	0.9	76.9	4650	73.7	MGM/MC
1202	5U-12	ENF	2	BIFACE	38.5	5.6	28.9	1410	37.7	MH
1203	5U-12	ENF	5	BIFACE	94.4	65.1	129.7	4130	159.2	SV
1204	5U-12	ENF	6	FRMFLKTL	135.2	83.2	186.1	7890	187.9	CD
1205	5U-12	ENF	7	FRMFLKTL	178.8	3.3	134.4	7380	564.8	QI
1206	5U-12	ENF	8	FRMFLKTL	157	1.8	46.9	3610	50	MGM
1207	5U-12	ENF	9	FLKTL	250.4	2.3	87.2	4600	716.7	FS
1208	5U-12	ENF	12	FLKTL	100.7	56.7	159.4	6070	64	CD
1209	5U-12	ENF	13	FLKTL	149	1.5	60.7	3000	313.8	TQ
1210	5U-12	ENF	14	FLKTL	147.5	0.5	55	3450	44.3	MGM
1211	5U-12	ENF	16	FLKTL	152.1	132.7	200	10670	312.7	CD
1212	5U-12	ENF	19	PTBLNK	26.3	3.2	18.3	940	47.8	MH
1213	5U-13	ENF	3	FLKTL	73	53.7	126	5010	57.5	SV
1214	5U-13	ENF	6	FLKTL	54.7	3.6	48.4	3110	73.8	MH
1215	5U-13A	ENF	3	FRMFLKTL	133.9	4	103.6	2730	247.5	TQ
1216	5U-13A	ENF	6	FLKTL	66.3	33.2	108.9	5470	54.5	SV
1217	5U-13A	ENF	7	FLKTL	110.4	5.4	80.3	3870	261.5	TQ/MH
1218	5U-13A	ENF	10	FLKTL	135	3.2	116.6	4290	313.5	QI/TQ
1219	5U-13A	ENF	12	FLKTL	69.5	2	70.9	2480	122.4	MH
1220	5U-13A	ENF	14	FLKTL	118.2	4.2	118.1	4640	544	TQ
1221	5U-14	ENF	2	BIFACE	222.7	2.6	90	4900	706	FS
1222	5U-14	ENF	5	FLKTL	155.2	20.3	107.7	4110	436.5	TQ
1223	5U-15	ENF	16	FLKTL	178.2	1	87.5	5210	104.3	MC/MGM
1224	5U-15	ENF	18	FLKTL	165.6	12.5	110.2	4670	518.2	TQ
1225	5U-15	ENF	19	FLKTL	156.7	3.1	80.6	4840	126.1	MGM
1226	5U-15	ENF	22	FLKTL	71.2	41.8	147.9	6440	68	SV
1227	5V-11	ENF	1	PRJPT	196	1.7	78.6	6570	214	MGM/MC
1228	5V-11	ENF	3	BIFACE	12.9	15.4	52.6	2460	41.7	MH/SV
1229	5V-11	ENF	6	BIFACE	87.5	85.9	136	6580	65.5	SV
1230	5V-11	ENF	7	BIFACE	114.9	95.8	120.1	9040	118	SV
1231	5V-11	ENF	9	BIFACE	119.9	105.4	224	10060	202.9	CD
1232	5V-11	ENF	10	BIFACE	197.4	1.5	81.1	5680	178.9	MGM/MC
1233	5V-11	ENF	15	FLKTL	196	3.8	76.8	7430	275.8	MGM
1234	5V-11	ENF	17	FLKTL	183.7	0.7	69	6840	167.1	MGM
1235	5V-11	ENF	19	FLKTL	142.2	133.2	226.2	10460	217.3	CD
1236	5V-11	ENF	21	FLKTL	138.8	86.4	174.5	12490	306.5	CD
1237	5V-11	ENF	22	FLKTL	194.4	0	58	7300	248.5	MGM
1238	5V-11	ENF	23	FLKTL	100.6	97.3	155.3	9470	90.3	CD
1239	5V-11	ENF	25	FLKTL	128.3	0.9	63.7	4150	108.6	MGM
1240	5V-11	ENF	26	FLKTL	187.8	1.9	70.4	5280	159.6	MGM
1241	5V-15	ENF	2	PRJPT	76.2	54.8	102.2	5170	65.6	SV
1242	5V-15	ENF	4	PRJPT	137.9	4.3	124.3	5190	221.9	QI
1243	5V-15	ENF	6	BIFACE	49.1	1	62.5	2290	50.1	MH
1244	5V-15	ENF	7	BIFACE	88.7	4	89.6	2840	131.4	QI
1245	5V-15	ENF	9	DBTG	103.4	5.6	94.2	4910	262.4	QI
1246	5V-15	ENF	11	PTBLNK	183.3	4.2	138.2	6940	496.6	QI
1247	5V-15	ENF	15	PRJPT	38.4	11.5	19	2050	30.9	MH
1248	5V-15	ENF	17	FLKTL	161	1.3	98.3	5580	264.5	QI/MC
1249	5V-15	ENF	20	FLKTL	128.7	2.6	69.8	4240	195	MH
1250	5V-15	ENF	21	FLKTL	84.2	1.9	37.3	3260	117.4	MH
1251	5V-15	ENF	22	FLKTL	192.3	3.4	94.4	7750	553.9	QI/MH
1252	5V-15	ENF	23	FLKTL	218.1	2.8	79.9	8180	603.9	MH
1253	5V-15	ENF	26	FLKTL	86.1	3.4	40.4	2890	93.2	MH
1254	5V-15	ENF	27	FLKTL	186.5	1	34.2	3610	552.4	FS

ITEM	SITE	ACC	CAT	DESCRIP	RB	SR	ZR	FE	MN	SOURCE
1255	5V-20	ENF	1	FLKTL	82.9	1	31.2	2030	47.7	MGM/MH
1256	5V-21	ENF	1	BIFACE	140	0.9	49.5	4500	104.5	MGM
1257	5W-3	ENF	1	PTBLNK	107.4	1.6	39.5	3680	47	MGM
1258	5W-3	ENF	2	BIFACE	153.4	123.2	185.3	9600	181.8	CD
1259	5W-3	ENF	5	FLKTL	67.1	39.6	66.1	3970	80.5	SV
1260	5W-3	ENF	7	FLKTL	223.5	0.3	45	6590	199.5	MGM
1261	5W-3	ENF	10	FLKTL	86	52.6	101.9	6200	85.6	SV
1262	5W-5	ENF	4	FLKTL	182.6	5.1	37.2	5870	631.4	MH
1263	5W-5	ENF	7	FLKTL	102.8	60.5	125.2	5140	71.7	SV
1264	5W-5	ENF	12	FLKTL	101.7	1.4	30.2	2700	26.9	MGM
1265	5W-6	ENF	2	BIFACE	102.9	1.3	57.3	3240	49.6	MGM
1266	5W-6B	ENF	2	BIFACE	84.3	48.6	159.8	4770	58.3	CD/SV
1267	5W-8	ENF	4	BIFACE	145.3	0.2	50.5	4660	81.8	MGM
1268	5W-8	ENF	8	FLKTL	163	0.9	73.3	3890	148.8	MGM
1269	5W-8	ENF	16	BIFACE	172.9	1.2	106.8	4570	101.3	MC
1270	5W-8	ENF	26	FLKTL	186.3	0.3	85.8	5100	203.5	MGM/MC
1271	5W-8	ENF	28	FLKTL	196.1	1.4	82.3	4530	701.3	FS
1272	5W-8	ENF	29	PTBLNK	27.6	8.6	23.4	2320	50.3	MH
1273	5W-8	ENF	30	FLKTL	28.9	15.1	50.7	2510	36.6	MH
1274	5W-8	ENF	32	FLKTL	101.6	62.4	167.7	5500	49.3	CD
1275	5W-8	ENF	36	FLKTL	8.1	2.9	7.5	370	23.6	MH
1276	5W-8	ENF	39	FLKTL	143	6	85.6	6150	620.2	TQ
1277	5X-5	ENF	2	PRJPT	254.2	2.6	133.5	5690	125	CO
1278	5Y-7	ENF	1	FRMFLKTL	150.5	0.9	51.3	4040	100.7	MGM
1279	6B-14	ENF	1	PRJPT	160.9	0.8	38	4900	470.1	MH
1280	6B-14	ENF	4	BIFACE	193.5	0.7	70.5	6430	237.9	MGM
1281	6B-14	ENF	8	BIFACE	147.8	1.8	78	3910	120.3	MGM
1282	6B-14	ENF	9	BIFACE	207.2	0.6	70.1	6110	211.3	MGM
1283	6B-14	ENF	12	FLKTL	179.1	2.3	46.9	7820	281.5	MGM
1284	6B-14	ENF	14	FLKTL	216.9	1.4	71.2	5690	244.9	MGM
1285	6B-14	ENF	15	FLKTL	147.4	1	66.2	6690	141.8	MGM
1286	6D-8	ENF	1	PRJPT	134.1	66.7	176.4	6860	61.9	CD
1287	6D-8	ENF	2	BIFACE	160.2	2.7	79.6	4650	54.8	MGM/MC
1288	6D-8	ENF	10	FLKTL	69.1	74.7	135.6	7170	167.6	SV
1289	6D-9	ENF	1	PRJPT	146	3.5	107.4	3550	312.3	TQ
1290	6D-9	ENF	2	PRJPT	226.5	2	78.9	4450	620.8	FS
1291	6D-9	ENF	6	BIFACE	178.7	0.8	74.2	4910	170.7	MGM
1292	6D-9	ENF	19	FLKTL	173.4	10.3	127.9	5470	609.7	TQ
1293	6D-9	ENF	24	BIFACE	169.2	0.5	68.6	4730	167.2	MGM
1294	6D-9	ENF	25	FLKTL	241.2	2.6	60.7	5450	867.6	FS
1295	6E-16	ENF	1	PRJPT	97.4	2.2	61	3000	134.7	MH
1296	6E-16	ENF	3	BIFACE	134.9	122.4	209.6	7670	155.4	CD
1297	6E-16	ENF	4	BIFACE	58.3	94.5	141.5	5530	55.5	SV
1298	6E-16	ENF	8	BIFACE	40.7	38.1	134.3	4390	56.3	SV
1299	6E-16	ENF	12	BIFACE	88.6	0.6	30.2	2240	163.8	MH
1300	6E-16	ENF	19	FRMFLKTL	200.8	2.3	41.1	3870	567.3	FS
1301	6E-16	ENF	21	FLKTL	124.2	54.7	183.3	8160	201.5	CD
1302	6E-16	ENF	22	FLKTL	149.5	122.9	188.2	7210	150.2	CD
1303	6E-16	ENF	23	FLKTL	195.6	1.6	89.1	5070	817.5	FS
1304	6E-16	ENF	24	FLKTL	173	3	117.6	4720	488.5	TQ
1305	6E-16	ENF	25	FLKTL	179.4	2	71.1	3850	532.2	FS
1306	6E-16	ENF	28	FLKTL	165.9	1.4	49	3150	358	MH
1307	6E-16	ENF	31	FLKTL	14.8	3.4	7.9	1140	28.8	MH
1308	6E-16	ENF	33	FLKTL	20.6	47.8	57.6	2580	68.7	SV
1309	6E-16	ENF	34	FLKTL	62	1.9	11.2	1990	41.2	MH
1310	6E-16	ENF	35	FLKTL	38.5	14.5	42.8	2570	45.9	MH
1311	6E-16	ENF	36	FLKTL	83.1	1.9	52.7	2150	55.6	MH/MGM

ITEM	SITE	ACC	CAT	DESCRIP	RB	SR	ZR	FE	MN	SOURCE
1312	6E-16	ENF	38	FLKTL	48.9	5.1	12.1	1490	52.7	MH
1313	6Q-9	ENF	1	PRJPT	53.8	1.6	34.6	1820	116	MH
1314	6Q-9	ENF	4	PRJPT	52	29.5	85.4	4550	81.1	SV
1315	6Q-9	ENF	6	BIFACE	87.1	1.3	12.1	1820	29.5	MGM
1316	6Q-9	ENF	7	BIFACE	144.6	2.3	78	3740	90.6	MGM
1317	6Q-9	ENF	9	BIFACE	72.7	48.3	112.4	4390	48.4	SV
1318	6Q-9	ENF	10	BIFACE	84.2	0.5	30.4	1980	45.2	MGM/MH
1319	6Q-9	ENF	20	FLKTL	118.1	80.5	152.4	8620	122.4	CD/SV
1320	6Q-9	ENF	22	FLKTL	92.5	106.3	168.3	5320	45	CD
1321	6Q-9	ENF	23	FLKTL	63.2	41.7	86.1	4220	67.3	SV
1322	6Q-12	ENF	1	PRJPT	155.5	75.2	168.7	9100	191.4	CD
1323	6X-1	ENF	2	FLKTL	92	4.1	71.8	4200	315.8	TQ
1324	6X-1	ENF	6	FLKTL	185.9	1.9	25	3970	453.1	MH
1325	6X-1	ENF	8	FLKTL	158.8	72.9	176.7	9820	263.4	CD
1326	7Q-19	ENF	2	BIFACE	145.1	0.8	39	3150	68.6	MGM
1327	7Q-19	ENF	6	FLKTL	96.9	71.6	130.4	5280	67.4	SV
1328	7S-16	ENF	6	FLKTL	150.5	0.3	45.1	4280	95.6	MGM
1329	7S-16	ENF	7	FLKTL	102.7	55.3	111.6	5250	55.5	SV
1330	7Y-12	ENF	2	FRMFLKTL	117.9	2	54.7	3090	52.2	MGM
1331	7Y-12	ENF	8	FLKTL	176.1	4	100.8	5130	486.4	TQ
1332	7Y-12	ENF	10	FLKTL	175.9	67.7	184.3	9620	155.5	CD
1333	7Y-12	ENF	11	PTBLNK	197.1	0.8	71.9	6040	274.9	MGM
1334	7Y-12	ENF	13	FLKTL	109.1	3.5	109.2	3310	311.5	TQ
1335	7Y-12	ENF	14	FLKTL	79.8	45.8	138.3	5570	37.6	SV
1336	7Y-12	ENF	17	FLKTL	113.8	111.3	166.8	7070	91.6	CD
1337	8B-11	ENF	1	FLKTL	81.4	1.5	53.6	2590	45.4	MGM
1338	8B-11	ENF	3	PRJPT	228.1	1.3	93.3	6000	87.8	MC
1339	8B-15	ENF	2	PRJPT	120.9	3.4	104.9	3310	338.2	TQ
1340	8B-15	ENF	3	BIFACE	110.9	82.1	155.8	7140	94.8	CD
1341	8B-15	ENF	4	FLKTL	115.3	2.1	64.9	3220	39	MGM
1342	7S-16	ENF	9	FLKTL	215.5	1	100.4	6710	249	MC/MGM
1343	5U-12	ENF	3	BIFACE	58.9	3.2	15.4	1770	24	MGM/MH
1344	8D-3	ENF	7	FRMFLKTL	175	1.4	73.6	4770	118.5	MGM
1345	8D-3	ENF	13	FLKTL	201.2	1.2	104	5700	180.3	MC
1346	8D-3	ENF	14	FLKTL	119.8	0.5	83.1	4520	137.6	MGM
1347	8D-3	ENF	15	FLKTL	136.6	1.2	64.5	3220	79.5	MGM
1348	8D-3	ENF	16	FLKTL	114.8	81.2	176.6	6560	67.8	CD
1349	8D-3	ENF	20	FLKTL	114.1	94.2	188.5	7980	117.7	CD
1350	8D-3	ENF	21	FLKTL	107.3	0.8	43.3	2930	425.3	TQ/FS
1351	8D-3	ENF	24	FLKTL	58.5	21	126.1	4270	28.4	SV
1352	8D-3	ENF	25	FLKTL	47.4	51.4	84.2	3990	29.2	SV
1353	8D-3	ENF	27	FLKTL	79,8	1.6	24.7	2140	22.5	MGM
1354	8D-3	ENF	28	FLKTL	90.8	48.4	149.8	6030	45.1	CD/SV
1355	8D-3	ENF	29	FRMFLKTL	42.2	28.4	104.6	4240	68.2	SV
1356	8D-3	ENF	30	FLKTL	71.1	64.9	135.6	5220	91.1	SV
1357	8D-3	ENF	31	PTBLNK	59.8	86.1	124.9	4910	66.9	SV
1358	8D-3	ENF	33	FLKTL	7.9	4.6	27.2	1570	21.7	MH
1359	8D-3	ENF	34	FLKTL	55.5	37.6	83.9	2890	45.2	SV
1360	8D-3	ENF	35	FLKTL	41.3	4.9	10.7	870	33.9	MH
1361	8D-3	ENF	36	FLKTL	21.7	4.2	12.2	1440	51.7	MH
1362	8D-4	ENF	2	BIFACE	119.6	97.8	179.1	8140	100	CD
1363	8D-4	ENF	3	BIFACE	178	1.6	90.5	4480	73.1	MC/MGM
1364	8D-4	ENF	4	BIFACE	194.8	3.2	128.9	8160	970	TQ
1365	8D-4	ENF	5	BIFACE	108.5	2.5	109.3	4240	449.6	TQ
1366	8D-4	ENF	8	BIFACE	60.7	2.5	47.4	2350	25.9	MGM
1367	8D-4	ENF	11	PTBLNK	152.2	1.9	94.1	3830	77.3	MC/MGM
1368	8D-4	ENF	13	FLKTL	159.9	3.7	142.6	5990	651.1	TQ

ITEM	SITE	ACC	CAT	DESCRIP	RB	SR	ZR	FE	MN	SOURCE
1369	8D-4	ENF	14	FLKTL	25.7	5	22.3	2380	174.2	MH
1370	8D-4	ENF	16	FLKTL	162	4.8	45	5250	721.2	FS
1371	8D-4	ENF	20	FLKTL	183.3	1	77.6	5460	218.7	MGM
1372	8D-4	ENF	24	FLKTL	203.5	0.7	96.4	5790	217.9	MC/MGM
1373	8D-4	ENF	30	FLKTL	11.7	2	28.1	370	37.4	TQ
1374	8D-4	ENF	32	FLKTL	150.9	1	87.7	3940	118.8	MGM/MC
1375	9G-4	ENF	21	FLKTL	47.2	16	39.8	3290	29.8	MH/MGM
1376	9G-4	ENF	22	FLKTL	129.5	109.2	192	9150	189.6	CD
1377	9G-4	ENF	23	FLKTL	60.6	31.2	137	5110	87.8	SV
1378	9G-4	ENF	24	FLKTL	119.3	55.8	127.2	7580	109.6	SV
1379	9G-4	ENF	28	FLKTL	116.7	2.4	71.2	4520	436.8	TQ
1380	8H-11	ENF	23	FLKTL	29	22	53.4	2040	16.8	MH/SV
1381	8H-11	ENF	24	FLKTL	166.8	7.1	105.5	4670	491.2	TQ
1382	8H-11	ENF	26	FLKTL	45	29.4	36.7	2950	39.4	MH
1383	8H-11	ENF	27	FLKTL	170.2	1.3	78	4370	150.7	MGM
1384	8H-11	ENF	28	FLKTL	81.8	3	25.9	2790	44.6	MGM
1385	8H-11	ENF	29	FLKTL	10.8	18.2	50.8	2440	42.9	MH
1386	8H-11	ENF	30	FLKTL	52.3	3.8	15.8	1850	109	MH
1387	9G-4	ENF	1	PRJPT	109.1	1	22.6	3420	74.2	MGM
1388	9G-4	ENF	2	PRJPT	98.5	0.7	33.6	3300	122.8	MH
1389	9G-4	ENF	5	BIFACE	61	50.6	159.3	4790	47.8	CD/SV
1390	9G-4	ENF	7	BIFACE	87.3	52.3	135.8	5540	37.9	SV
1391	9G-4	ENF	9	DRILL	100.1	2	43.9	2910	63.8	MGM
1392	9G-4	ENF	13	FLKTL	146.5	0.8	71.1	3490	87	MGM
1393	9G-4	ENF	17	FLKTL	193.1	7.3	127.6	6090	702.9	TQ
1394	9G-4	ENF	20	FLKTL	52.4	34.1	128.7	4370	45.7	SV
1395	2-A	474	48A	DBTG	45.5	2.5	65.2	2810	158.2	TQ/MH
1396	2-B	474	50A	DBTG	145	5	92.9	5350	457.1	TQ
1397	2-B	474	50B	DBTG	16.8	1.8	33.3	1800	81.8	MH
1398	2-B	474	50C	DBTG	150.9	3	107.4	4360	344.5	TQ/QI
1399	2-B	474	50D	DBTG	15.5	13.2	105.6	2990	32.5	SV
1400	4-A	474	54A	DBTG	123.2	99.3	199.9	7700	114.9	CD
1401	4-A	474	54B	DBTG	70.4	63.5	126.5	4310	53.1	SV
1402	4-A	474	54C	DBTG	117.2	76.3	188.1	9350	100.1	CD
1403	4-A	474	54D	DBTG	86.5	96.1	175.4	6440	63.4	CD
1404	4-A	474	54E	DBTG	155.4	1.6	68	2930	34.8	MGM
1405	4-A	474	54F	DBTG	87.1	45.2	147.7	5320	67.2	SV
1406	4-A	474	54G	DBTG	107.4	51.4	127.5	6100	103.3	SV
1407	4-A	474	54H	DBTG	107.4	89.6	165.8	9670	140.9	CD
1408	4-A	474	54I	DBTG	128.4	88.2	149.6	6700	73.1	CD
1409	4-A	474	54J	DBTG	179.8	0.8	82.7	3750	76.1	MGM/MC
1410	4-A	474	54K	DBTG	103.9	61.3	126.8	4670	53.2	SV
1411	4-A	474	54L	DBTG	71.1	1.9	9.1	1560	50.5	MH
1412	4-A	474	55A	DBTG	186.7	0.9	74.3	6960	265.6	MGM
1413	4-A	474	55B	DBTG	154.1	101.6	193.8	9910	169.9	CD
1414	4-A	474	55C	DBTG	143.6	1.1	45.7	4330	137.3	MGM
1415	4-A	474	55D	DBTG	93.8	80.5	145.6	5590	65.7	SV/CD
1416	4-A	474	55E	DBTG	119.3	94.7	167	8330	210.1	CD/SV
1417	4-A	474	55F	DBTG	150.9	76.5	196.2	8760	127	CD
1418	4-A	474	55G	DBTG	181.4	1	70.4	3650	50.4	MGM
1419	4-A	474	55H	DBTG	69.2	59.3	117.7	6010	65.7	SV
1420	4-B	474	59A	DBTG	85.6	3.1	18.3	2770	56.7	MGM/MH
1421	4-B	474	59B	DBTG	163.2	1.7	83.9	4550	96.2	MGM/MC
1422	4-B	474	59C	DBTG	214.7	1	96.6	5580	210.7	MC/MGM
1423	4-B	474	59D	DBTG	81.5	3.2	36.6	1950	32.5	MGM
1424	4-B	474	59E	DBTG	83.2	2.3	40.6	2920	40.2	MGM
1425	4-B	474	59F	DBTG	83.8	1.2	17.5	3840	128.7	MH

ITEM	SITE	ACC	CAT	DESCRIP	RB	SR	ZR	FE	MN	SOURCE
1426	4-B	474	59G	DBTG	102.9	1.3	26.8	3040	28.9	MGM
1427	4-B	474	59H	DBTG	119.4	1.1	58.1	2230	46.9	MGM
1428	4-B	474	59I	DBTG	38.9	1.1	11.8	1320	24.9	MH
1429	4-B	474	59J	DBTG	56.7	4.1	8.9	1810	36.3	MH
1430	4-B	474	59K	DBTG	59	2.5	28.8	2250	58.4	MH
1431	4-B	474	59L	DBTG	126.6	1.5	57.2	3250	62.6	MGM
1432	6-A	474	60A	DBTG	187.9	0.6	66.1	4190	107.6	MGM
1433	6-A	474	60B	DBTG	175.6	7	110.2	5360	515.9	TQ
1434	8-A	474	62A	DBTG	160.8	0.5	83.1	4010	202.3	MGM/MH
1435	8-A	474	62B	DBTG	80.3	1.7	35.7	2320	72.5	MH
1436	8-A	474	62C	DBTG	99.6	1.5	32.2	2690	30.3	MGM
1437	8-A	474	62D	DBTG	182.5	5.2	113.8	5980	648.3	TQ
1438	8-A	474	62E	DBTG	150.3	98	201	9070	141.5	CD
1439	8-A	474	62F	DBTG	138.5	95.8	186.7	8240	77.3	CD
1440	8-A	474	62G	DBTG	119.9	2.8	113.4	5940	514.9	TQ
1441	8-A	474	62H	DBTG	148.3	0.5	83.6	3730	141.7	MGM
1442	8-A	474	62I	DBTG	128.8	4.8	97	3320	251.8	TQ
1443	8-A	474	62J	DBTG	174.9	110.2	226	12560	361.2	CD
1444	10-B	474	64A	DBTG	212	0.3	62.9	5480	123.3	MGM
1445	10-B	474	64B	DBTG	200.6	164.3	277.7	16670	488.9	CD
1446	10-B	474	64C	DBTG	223.4	164.4	268.5	16990	373.5	CD
1447	10-B	474	64D	DBTG	186.6	137.9	226.3	9480	224.3	CD
1448	10-B	474	64E	DBTG	193.6	135.8	256.2	11070	295.9	CD
1449	10-B	474	64F	DBTG	176.9	132.5	231.9	10710	169.8	CD
1450	10-B	474	64G	DBTG	174.2	108.5	212.8	9890	198.5	CD
1451	20-A	474	71A	DBTG	191	132.6	199.9	9940	203.4	CD
1452	20-A	474	71B	DBTG	199.3	0.7	82.2	6350	175.2	MGM
1453	20-A	474	71C	DBTG	157.1	95.2	224	10880	152.8	CD
1454	20-A	474	71D	DBTG	178.5	146.5	212.2	12280	335.2	CD
1455	20-A	474	71E	DBTG	187.2	161.5	261	10600	249	CD
1456	20-A	474	71F	DBTG	167	101.5	245	10690	224.1	CD
1457	20-A	474	71G	DBTG	193.4	155.1	215.7	12840	158.1	CD
1458	20-A	474	71H	DBTG	195.1	161.7	277.2	11220	280	CD
1459	20-A	474	71I	DBTG	177.1	87.1	209.1	13440	376.1	CD
1460	20-A	474	73A	DBTG	197.2	105.1	232.3	12650	359.2	CD
1461	20-A	474	73B	DBTG	168.6	109.3	204.3	10050	192.3	CD
1462	20-A	474	73C	DBTG	156.7	125.3	183.2	10820	128.3	CD
1463	20-A	474	73D	DBTG	196.8	0.1	81.5	6330	269.8	MGM/MC
1464	20-A	474	73E	DBTG	185.5	94.5	209.1	12500	332.1	CD
1465	20-A	474	73F	DBTG	235.3	1.4	103.7	6240	269.7	MC
1466	20-A	474	73G	DBTG	171.6	153.4	241.5	11470	243.2	CD
1467	20-A	474	73H	DBTG	214.7	0.6	88	6120	237.3	MC/MGM
1468	20-A	474	73I	DBTG	184.6	103.1	196.9	12230	275.1	CD
1469	20-A	474	73J	DBTG	159.9	139.4	229.3	11110	207.8	CD
1470	20-A	474	73K	DBTG	170.6	139	222.6	10340	229.6	CD
1471	16-A	474	77A	DBTG	250.3	0.6	107.3	7650	341	MC
1472	23-A	474	80A	DBTG	201.6	166	263.4	16710	435.2	CD
1473	23-A	474	80B	DBTG	162.8	154.7	240.3	10730	266.9	CD
1474	23-A	474	80C	DBTG	178.4	141	282.6	18840	505.2	CD
1475	23-A	474	80D	DBTG	210.8	0.6	87.5	6260	274.9	MGM/MC
1476	23-A	474	80E	DBTG	192.3	4.9	151.4	6340	718.5	TQ
1477	23-A	474	80F	DBTG	228.4	13	144.6	6620	617.7	QI
1478	23-A	474	80G	DBTG	172.5	117.9	227	10650	248	CD
1479	23-A	474	80H	DBTG	185.7	127.8	223	12100	226.3	CD
1480	23-A	474	80I	DBTG	169.1	123.6	241.9	14640	220.6	CD
1481	24-A	474	86A	DBTG	164.9	123	215.2	10990	253.9	CD
1482	24-A	474	86B	DBTG	190	18.5	69.1	4770	363.8	MH

ITEM	SITE	ACC	CAT	DESCRIP	RB	SR	ZR	FE	MN	SOURCE
1483	24-A	474	86C	DBTG	196.1	5.3	93.4	5600	627.3	TQ
1484	24-A	474	82A	DBTG	261.1	2.5	96.2	5730	892.6	FS
1485	24-A	474	82B	DBTG	252.3	2.7	84.7	5880	1048.8	FS
1486	24-A	474	82C	DBTG	417.4	1	112.6	7060	571.1	CO
1487	24-A	474	82D	DBTG	219.4	1	103.3	6530	282.9	MC
1488	24-A	474	82E	DBTG	164.2	101	215.2	10690	228.1	CD
1489	24-A	474	82F	DBTG	196.5	6.2	149.7	7010	747.4	TQ
1490	24-A	474	86D	DBTG	159.8	142	244.2	8010	153	CD
1491	24-A	474	86E	DBTG	164.2	120.3	217.2	10860	207.9	CD
1492	24-C	474	89A	DBTG	191.9	1.1	77.8	5010	182.9	MGM
1493	24-C	474	89B	DBTG	179.4	132.4	229.6	10770	226	CD
1494	24-C	474	89C	DBTG	165.2	145.4	242.3	12420	253.1	CD
1495	24-C	474	89D	DBTG	199.4	13.3	145.3	7130	833.8	TQ
1496	24-C	474	89E	DBTG	232.7	0.8	97.8	6590	176.4	MC
1497	24-C	474	89F	DBTG	162.9	1.8	84.9	5290	118.8	MGM/MC
1498	24-C	474	89G	DBTG	178.7	122.2	256.2	13570	298	CD
1499	28-A	474	95A	DBTG	239.8	0.7	89.5	4080	642.7	FS
1500	28-A	474	95B	DBTG	170.3	100.2	249.5	10750	285.9	CD
1501	28-A	474	95C	DBTG	243.1	1.2	92	6510	284.9	MC/MGM
1502	28-A	474	95D	DBTG	185.2	136.7	219.4	11310	243.4	CD
1503	28-A	474	95E	DBTG	203.6	1.7	89.4	6780	261.8	MC/MGM
1504	28-A	474	95F	DBTG	212.6	1.2	102.6	6780	253.4	MC
1505	28-A	474	95G	DBTG	189.8	138.4	239.8	12290	185.7	CD
1506	28-A	474	95H	DBTG	184.4	109.8	233.7	11060	160.8	CD
1507	30-A	474	97A	DBTG	177.7	153.6	220.9	10110	260.3	CD
1508	30-A	474	97B	DBTG	202	1.5	93	5000	144	MC/MGM
1509	30-A	474	97C	DBTG	191.3	1	102.9	4600	65.8	MC
1510	30-A	474	97D	DBTG	190.7	9.6	151.2	5770	658.6	TQ
1511	30-A	474	97E	DBTG	247.1	1.7	80.5	4590	809.6	FS
1512	30-A	474	97F	DBTG	197.5	4.6	143.3	6340	705.5	TQ
1513	30-A	474	97G	DBTG	214.7	3.1	144.1	5970	670.7	TQ
1514	30-A	474	98A	DBTG	176.4	0.8	101.2	4890	198.8	MC/MGM
1515	30-A	474	98B	DBTG	221.2	2.9	143.9	7090	733.8	QI/TQ
1516	30-A	474	98C	DBTG	197.9	3	144.9	5500	525.5	QI/TQ
1517	30-A	474	98D	DBTG	205.9	6.6	154.1	6490	730.1	TQ
1518	30-A	474	98E	DBTG	225.9	6.9	139.8	7680	944.8	TQ/FS
1519	30-A	474	98F	DBTG	201.5	119.6	224.3	11700	311.7	CD
1520	30-B	474	101A	DBTG	181.8	0.4	81.8	6910	151.7	MGM/MC
1521	30-B	474	101B	DBTG	220.4	0.4	67.6	6970	301.7	MGM
1522	30-B	474	101C	DBTG	202.1	0.9	105.1	6210	203.9	MC
1523	30-B	474	101D	DBTG	215.5	0.6	86.1	5940	203.1	MC/MGM
1524	30-B	474	101E	DBTG	212.3	1.2	93.2	6040	127.5	MC
1525	30-B	474	101F	DBTG	280.5	2.4	107	7140	1184.4	FS
1526	30-B	474	101G	DBTG	197.4	0.7	96.8	5520	146.5	MC/MGM
1527	30-B	474	102A	DBTG	214	0.4	106.3	5830	176.7	MC
1528	30-B	474	102B	DBTG	220	1.3	99.4	5550	260	MC
1529	30-B	474	102C	DBTG	195.2	6.5	131.9	5400	634.9	TQ
1530	30-B	474	102D	DBTG	232.6	0.7	94.9	5830	261.6	MC/MGM
1531	30-B	474	102E	DBTG	266.2	2.1	88.5	6370	261.7	CO
1532	30-B	474	102F	DBTG	248.4	2.4	112	5560	212.4	MC
1533	30-B	474	102G	DBTG	220.3	0.5	89.5	5450	282.8	MC/MGM
1534	30-B	474	102H	DBTG	220.3	0.5	96	6180	296.6	MC/MGM
1535	30-B	474	102I	DBTG	245.1	0.7	126.7	5960	161.2	CO/MC
1536	30-B	474	102J	DBTG	241.9	2.1	102.6	5260	219.1	MC
1537	30-B	474	102K	DBTG	187.7	134.7	261.7	12070	262.8	CD
1538	E-17A	ENF	6A	DBTG	165.3	2.2	53.5	2500	60.1	MGM
1539	E-17A	ENF	6B	DBTG	157.8	97.3	194.6	6600	149.5	CD

ITEM	SITE	ACC	CAT	DESCRIP	RB	SR	ZR	FE	MN	SOURCE
1540	E-17A	ENF	6C	DBTG	157.3	74.7	208.5	7170	139	CD
1541	E-17A	ENF	6D	DBTG	147.6	74.6	204.7	6280	179.3	CD
1542	E-17A	ENF	6E	DBTG	177.6	94.5	203	7890	197.9	CD
1543	E-17A	ENF	6F	DBTG	137.7	59.5	176.4	5040	119.1	CD
1544	E-17A	ENF	6G	DBTG	198.3	13.2	123.3	4180	445.6	TQ
1545	E-17A	ENF	6H	DBTG	171.2	0.7	54.4	2560	85.8	MGM
1546	E-17A	ENF	6I	DBTG	143	72.3	151.6	5060	105.3	SV/CD
1547	E-17B	ENF	22A	DBTG	126.4	1.1	62	2620	72.7	MGM
1548	E-17B	ENF	22B	DBTG	151.3	2.4	79	2470	80.1	MGM
1549	E-17B	ENF	22C	DBTG	166.6	12	60.7	4050	328.6	MH
1550	E-17B	ENF	22D	DBTG	146.7	99.5	204.8	5550	86.3	CD
1551	G-32	ENF	19A	DBTG	209.8	2.3	66.6	2650	367	FS
1552	G-32	ENF	19B	DBTG	206	1.9	59.2	2950	388	FS
1553	G-32	ENF	19C	DBTG	187	0.2	36.6	3580	84.8	MGM
1554	G-32	ENF	19D	DBTG	226.1	1.3	54.1	2660	383.9	FS
1555	G-32	ENF	19E	DBTG	186.1	0.5	68.6	3770	132.2	MGM
1556	G-32	ENF	19F	DBTG	133.2	107.9	189.4	5220	66.9	CD
1557	G-32	ENF	19G	DBTG	198.3	1.1	62.3	3090	421.1	FS
1558	G-32	ENF	19H	DBTG	139.5	83.9	177.4	6130	126.8	CD
1559	G-32	ENF	19I	DBTG	216.1	4	68.3	3230	502.9	FS
1560	K-0	ENF	236A	DBTG	225.6	1.5	56.5	4890	769.4	FS
1561	K-0	ENF	236B	DBTG	177.9	0.3	67.9	3100	102	MGM
1562	K-0	ENF	236C	DBTG	213.2	1.6	60	2840	449.9	FS
1563	K-0	ENF	236D	DBTG	188.9	0.2	79.7	2790	102	MGM/MC
1564	K-0	ENF	236E	DBTG	184.7	11.8	102	3070	336.5	TQ
1565	K-0	ENF	236F	DBTG	219.9	2.1	85.7	4140	168.7	MGM/MC
1566	K-0	ENF	236G	DBTG	182.6	0.6	47.2	2840	73.8	MGM
1567	K-0	ENF	236H	DBTG	154.2	5.8	113.8	3660	369.1	TQ
1568	K-0	ENF	236I	DBTG	181.5	5.1	61.5	4220	382.3	MH
1569	K-0	ENF	236J	DBTG	148.6	5.4	99	3400	352.7	TQ
1570	Y-1	ENF	27A	DBTG	234	1	75.9	4900	229.7	MGM/MC
1571	Y-1	ENF	27B	DBTG	221	0.9	72.8	4170	167.3	MGM
1572	Y-1	ENF	27C	DBTG	179	0.8	66.3	2910	73.9	MGM
1573	Y-1	ENF	27D	DBTG	177	0.4	67.8	2440	107.8	MGM
1574	Y-1	ENF	27E	DBTG	186.4	112.5	210.7	7630	197.8	CD
1575	Y-1	ENF	27F	DBTG	138	92.1	106.6	6230	139.7	SV
1576	Y-1	ENF	27G	DBTG	136.7	65.1	151.6	6370	148.8	SV
1577	Y-1	ENF	27H	DBTG	175.3	0.9	68.2	3010	72.2	MGM
1578	Y-1	ENF	27I	DBTG	142.7	78.8	171.9	5860	132.9	CD
1579	Y-1	ENF	27J	DBTG	209.5	2.8	81	2770	372.5	FS
1580	Y-1	ENF	27K	DBTG	149.3	0.7	65.9	3450	72.8	MGM
1581	1W-3	ENF	51A	DBTG	140.7	73.3	155.4	5920	143	SV/CD
1582	1W-3	ENF	51B	DBTG	203.4	1.6	76.8	3400	106.8	MGM/MC
1583	1W-3	ENF	51C	DBTG	163.2	0.9	51.1	2880	92.4	MGM
1584	1W-3	ENF	51D	DBTG	190	0.3	67.5	4330	212.7	MGM
1585	1W-3	ENF	51E	DBTG	164	77	211.4	8960	227.6	CD
1586	1W-3	ENF	51F	DBTG	134.5	82.9	179.1	5620	120.3	CD
1587	1W-3	ENF	51G	DBTG	197.9	0.6	59.2	3160	137.2	MGM
1588	1W-3	ENF	51H	DBTG	194.2	0.3	65.4	4730	231.9	MGM
1589	1W-3	ENF	51I	DBTG	203.6	0.7	54.7	3310	118.6	MGM
1590	2D-13	ENF	43A	DBTG	254.3	3.1	63.7	4900	863.6	FS
1591	2D-13	ENF	43B	DBTG	177.5	6.6	118.4	3140	355.2	TQ
1592	2D-13	ENF	43C	DBTG	185.1	0.5	95.1	2970	122.9	MC/MGM
1593	2D-13	ENF	43D	DBTG	183.1	0.8	69.4	2630	89.2	MGM
1594	2D-13	ENF	43E	DBTG	164.8	0.5	78.7	3020	88.6	MGM
1595	2D-13	ENF	43F	DBTG	159.6	0.3	32.8	1700	50.9	MGM
1596	2D-13	ENF	43G	DBTG	165.3	5.8	105.2	2990	320.6	TQ

ITEM	SITE	ACC	CAT	DESCRIP	RB	SR	ZR	FE	MN	SOURCE
1597	2D-13	ENF	43H	DBTG	129	64.5	171	5130	153.4	SV/CD
1598	2D-13	ENF	43I	DBTG	193	0.8	63.2	2860	124	MGM
1599	2D-13	ENF	43J	DBTG	131.5	69.1	164.1	4220	48.9	CD
1600	2D-13	ENF	43K	DBTG	166.6	16.7	113.6	3150	345.3	TQ
1601	2D-13	ENF	43L	DBTG	149.7	66.5	168.6	5270	120.8	CD
1602	2D-13	ENF	43M	DBTG	148.1	62.7	171.4	6090	145.4	CD
1603	2D-13	ENF	43N	DBTG	173.8	0.3	65.5	2770	64	MGM
1604	4L-11	ENF	39A	DBTG	178.4	0.7	67.7	3100	71.4	MGM
1605	4L-11	ENF	39B	DBTG	106	67.9	172.4	5790	123.1	CD
1606	4L-11	ENF	39C	DBTG	112.8	63.3	151	5010	112.8	SV
1607	4L-11	ENF	39D	DBTG	160.3	86.4	168.9	6240	131.7	CD
1608	4L-11	ENF	39E	DBTG	223	0.3	57.7	3280	517.3	FS
1609	4L-11	ENF	39F	DBTG	133.8	77.4	178.6	5520	131.5	CD
1610	4L-11	ENF	39G	DBTG	213.8	2	61.8	2830	378.3	FS
1611	4L-11	ENF	39H	DBTG	137.5	61.9	132.3	4940	241.9	SV
1612	4L-11	ENF	39I	DBTG	128.1	78.7	188.4	5810	110.7	CD
1613	4L-11	ENF	39J	DBTG	161	101.7	183.6	5970	125.7	CD
1614	4L-11	ENF	39K	DBTG	163.6	119.8	186.7	6190	94.6	CD
1615	4L-11	ENF	39L	DBTG	143.2	77.3	114	4090	212.8	SV
1616	4L-11	ENF	39M	DBTG	203.2	1.8	119	5010	172.8	MC
1617	4L-11	ENF	39N	DBTG	138.4	80	145.7	5320	122.6	SV
1618	4L-11	ENF	39O	DBTG	160.2	75	169.5	6720	134.7	CD
1619	5B-18	ENF	54A	DBTG	199.2	1.2	71	3120	57.5	MGM/MC
1620	5B-18	ENF	54B	DBTG	180.4	0.5	71.1	2620	42.7	MGM
1621	5B-18	ENF	54C	DBTG	180.5	0.6	80	2600	95.4	MGM
1622	5B-18	ENF	54D	DBTG	183	0.4	58.6	2880	116.7	MGM
1623	5D-3	ENF	11A	DBTG	199.7	0.9	71.7	3140	397.9	FS
1624	5D-3	ENF	11B	DBTG	216.7	3.3	64.6	2910	398.9	FS
1625	5D-3	ENF	11C	DBTG	172.4	0.5	56.3	3180	70.3	MGM
1626	5D-3	ENF	11D	DBTG	157.8	108	188	5510	67.2	CD
1627	5D-3	ENF	11E	DBTG	223	1.8	39.3	2690	348.1	FS
1628	5D-3	ENF	11F	DBTG	189.9	0.7	42.2	4600	225.3	MGM
1629	5D-3	ENF	11G	DBTG	134.9	82.7	167.3	5710	100.5	CD
1630	5D-3	ENF	11H	DBTG	133.6	71.9	173	6010	108	CD
1631	5D-3	ENF	11I	DBTG	150.2	0.7	67.1	2910	102.9	MGM
1632	5S-11	ENF	29A	DBTG	171	0.3	51.6	2790	97.7	MGM
1633	5S-11	ENF	29B	DBTG	139.9	75.8	142.9	5370	137.7	SV
1634	5S-11	ENF	29C	DBTG	137.7	90.8	176.4	5680	91.6	CD
1635	5S-11	ENF	29D	DBTG	102.6	71.9	127.6	4460	106	SV
1636	5S-11	ENF	29E	DBTG	161	3.9	92.7	3590	382.5	TQ
1637	5S-11	ENF	29F	DBTG	145.5	74.3	160	6290	136.8	CD/SV
1638	5A-12	ENF	59A	DBTG	182.2	0.6	87.4	3150	134.7	MGM/MC
1639	5A-12	ENF	59B	DBTG	156.3	114.6	187.6	8020	185.9	CD
1640	5A-12	ENF	59C	DBTG	198.4	5	130.7	4730	564.1	TQ
1641	5A-12	ENF	59D	DBTG	170.1	9.8	110.9	3040	283.5	TQ
1642	5A-12	ENF	59E	DBTG	166.5	8.3	118.3	3310	331.7	TQ
1643	5A-12	ENF	59F	DBTG	184.6	17.2	130.3	5650	550.2	TQ
1644	5A-12	ENF	59G	DBTG	165	4.9	111.4	3660	319.3	TQ
1645	5T-19	ENF	132A	DBTG	176.3	0.6	85	3890	208	MGM/MC
1646	5T-19	ENF	132B	DBTG	190.3	0.4	44.5	4580	260.8	MGM/MH
1647	5T-19	ENF	132C	DBTG	148.4	77.1	148.5	9660	242.7	SV
1648	5T-19	ENF	132D	DBTG	146	70.1	155.5	4310	61.4	CD
1649	5T-19	ENF	132E	DBTG	136.5	87.1	181.7	6730	131.6	CD
1650	5T-19	ENF	132F	DBTG	161.8	0.5	70.3	2810	66.4	MGM
1651	5T-19	ENF	132G	DBTG	153.6	103.8	196.4	7450	164.2	CD
1652	5T-19	ENF	132H	DBTG	150.4	76.6	199.8	8890	219.4	CD
1653	5T-16	ENF	9A	DBTG	154.2	5.5	111.1	4230	439.1	TQ

ITEM	SITE	ACC	CAT	DESCRIP	RB	SR	ZR	FE	MN	SOURCE
1654	5T-16	ENF	9B	DBTG	140	74.1	179.8	5340	127	CD
1655	5T-16	ENF	9C	DBTG	148.2	58.3	188.1	8140	182.4	CD
1656	5U-10	ENF	4A	DBTG	231.5	1.2	57.1	3630	550.5	FS
1657	5U-10	ENF	4B	DBTG	108.2	92.4	199.3	5810	147.1	CD
1658	5U-10	ENF	4C	DBTG	162	7.2	70.3	3200	291.7	MH
1659	5U-10	ENF	4D	DBTG	170.2	5	91.2	3420	299.4	TQ
1660	5U-10	ENF	4E	DBTG	185.3	8.3	123.2	3710	400.5	TQ
1661	5U-10	ENF	4F	DBTG	166.6	117.6	201.6	8130	119.8	CD
1662	5U-10	ENF	4G	DBTG	205.1	0.9	58.2	3270	90.5	MGM
1663	5U-12	ENF	21A	DBTG	244.4	0.9	76.3	4400	721.9	FS
1664	5U-12	ENF	21B	DBTG	152	98.3	184.5	5640	136.9	CD
1665	5U-12	ENF	21C	DBTG	153.4	0.4	71.8	2920	50	MGM
1666	5U-12	ENF	21D	DBTG	153.7	70.7	195.6	6180	134.8	CD
1667	5U-12	ENF	21E	DBTG	163.7	116.9	196.8	6050	127.5	CD
1668	5U-12	ENF	21F	DBTG	142.5	58.4	151.4	5010	133	SV
1669	5U-12	ENF	21G	DBTG	128.2	111	202	5650	163.8	CD
1670	5U-12	ENF	21H	DBTG	156.1	73	175.9	5850	134.9	CD
1671	5U-12	ENF	21I	DBTG	129	110.7	204.9	6190	106.8	CD
1672	5U-13	ENF	9A	DBTG	186.7	7.8	123.1	7790	1007.7	TQ
1673	5U-15	ENF	26A	DBTG	219.8	1	94.7	3980	135.1	MC/MGM
1674	5U-15	ENF	26B	DBTG	208.6	6.2	140.3	5740	663.7	TQ
1675	5U-15	ENF	26C	DBTG	194.7	1.1	71.9	3330	113.7	MGM
1676	5U-15	ENF	26D	DBTG	133.7	84.9	184.1	6020	114.9	CD
1677	5U-15	ENF	26E	DBTG	188.9	12.6	114.6	3260	332.4	TQ
1678	5V-15	ENF	28A	DBTG	203.4	1.9	64.1	2900	385.3	FS
1679	5V-15	ENF	28B	DBTG	192.5	4.9	117	5370	364.7	QI
1680	5V-15	ENF	28C	DBTG	156.7	6.1	102.7	3060	180.4	QI
1681	5V-15	ENF	28D	DBTG	137.5	3.8	113	3840	193.4	QI
1682	5V-15	ENF	28E	DBTG	162.9	4.6	88.9	3730	220.4	QI/MH
1683	5V-15	ENF	28F	DBTG	164.6	2.4	93.9	3710	231.1	QI
1684	5V-15	ENF	28G	DBTG	170.4	4.6	109.1	3620	246.5	QI
1685	5V-15	ENF	28H	DBTG	170.6	2.3	108.8	3930	256.8	QI
1686	5V-15	ENF	28I	DBTG	183.7	4.4	131.6	3660	192.4	QI
1687	5V-15	ENF	28J	DBTG	168.6	4.8	96	3690	204.6	QI
1688	5V-15	ENF	28K	DBTG	186.3	3.4	140.5	4930	362.9	QI
1689	5V-15	ENF	28L	DBTG	214.3	5.1	127.3	5480	433.5	QI
1690	5V-15	ENF	28M	DBTG	198.5	6.1	126.5	7440	622.5	QI
1691	5V-15	ENF	28N	DBTG	197.3	6.4	115.7	6530	515.9	QI
1692	5W-3	ENF	14A	DBTG	190.3	0.8	68.4	3000	117.2	MGM
1693	5W-3	ENF	14B	DBTG	140	0.6	70	3060	148.5	MH
1694	5W-3	ENF	14C	DBTG	124.9	0.6	50.3	3070	62	MGM
1695	5W-3	ENF	14D	DBTG	177.6	4.8	93.4	3510	342.1	TQ
1696	5W-3	ENF	14E	DBTG	165.7	0.5	77.6	3560	153.3	MGM
1697	5W-3	ENF	14F	DBTG	157.4	112.9	188.2	6420	123.8	CD
1698	5W-3	ENF	14G	DBTG	185.3	0.7	73.3	3060	107.9	MGM
1699	5W-3	ENF	14H	DBTG	164.3	0.8	64.6	3840	132.5	MGM
1700	5W-3	ENF	14I	DBTG	157.8	84.9	166.8	5670	144.5	CD
1701	5W-3	ENF	14J	DBTG	147.2	53.8	178.2	6240	135.1	CD
1702	5W-8	ENF	41A	DBTG	182.7	10.8	95.7	4310	459.9	TQ
1703	5W-8	ENF	41B	DBTG	157.5	0.5	53.2	3100	121.3	MGM
1704	5W-8	ENF	41C	DBTG	207.9	12.2	135.6	4810	511.8	TQ
1705	5W-8	ENF	41D	DBTG	182.4	0.6	80.6	3950	121.3	MGM/MC
1706	5W-8	ENF	41E	DBTG	132.4	66	159.9	5110	129	SV/CD
1707	5W-8	ENF	41F	DBTG	153	67.6	149.2	6940	101.3	CD
1708	6E-16	ENF	46A	DBTG	220.9	0.8	79.2	3850	551.2	FS
1709	6E-16	ENF	46B	DBTG	224.2	3.3	64	2810	447.3	FS
1710	6E-16	ENF	46C	DBTG	124.9	76.4	193	5480	136.1	CD

ITEM	SITE	ACC	CAT	DESCRIP	RB	SR	ZR	FE	MN	SOURCE
1711	6E-16	ENF	46D	DBTG	140	73.7	147.8	6460	116.3	SV/CD
1712	6E-16	ENF	46E	DBTG	133.5	101.6	184.6	5450	126.7	CD
1713	6E-16	ENF	46F	DBTG	196.7	19	108.2	3420	328.8	TQ
1714	6E-16	ENF	46G	DBTG	137.1	83.4	174.5	6380	103.5	CD
1715	6E-16	ENF	46H	DBTG	140.8	90.9	189.4	6340	158.7	CD
1716	6E-16	ENF	46I	DBTG	177.4	0.2	41.8	3320	115.1	MGM
1717	6Q-9	ENF	24A	DBTG	143.8	104.6	193	5140	139.7	CD
1718	6Q-9	ENF	24B	DBTG	124.5	85.2	164.1	6270	108.5	CD
1719	6Q-9	ENF	24C	DBTG	122.4	46.9	136.8	4490	116.4	SV
1720	6Q-9	ENF	24D	DBTG	138.2	79	178.4	5240	90.1	CD
1721	6Q-9	ENF	24E	DBTG	141.9	71.4	158.2	5520	121.3	CD/SV
1722	6Q-9	ENF	24F	DBTG	145.3	71	160.4	5510	106.3	CD
1723	6Q-9	ENF	24G	DBTG	136.3	79.9	194.4	6090	148.1	CD
1724	6Q-9	ENF	24H	DBTG	153.4	72.3	198.8	5790	126.6	CD
1725	6Q-9	ENF	24I	DBTG	122.9	71.6	180.9	6070	140.8	CD
1726	6Q-9	ENF	24J	DBTG	139.1	75.6	178.8	5540	124.9	CD
1727	6Q-9	ENF	24K	DBTG	144.6	56.9	190.6	5690	111.6	CD
1728	7Q-19	ENF	8A	DBTG	225.7	0.6	46.9	3160	483.6	FS
1729	7Q-19	ENF	8B	DBTG	125.9	104.3	183.2	5540	101.7	CD
1730	7Q-19	ENF	8C	DBTG	188.1	0.3	73.3	3010	119.7	MGM
1731	7Q-19	ENF	8D	DBTG	119.7	77.3	170.8	6190	173.3	SV/CD
1732	7Q-19	ENF	8E	DBTG	155.6	95.4	175.3	5510	123.6	CD
1733	7Q-19	ENF	8F	DBTG	191.9	0.2	76.5	3740	123.4	MGM
1734	7Q-19	ENF	8G	DBTG	179.5	0.7	42.3	3240	103.4	MGM
1735	7Q-19	ENF	8H	DBTG	141.1	5.5	79.6	3090	333.1	TQ
1736	7Q-19	ENF	8I	DBTG	180.6	0.8	84.3	3240	91.9	MGM/MC
1737	7Q-19	ENF	8J	DBTG	171.9	1.5	54.5	3140	96.6	MGM
1738	8D-3	ENF	37A	DBTG	196.1	0.4	63.1	2790	97.9	MGM
1739	8D-3	ENF	37B	DBTG	151.5	0.4	83.2	3110	87.1	MGM
1740	8D-3	ENF	37C	DBTG	160.9	96.1	188.5	5310	109.8	CD
1741	8D-3	ENF	37D	DBTG	181.7	0.4	61.7	2640	125	MGM
1742	8D-3	ENF	37E	DBTG	199	1.2	72.2	3150	94.4	MGM
1743	8D-3	ENF	37F	DBTG	155.4	109.7	156.1	5230	73.6	CO
1744	8D-3	ENF	37G	DBTG	142	86.3	179.7	6390	166	CD
1745	8D-4	ENF	43A	DBTG	139.3	1	72.8	3230	138.2	MGM/MH
1746	8D-4	ENF	43B	DBTG	223.9	4.2	80.3	3080	450	FS
1747	8D-4	ENF	43C	DBTG	200.7	5.9	78.5	3570	340.7	MH
1748	8D-4	ENF	43D	DBTG	190.8	0.1	79.6	3740	173.7	MGM
1749	8H-11	ENF	33A	DBTG	131.3	109.6	162.7	5430	124	CD/SV
1750	8H-11	ENF	33B	DBTG	191.3	0.4	64.3	3460	94.3	MGM
1751	8H-11	ENF	33C	DBTG	164.9	120.8	168.6	12300	313.4	CD
1752	8H-11	ENF	33D	DBTG	201.5	0.7	77.4	4210	153.8	MGM/MC
1753	8H-11	ENF	33E	DBTG	202	1.1	70.7	3860	139.6	MGM
1754	9G-4	ENF	29A	DBTG	157.1	0.5	71	3260	100.1	MGM
1755	9G-4	ENF	29B	DBTG	167.5	123	200.5	7030	130.2	CD
1756	9G-4	ENF	29C	DBTG	139.6	94.7	165.4	5350	106	CD
1757	9G-4	ENF	29D	DBTG	138.9	63.3	156.8	4680	138.1	SV
1758	9G-4	ENF	29E	DBTG	219.6	1.1	79.6	5930	373.5	MGM
1759	9G-4	ENF	29F	DBTG	162.7	87.6	200.9	8330	175.6	CD
1760	9G-4	ENF	29G	DBTG	158.4	87.2	166.6	7280	159.2	CD
1761	9G-4	ENF	29H	DBTG	169.3	77.3	155.3	5560	114.6	CD
1762	9G-4	ENF	29I	DBTG	137.2	75	160.3	7050	188.3	SV/CD
1763	5B-18	ENF	54E	DBTG	191.8	0.9	85.2	5180	252	MGM/MC
1764	5B-18	ENF	54F	DBTG	190.1	0.9	75.8	3540	135.1	MGM
1765	4C-1	455	1025A	DBTG	185.5	0.9	41.6	3060	114.9	MGM
1766	4C-1	455	1025B	DBTG	180.5	4.8	92.1	4010	486	TQ
1767	4C-1	455	1025C	DBTG	191.9	0.8	89.2	4010	156.2	MGM/MC

ITEM	SITE	ACC	CAT	DESCRIP	RB	SR	ZR	FE	MN	SOURCE
1768	4C-1	455	1025D	DBTG	156.5	9.7	112.1	3030	294.7	TQ
1769	4C-1	455	1025E	DBTG	174.8	0.6	57.1	2810	84.8	MGM
1770	10A-2	455	1043A	DBTG	188.9	0.5	93.5	3560	112.1	MC/MGM
1771	10A-2	455	1043B	DBTG	146.1	67.1	186	5930	134.1	CD
1772	10A-2	455	1043C	DBTG	172.8	11.1	54.9	2930	207.2	MH
1773	10A-2	455	1043D	DBTG	132.4	89.3	193.6	7950	202.2	CD
1774	10A-2	455	1043E	DBTG	192.1	3.7	122.9	4520	507.7	TQ
1775	10A-2	455	1043F	DBTG	162.4	7.9	120.1	3290	339.8	TQ
1776	10A-2	455	1043G	DBTG	190.8	0.6	72.5	3100	103.2	MGM
1777	12C-2	455	1055A	DBTG	166.6	90.5	159	6030	172	SV
1778	12C-2	455	1055B	DBTG	175	0.9	55.3	2970	138.5	MGM
1779	12C-2	455	1055C	DBTG	154.9	76.4	197.9	5720	95.8	CD
1780	12C-2	455	1055D	DBTG	131.8	89	193.6	5930	138.8	CD
1781	12C-2	455	1055E	DBTG	171.4	7.5	127.8	3460	390.1	TQ
1782	12C-2	455	1055F	DBTG	200.7	0.2	70.3	3650	150.4	MGM
1783	12C-2	455	1055G	DBTG	140.2	126.1	209.2	5280	70.5	CD
1784	12C-2	455	1055H	DBTG	174.3	0.6	72.5	3310	101.5	MGM
1785	12C-2	455	1055I	DBTG	177.9	3.3	125.1	3750	392.1	TQ
1786	12C-2	455	1055J	DBTG	169	11.4	94.9	2910	280.5	TQ
1787	18C-1	455	1017A	DBTG	179.4	0.4	41.7	2620	115.5	MGM
1788	18C-1	455	1017B	DBTG	169.2	3.2	136.9	3990	434.5	TQ
1789	18C-1	455	1017C	DBTG	155.1	89.2	194	5490	116.9	CD
1790	18C-1	455	1017D	DBTG	158.3	96	172.7	6040	143.6	CD
1791	18C-1	455	1017E	DBTG	144.6	83.5	198.3	5960	160.5	CD
1792	18C-1	455	1017F	DBTG	135.3	90.8	178.6	5830	150.6	CD
1793	18C-1	455	1017G	DBTG	109.8	82.3	164.8	5180	89.1	CD
1794	18C-1	455	1017H	DBTG	197.9	8.2	97.9	3800	372.9	TQ
1795	18C-1	455	1017I	DBTG	164.9	8.7	103.7	3050	296.3	TQ
1796	18C-3	455	1021A	DBTG	199.1	0.4	88.5	3340	116.4	MC/MGM
1797	22C-1	455	1009A	DBTG	157	0.5	51.6	2410	93.4	MGM
1798	22C-1	455	1009B	DBTG	155	4.6	94	2770	263.8	TQ
1799	22C-1	455	1009C	DBTG	203.9	0.7	78.3	3470	122	MGM/MC
1800	22C-1	455	1009D	DBTG	121.5	96.5	170.4	8160	171.9	CD
1801	22C-1	455	1009E	DBTG	146.5	74.6	185.3	5990	131.2	CD
1802	22C-1	455	1009F	DBTG	125.8	62.8	147.5	5990	101.2	SV/CD
1803	22C-1	455	1009G	DBTG	169.6	5.3	83.2	4670	55.9	MGM/MC
1804	MNO-1992	455	275A	DBTG	153.8	91.1	175.1	5320	110.4	CD
1805	MNO-1992	455	275B	DBTG	76	8.8	209.8	4830	296.7	QI/TQ
1806	MNO-1992	455	275C	DBTG	171.5	1	50	3030	80.8	MGM
1807	MNO-1992	455	275D	DBTG	150.2	2.2	102.7	4220	390.4	TQ
1808	MNO-1992	455	275E	DBTG	147.7	63.5	158.7	5410	133.4	SV/CD
1809	MNO-1992	455	275F	DBTG	116.3	78.5	169.5	5630	125.4	CD
1810	MNO-1992	455	275G	DBTG	156	7	124	3160	317.3	TQ
1811	MNO-1992	455	275H	DBTG	176.3	7.9	98.9	3420	333.9	TQ
1812	MNO-1992	455	275I	DBTG	130.1	102.3	169.1	5270	116.8	CD
1813	MNO-1992	455	275J	DBTG	154.5	92.5	187.2	5600	94.5	CD
1814	MNO-1992	455	489A	DBTG	133.6	65.1	180.4	5590	118.7	CD
1815	MNO-1992	455	489B	DBTG	170.1	3.5	87.1	3290	334.5	TQ
1816	MNO-1992	455	489C	DBTG	166.3	8.2	114	3390	366.5	TQ
1817	MNO-1992	455	489D	DBTG	170.8	87	96.4	2690	246	PG
1818	MNO-1992	455	489E	DBTG	188.7	0.9	70.7	2830	112.6	MGM
1819	MNO-1992	455	489F	DBTG	124.5	87.1	179.7	3980	48.6	CD
1820	MNO-1992	455	489G	DBTG	166.4	8.2	122.2	3420	307.5	TQ
1821	MNO-1992	455	489H	DBTG	153.2	87.3	169.9	5070	113.3	CD
1822	MNO-1992	455	489I	DBTG	157.7	137.9	69.3	3140	174	PG
1823	MNO-1992	455	425A	DBTG	139.2	98.1	175.7	5130	160.4	CD/SV
1824	MNO-1992	455	425B	DBTG	190.2	0.6	56.9	3030	128.4	MGM

ITEM	SITE	ACC	CAT	DESCRIP	RB	SR	ZR	FE	MN	SOURCE
1825	MNO-1992	455	425C	DBTG	121.3	7.8	36.7	2400	157.5	MH
1826	MNO-1992	455	431A	DBTG	155.7	4.9	101.1	2700	266.2	TQ
1827	MNO-1992	455	431B	DBTG	219.1	1.2	81.2	3430	115.7	MGM/MC
1828	MNO-1992	455	431C	DBTG	192.1	39.7	103.2	2810	244.5	TQ
1829	MNO-1992	455	431D	DBTG	186.9	10.2	93.7	4050	397.3	TQ
1830	MNO-1992	455	431E	DBTG	164	66.4	148.7	5620	133.3	SV/CD
1831	18C-2	455	1019A	DBTG	182.5	26	69.3	3200	73.4	MGM
1832	18C-2	455	1019B	DBTG	193.6	8.1	92	4140	170.1	MGM/MC
1833	18C-2	455	1019C	DBTG	204.6	0.4	44.9	4140	146.2	MGM
1834	18C-2	455	1019D	DBTG	179.6	20.6	112.4	3110	301.2	TQ
1835	18C-2	455	1019E	DBTG	174.9	18.1	128.9	3160	276.7	TQ
1836	18C-2	455	1019F	DBTG	172.1	1.1	50.8	2860	115.8	MGM
1837	18C-2	455	1019G	DBTG	151.3	78.9	184.4	5800	189.1	CD
1838	18C-2	455	1061A	DBTG	143.6	19.4	55.5	2110	134.6	MH
1839	18C-2	455	1061B	DBTG	144.6	93.8	180.9	4430	88.3	CD
1840	18C-2	455	1061C	DBTG	174.4	21.5	94.8	2970	284.2	TQ
1841	18C-2	455	1061D	DBTG	179	5.5	115.8	4550	495.6	TQ
1842	18C-2	455	1061E	DBTG	206.8	1.4	72	2970	87.8	MGM
1843	22B-1	455	1051A	DBTG	209.1	5	79.1	2810	388.4	FS
1844	22B-1	455	1051B	DBTG	143.3	1.2	57.4	3820	198.2	MH
1845	22B-1	455	1051C	DBTG	198.2	1.2	77.7	3420	146.2	MGM
1846	22B-1	455	1051D	DBTG	131.1	1.5	63.4	3080	144.2	MH
1847	22B-1	455	1051E	DBTG	194.5	0.4	59.5	3070	78.4	MGM
1848	22B-1	455	1005A	DBTG	179.3	0.5	53.8	3560	110.1	MGM
1849	22B-1	455	1005B	DBTG	197.7	0.7	73.4	3390	96.2	MGM
1850	22B-1	467	919A	DBTG	149	104.5	190.4	4970	65.6	CD
1851	22B-1	467	921A	DBTG	171.6	137.8	227.9	9570	268.6	CD
1852	22B-1	467	921B	DBTG	185.7	3.7	90.7	4850	207.2	MGM/MC
1853	22B-1	467	921C	DBTG	159.4	92.5	208.8	5540	86.8	CD
1854	20C-1	455	1002A	DBTG	169.3	15.6	111.6	2800	296.8	TQ
1855	20C-1	455	1002B	DBTG	147	120.5	199.8	5370	129.4	CD
1856	20C-1	455	1002C	DBTG	150.7	64.6	154.6	6310	121.8	CD
1857	20C-1	455	1002D	DBTG	113.9	64.1	189.1	6810	155.3	CD
1858	20C-1	455	1002E	DBTG	126.8	54.2	149.2	6000	151.3	SV
1859	20C-1	455	1002F	DBTG	128.7	96.5	167.2	5380	96.9	CD
1860	20C-1	467	811A	DBTG	160.6	88	175.8	6600	167.4	CD
1861	20C-1	467	813A	DBTG	142.7	90.4	191.5	5350	99.2	CD
1862	20C-1	467	813B	DBTG	174	5.6	111.9	3750	401	TQ
1863	20C-1	467	814A	DBTG	129.7	106.8	183.1	7710	108.4	CD
1864	20C-1	467	814B	DBTG	209.7	1.1	74.2	3040	483.2	FS
1865	20C-1	467	815A	DBTG	129.4	73.9	177.1	7150	152.9	CD
1866	26B-1	455	1013A	DBTG	180.3	0.6	69.5	2630	95.9	MGM
1867	26B-1	455	1013B	DBTG	126.7	58	161.8	5390	123.5	SV/CD
1868	26B-1	455	1013C	DBTG	205.4	0.2	77.5	4760	190.1	MGM/MC
1869	26B-1	455	1013D	DBTG	208.8	11.3	124.1	4410	491.5	TQ
1870	26B-1	455	1013E	DBTG	185.8	0.2	57.6	3430	107.2	MGM
1871	26B-1	467	1292A	DBTG	356.3	0.8	79.2	3510	262.5	CO
1872	26B-1	467	1292B	DBTG	168.9	4.6	104.9	3270	351.4	TQ
1873	26B-1	467	1292C	DBTG	161.9	90.5	178.7	5420	95.5	CD
1874	26B-1	467	1292D	DBTG	186.4	1.8	58.4	2450	318.7	FS
1875	26B-1	467	1292E	DBTG	187.2	0.9	49.9	3270	131.4	MGM
1876	26B-1	467	1273A	DBTG	137.8	77.8	180.7	4800	88.1	CD
1877	26B-1	467	1273B	DBTG	197.1	1	50.9	2790	362.4	FS
1878	26B-1	467	1313A	DBTG	208.4	1.2	63.8	3090	360.8	FS
1879	26B-1	467	1313B	DBTG	267.2	1.5	91	4550	96.8	CO
1880	26B-1	467	1313C	DBTG	151.3	14	55.9	2560	141.5	MH
1881	26B-1	467	1313D	DBTG	205.1	1.6	73.5	2820	374.3	FS

ITEM	SITE	ACC	CAT	DESCRIP	RB	SR	ZR	FE	MN	SOURCE
1882	26B-1	467	1313E	DBTG	97.6	71.1	150.3	4540	60.1	SV/CD
1883	26B-1	467	1313F	DBTG	169.1	1.6	34.5	2350	333.2	FS
1884	14C-2	467	1136A	DBTG	209.4	0.9	82.4	5320	305	MGM/MC
1885	14C-2	467	1136B	DBTG	145.3	0.6	41.7	3140	116.4	MGM
1886	14C-2	467	1136C	DBTG	139.7	80.2	158.2	6510	154.2	SV/CD
1887	14C-2	467	1136D	DBTG	198	0.7	82.3	2970	83	MGM/MC
1888	14C-2	467	1136E	DBTG	192.7	0.6	62.4	3450	148.5	MGM
1889	18D-1	455	999A	DBTG	154.3	94.6	207.6	6350	91.7	CD
1890	18D-1	455	999B	DBTG	363.8	0.7	110.3	4410	108.8	CO
1891	18D-1	455	999C	DBTG	178.2	3.5	108.5	3270	320.2	TQ
1892	18D-1	455	999D	DBTG	137.7	85.2	168.2	6920	141	CD
1893	18D-1	455	999E	DBTG	190.5	1	93.2	3200	111.5	MC/MGM
1894	18D-1	455	999F	DBTG	154.7	63.4	154.6	6380	182.3	SV
1895	18D-1	455	999G	DBTG	136.3	59.6	158.8	5950	116.3	CD
1896	18D-1	455	999H	DBTG	128	89.6	188.1	7350	103.8	CD
1897	18D-1	455	999I	DBTG	158.7	28.2	71.4	3130	256.7	MH
1898	18D-1	467	1010A	DBTG	181.8	0.8	53	3490	100.1	MGM
1899	18D-1	467	1010B	DBTG	137.5	101.3	187.5	6770	191.5	CD
1900	18D-1	467	1010C	DBTG	131.7	70.2	183.2	6160	134.1	CD
1901	18D-1	467	1010D	DBTG	110.7	105.3	183	9070	191.8	CD
1902	18D-1	467	1010E	DBTG	146.6	30.8	64.6	4370	117.5	MGM
1903	18D-1	467	1010F	DBTG	170.5	31.4	109.7	3700	293.7	TQ
1904	18D-1	467	1010G	DBTG	165.2	104.1	198.8	6250	117.4	CD
1905	18D-1	467	1010H	DBTG	146.2	110.6	162.6	5390	144.3	CD/SV
1906	18D-1	467	1010I	DBTG	143.1	61.9	191.1	5930	120.5	CD
1907	18D-1	467	1010J	DBTG	140.1	149.1	179.7	7730	109.7	CD
1908	18D-1	467	1010K	DBTG	187.6	103.8	93.4	3670	239.4	BH
1909	18D-1	467	1010L	DBTG	168.2	118	112.7	4760	270.1	BH
1910	18D-1	467	1029A	DBTG	157.8	55.1	155.3	5300	135.6	SV/CD
1911	18D-1	467	1029B	DBTG	177.2	0.4	55.5	2760	105	MGM
1912	18D-1	467	1037A	DBTG	204	3	59.1	2780	404.3	FS
1913	18D-1	467	1037B	DBTG	188	6.3	117.1	4220	251.1	QI
1914	18D-1	467	1037C	DBTG	192.2	1.6	40.1	3270	93.5	MGM
1915	18D-1	467	1037D	DBTG	174.1	0.4	48.8	2890	91.6	MGM
1916	18D-1	467	1037E	DBTG	141.2	95.4	169.3	6160	115.7	CD
1917	18D-1	467	1037F	DBTG	91.5	288.2	167.2	3090	51.3	PG
1918	18D-1	467	1037G	DBTG	147.4	85.7	186.1	4900	83.8	CD
1919	18D-1	467	1041A	DBTG	142	72.8	167	4970	102.7	CD
1920	18D-1	467	1041B	DBTG	135.4	121.7	179.7	5010	94.2	CD
1921	14C-1	467	1649A	DBTG	129	78.1	176.5	5500	128.9	CD
1922	14C-1	467	1649B	DBTG	184.5	6.8	128.3	3440	354.9	TQ
1923	14C-1	467	1649C	DBTG	210.9	1.7	56.7	2680	383.4	FS
1924	14C-1	467	1649D	DBTG	164.4	98.9	186.4	5960	120.5	CD
1925	14C-1	467	1463A	DBTG	172.6	16	88	3640	371.3	TQ
1926	14C-1	467	1463B	DBTG	157.6	108.4	187.2	6210	127.1	CD
1927	14C-1	467	1469A	DBTG	181.1	0.2	60.5	3250	109.4	MGM
1928	14C-1	467	1469B	DBTG	180.9	0.5	80.3	3210	110.5	MGM/MC
1929	14C-1	467	1469C	DBTG	177.6	11.9	110.5	3270	324.4	TQ
1930	14C-1	467	1469D	DBTG	138.9	86.8	162.3	5440	115.6	CD
1931	14D-1	467	2678A	DBTG	138.4	77.6	152.8	5820	148.7	SV
1932	14D-1	467	2678B	DBTG	212.4	0.3	78.6	3800	168.6	MGM/MC
1933	14D-1	467	2678C	DBTG	128.7	56.6	124.4	4420	108	SV
1934	14D-1	467	2678D	DBTG	198.5	0.5	69.2	3630	126.2	MGM
1935	14D-1	467	2678E	DBTG	181.1	0.5	56.2	3130	119.5	MGM
1936	14D-1	467	2678F	DBTG	198.5	0.9	76.7	2990	144.4	MGM
1937	14D-1	467	2678G	DBTG	196.5	1.4	80.5	3580	115.7	MGM/MC
1938	14D-1	467	2678H	DBTG	182.3	3.3	82.8	3520	353.8	TQ

ITEM	SITE	ACC	CAT	DESCRIP	RB	SR	ZR	FE	MN	SOURCE
1939	14D-1	467	2678I	DBTG	159	2.6	91.4	4590	510.1	TQ
1940	14D-1	467	2757A	DBTG	203.7	82.2	76.2	4000	244.2	BH
1941	14D-1	467	2757B	DBTG	115.2	82.1	180.2	5080	102.6	CD
1942	14D-1	467	2757C	DBTG	149	6.1	114.7	3070	304.2	TQ
1943	14D-1	467	2770A	DBTG	150.3	8.3	93.3	3920	459	TQ
1944	14D-1	467	2770B	DBTG	193.8	0.2	69.9	3180	128.7	MGM
1945	14D-1	467	2770C	DBTG	165.7	10	86.6	3230	297.7	TQ
1946	14D-1	467	2770D	DBTG	155	71	149.1	5360	126.3	SV
1947	14D-1	467	2770E	DBTG	146.6	3.5	118.9	3150	319	TQ
1948	14D-1	467	2870A	DBTG	178.3	0.8	59.4	3590	84.6	MGM
1949	14D-1	467	2870B	DBTG	125	67.6	183.6	6100	158.2	CD
1950	14D-1	467	2870C	DBTG	120	67.9	146.3	5810	114.2	SV
1951	14D-1	467	2870D	DBTG	119.8	122.2	194.4	5770	142.4	CD
1952	14D-1	467	2870E	DBTG	203.1	5.7	113.3	3710	400.4	TQ
1953	14D-1	467	2870F	DBTG	163.4	0.4	64.1	2960	51.2	MGM
1954	10B-2	467	391A	DBTG	178.2	0.3	61.3	2840	77.4	MGM
1955	10B-2	467	391B	DBTG	237.3	5.6	83.7	6740	402.5	MGM/MC
1956	10B-2	467	391C	DBTG	179.2	0.6	37.7	2580	99	MGM
1957	10B-2	467	391D	DBTG	182.9	2.4	104.7	3520	402.2	TQ
1958	10B-2	467	391E	DBTG	137.6	75.1	171.5	6370	191.8	CD/SV
1959	10B-2	467	391F	DBTG	141.7	116	183.1	6980	151.9	CD
1960	10B-2	467	391G	DBTG	135	66.6	183.4	5470	102.2	CD
1961	10B-2	467	470A	DBTG	132.3	61.7	183.4	6970	145.9	CD
1962	10B-2	467	470B	DBTG	192.4	0.6	45.2	3420	138.8	MGM
1963	10B-2	467	470C	DBTG	167.3	96.7	168.1	5510	80.7	CD
1964	10B-2	467	470D	DBTG	174.4	0.6	51.4	3170	61.5	MGM
1965	10B-2	467	470E	DBTG	197.5	0.7	53.9	3420	108.8	MGM
1966	10B-2	467	34A	DBTG	127.7	75.5	177.4	5780	130.6	CD
1967	10B-2	467	34B	DBTG	177.4	3.7	106.1	3760	344	TQ
1968	10B-2	467	34C	DBTG	119.6	94.4	189.2	6370	127.3	CD
1969	10B-2	467	34D	DBTG	149	106.6	153.9	6730	160.1	SV
1970	10B-2	467	34E	DBTG	153.8	119.3	198.9	6610	185.7	CD
1971	10B-2	467	48A	DBTG	144	73	145.2	5000	73.2	CD
1972	14D-1	467	2929A	DBTG	151.8	83.9	173.6	6240	114.8	CD
1973	14D-1	467	2929B	DBTG	178.3	0.4	57.7	2990	86.8	MGM
1974	14D-1	467	2929C	DBTG	188.4	0.9	43	2930	102.2	MGM
1975	14D-1	467	2929D	DBTG	146.8	41.3	129.9	5000	105.8	SV
1976	14D-1	467	2929E	DBTG	133	78.1	178	5500	86	CD
1977	14D-1	467	2929F	DBTG	158.2	120.4	193.9	5730	152.5	CD
1978	14D-1	467	2929G	DBTG	130.5	115.8	162.4	4750	59.9	CD
1979	14D-1	467	2929H	DBTG	166.7	2	49.1	2000	39	MGM
1980	14D-1	467	2929I	DBTG	132.5	128.6	195.8	5240	106.4	CD
1981	14D-1	467	2929J	DBTG	207.3	0.9	51.4	3570	143.8	MGM
1982	10B-2	467	558A	DBTG	126.6	87.7	172.2	6310	147.7	CD
1983	10B-2	467	558B	DBTG	191.3	1.3	73.7	3240	122.1	MGM
1984	10B-2	467	558C	DBTG	137.2	113.9	164.7	4880	68.5	CD
1985	10B-2	467	558D	DBTG	175.4	0.4	64.3	3150	97.6	MGM
1986	2D-13	ENF	4	FRMFLKTL	168.3	0.7	68.7	3060	117.4	MGM
1987	5S-10	ENF	4	FLKTL	153.5	84.9	159.9	5540	93.7	CD
1988	533	455	859A	DBTG	148.1	74.7	161.7	4640	99.6	CD
1989	533	455	859B	DBTG	210	0.6	47.7	3420	102.3	MGM
1990	533	455	859C	DBTG	180.7	10.1	109.8	2990	317	TQ
1991	533	455	859D	DBTG	162.2	9	86.2	3510	320.4	TQ
1992	533	455	859E	DBTG	161.1	4.4	72.2	3190	297.6	MH/TQ
1993	533	455	859F	DBTG	173.5	27.5	120.9	3700	332.6	TQ
1994	533	455	859G	DBTG	167.7	3.2	119.1	4310	262.7	QI
1995	533	455	859H	DBTG	154.4	128.9	190.4	6430	143.7	CD

ITEM	SITE	ACC	CAT	DESCRIP	RB	SR	ZR	FE	MN	SOURCE
1996	533	455	859I	DBTG	189.3	24.7	109.5	3820	345.6	TQ
1997	533	455	859J	DBTG	129.1	56.2	137.4	4830	95.1	SV
1998	533	455	761A	DBTG	142.8	116.7	193.9	9600	313.2	CD
1999	533	455	761B	DBTG	164.6	0.7	53	3230	124.4	MGM
2000	533	455	761C	DBTG	168.7	0.6	73.9	3470	147	MGM
2001	533	455	761D	DBTG	108.8	95.6	190.4	6030	108.9	CD
2002	533	455	761E	DBTG	98.6	83.4	172.9	5580	153.4	SV/CD
2003	533	455	761F	DBTG	110.3	82.6	164.5	5730	133.2	SV/CD
2004	533	455	761G	DBTG	185.8	1.2	42.5	3360	116.3	MGM
2005	533	455	761H	DBTG	176.6	3.2	86.1	3760	103.1	MGM/MC
2006	533	455	761I	DBTG	156.3	145.5	191.2	4920	117.1	CD
2007	533	455	771A	DBTG	154.4	122.8	179.1	5280	125.2	CD
2008	533	455	771B	DBTG	155.8	64	159.1	5700	88.6	CD
2009	533	455	775A	DBTG	155.7	115.8	160	5630	83.7	CD
2010	533	455	775B	DBTG	104.8	372.3	144.7	2300	29.4	PG
2011	533	455	775C	DBTG	136.2	1.1	62.5	2960	71	MGM
2012	533	455	775D	DBTG	128.5	77.9	167	6270	87.8	CD
2013	533	455	775E	DBTG	142.3	85.8	77.3	2420	99.9	BH
2014	6D-8	ENF	12A	DBTG	184.9	0.8	41.7	2810	60.2	MGM
2015	6D-8	ENF	12B	DBTG	126.4	54.5	171.2	5250	111.5	CD
2016	6D-8	ENF	12C	DBTG	157.9	1	81.6	4390	208.6	MGM
2017	6D-8	ENF	12D	DBTG	141.7	115.9	229.4	9550	205.4	CD
2018	6D-8	ENF	12E	DBTG	129.6	70.7	168.2	5230	106.5	CD
2019	6D-8	ENF	12F	DBTG	184.1	0.5	77	3010	89	MGM
2020	6D-8	ENF	12G	DBTG	170.9	0.6	78.8	2780	125.8	MGM
2021	6D-8	ENF	12H	DBTG	120.9	117.1	195	6680	172.4	CD
2022	6D-8	ENF	12I	DBTG	171.6	1.6	94.6	5030	159.8	MC/MGM

APPENDIX B - SITE CHARACTERISTICS INVENTORY

APPENDIX B - SITE CHARACTERISTICS CODING SHEET

Site, Enfield or temporary survey number; Trinomial, state trinomial; Project, project of origin; UTM North, universal transverse mercator coordinate, northing; UTM East, universal transmercator coordinate, easting; Quad, Tableland spatial quadrant; Site Type, type classification; FLK, flaked stone; GRN, ground stone; SHE, pottery sherds; PET, petroglyphs; RS, rockshelter; M/S, midden/shell deposit; RR, rock ring; TF, threshing floor; BM, bedrock milling feature; FSV, Fish Slough Valley; ENF, Enfield; FAR, Far Western 1987-1989; UCD, University of California, Davis (present research); Site Type "1", simple lithic scatter; Site Type "2", complex lithic scatter; Site Type "3", residential camp; Site Type "4", milling station; Site Type "5", isolated structure; FSV "Y", site present in Fish Slough Valley; FSV "N", site on Tableland plateau.

Appendix B - Site Characteristics Inventory

Site	Trinomial	Project	UTM North	UTM East	Quad	Site Type	FLK	GRN	SHE	PET	RS	M/S	RR	TF	BM	FSV
E-17, A&B	MNO-7	ENF	4160000	376560	2	3	+	+	-	+	-	-	+	-	-	N
H-3, A	MNO-2317	ENF	4153320	376330	3	3	+	+	-	-	+	-	+	+	+	Y
H-3B	MNO-2305	ENF	4154680	376660	3	5	+	-	-	-	-	-	-	-	-	N
K-0	MNO-6	ENF	4152600	375050	3	3	+	+	+	+	-	M,S	-	+	+	Y
K-0B	MNO-2310	ENF	4154390	374680	3	3	+	+	-	-	-	-	-	+	+	N
G-25		ENF	4141740	370300	4	3	+	+	+	+	+	S	+	-	+	N
G-32	INY-3588	ENF	4141670	370000	4	2	+	+	+	-	-	-	-	-	+	N
H-5	MNO-2312	ENF	4162020	374060	2	3	+	+	+	+	-	-	+	-	+	N
H-21	MNO-2323	ENF	4166720	373670	2	1	+	-	+	+	-	-	-	-	-	N
L-14	MNO-5	ENF	4159000	374910	2	3	+	+	-	+	-	-	+	+	+	N
L-14C	MNO-2565	ENF	4157340	375730	2	1	+	-	+	-	-	-	-	-	-	N
Y-1	MNO-2566	ENF	4161190	373570	2	3	+	+	-	-	-	-	+	+	+	N
1U-20	INY-2467	ENF	4160940	374760	2	3	+	+	-	+	-	-	+	+	-	N
1W-3	MNO-2648	ENF	4158630	376420	2	3	+	+	+	+	-	S	+	+	+	N
1W-19	INY-3596	ENF	4141520	367420	4	3	+	-	-	-	-	-	+	+	+	N
1Z-17	MNO-2301	ENF	4156630	374070	2	3	+	+	+	-	-	-	+	+	+	N
2A-1	MNO-2326	ENF	4156890	374110	2	3	+	+	+	-	-	-	-	+	+	N
2A-14	MNO-2327	ENF	4156810	374740	2	3	+	+	-	-	-	-	+	+	+	N
2D-13	INY-3387	ENF	4145880	376840	3	3	+	+	+	-	-	-	+	+	+	N
3A-5	INY-400	ENF	4142430	373600	3	3	+	+	+	+	-	-	+	+	+	N
4L-11	INY-2526	ENF	4143800	367650	4	3	+	+	+	-	-	-	+	+	+	N
4L-13, A	INY-3398	ENF	4144340	362790	4	2	+	+	-	-	-	-	-	-	-	N
4T-17	MNO-2518	ENF	4143320	373680	3	2	+	+	+	-	-	-	-	-	-	N
5A-12	MNO-2569	ENF	4168360	370660	1	2	+	+	+	-	-	-	-	-	-	N
5B-2	MNO-2645	ENF	4168700	370710	1	2	+	+	-	-	-	-	-	-	+	N
5B-5	MNO-2646	ENF	4168600	371250	2	2	+	+	-	-	-	-	-	-	-	N
5B-8	MNO-2647	ENF	4167020	368300	1	2	+	+	+	-	-	-	-	-	+	N
5B-14	MNO-2592	ENF	4165130	370960	1	3	+	+	-	-	-	-	+	-	+	N
5B-16A	MNO-2322	ENF	4166420	371740	2	3	+	+	-	-	-	-	+	-	-	N
5B-18	MNO-2593	ENF	4165480	371870	2	3	+	+	-	+	-	-	+	+	+	N
5B-18A	MNO-2571	ENF	4164020	372090	2	4	+	+	-	-	-	-	-	+	+	N
5B-18C	MNO-2587	ENF	4163070	372260	2	4	+	+	-	-	-	-	-	-	+	N
5C-6	MNO-2594	ENF	4167810	372400	2	3	+	+	-	-	-	-	+	-	+	N

Appendix B - Site Characteristics Inventory

Site	Trinomial	Project	UTM North	UTM East	Quad	Site Type	FLK	GRN	SHE	PET	RS	M/S	RR	TF	BM	FSV
5C-19	INY-2380	ENF	4143000	365300	4	3	+	+	-	-	-	-	+	+	+	N
5C-20	INY-3397	ENF	4145260	365300	4	1	+	-	-	-	-	-	-	-	-	N
5D-3	INY-3402	ENF	4142680	366140	4	3	+	+	-	+	-	-	+	-	-	N
5G-17		ENF	4163750	370600	1	4	+	+	-	-	-	-	-	-	-	N
5R-19	MNO-2573	ENF	4161390	372430	2	4	+	+	-	-	-	-	+	-	+	N
5S-4	MNO-2585	ENF	4155730	373360	2	3	+	+	-	-	-	-	+	+	+	N
5S-6	MNO-1752	ENF	4156400	372375	2	3	+	+	-	-	-	-	-	+	+	N
5S-11	MNO-2321	ENF	4157600	370500	2	3	+	+	-	-	-	-	+	-	+	N
5S-12	MNO-2320	ENF	4158140	370270	2	3	+	+	+	-	-	-	+	+	+	N
5S-14	MNO-1747	ENF	4160400	367660	1	2	+	+	-	+	-	-	-	-	+	N
5T-16	MNO-2586	ENF	4163300	368270	1	3	+	+	-	-	-	-	+	-	+	N
5T-18	MNO-2595	ENF	4166260	368840	1	4	+	+	-	-	-	-	-	-	+	N
5T-19	MNO-2596	ENF	4166770	368260	1	2	+	+	-	+	-	-	-	-	+	N
5U-4	MNO-2316	ENF	4152130	373970	3	3	+	+	+	-	-	-	+	+	+	N
5U-4A	MNO-2578	ENF	4152470	373320	3	3	+	+	-	+	-	-	+	+	+	N
5U-4B	MNO-2318	ENF	4151850	373450	3	3	+	+	+	-	-	-	+	-	+	N
5U-4F	MNO-2315	ENF	4152840	373900	3	3	+	+	-	-	-	-	+	-	-	N
5U-4G	MNO-2314	ENF	4152810	373660	3	3	+	+	+	-	-	-	+	+	+	N
5U-5	MNO-2579	ENF	4157410	368240	1	4	+	+	-	-	-	-	-	-	-	N
5U-6	MNO-2491	ENF	4152600	366620	4	3	+	+	-	-	-	-	+	-	-	N
5U-8	INY-2599	ENF	4141720	367760	4	3	+	+	-	-	-	-	+	-	+	N
5U-8A	INY-2774	ENF	4142760	367820	4	1	+	+	-	-	-	-	-	-	-	N
5U-10	INY-398	ENF	4143620	373300	3	1	+	-	-	+	-	-	-	-	-	N
5U-11A	INY-3590	ENF	4141830	370920	3	4	+	+	-	-	-	-	-	-	+	N
5U-12	INY-3589	ENF	4141760	370660	4	3	+	+	+	+	-	-	+	+	+	N
5U-13	MNO-2737	ENF	4164150	375540	2	2	+	+	-	-	-	-	-	-	+	N
5U-13A	MNO-2738	ENF	4164350	375900	2	3	+	+	-	+	-	-	+	-	-	N
5U-14	MNO-2598	ENF	4166640	374930	2	1	+	+	-	-	-	-	-	-	-	N
5U-15	MNO-2599	ENF	4166490	374920	2	3	+	+	-	-	-	-	-	+	+	N
5V-15	INY-3593	ENF	4143100	374360	3	2	+	+	-	-	-	-	-	-	+	N
5V-20	INY-3390	ENF	4144440	373540	3	4	+	+	-	-	-	-	-	+	-	N
5V-21	INY-3391	ENF	4144980	373640	3	3	+	-	-	-	-	-	+	-	+	N
5V-25	INY-3393	ENF	4146910	373680	3	4	+	+	-	-	-	-	-	-	+	N

Appendix B - Site Characteristics Inventory

Site	Trinomial	Project	UTM North	UTM East	Quad	Site Type	FLK	GRN	SHE	PET	RS	M/S	RR	TF	BM	FSV
5W-3	MNO-1993	ENF	4147430	373890	3	3	+	+	-	-	-	-	+	-	-	N
5W-5	MNO-1994	ENF	4147630	373650	3	3	+	+	+	-	-	S	-	-	+	N
5W-5A		ENF	4147500	373550	3	4	+	+	-	-	-	-	-	+	+	N
5W-6, B	MNO-2026	ENF	4147520	373100	3	2	+	+	-	+	-	-	-	-	+	N
5W-8	MNO-2025	ENF	4147620	374080	3	3	+	-	-	-	+	S	+	+	+	N
5X-5	MNO-2012	ENF	4148370	371670	3	3	+	+	-	-	+	-	-	-	+	N
5Y-7	MNO-2104	ENF	4148300	370380	4	3	+	+	-	-	-	-	+	+	+	N
6D-8		ENF	4149300	375250	3	3	+	-	+	-	-	S	-	-	-	Y
6D-9		ENF	4149300	374650	3	3	+	+	-	-	-	-	+	-	+	Y
6E-16	MNO-2027	ENF	4150420	365900	4	3	+	+	-	-	-	-	+	-	+	N
6L-1	MNO-2016	ENF	4149700	368080	4	3	+	+	-	-	-	-	+	-	+	N
6Q-9	INY-2521	ENF	4142660	366540	4	3	+	+	-	-	-	-	+	-	+	N
6Q-12	INY-3385	ENF	4144500	365040	4	3	+	+	-	-	-	-	+	-	+	N
6X-1	INY-3395	ENF	4146280	371960	3	3	+	+	-	-	-	-	+	+	+	N
7P-4		ENF	4142240	373000	3	3	+	+	-	+	-	-	+	-	+	N
7Q-10	MNO-2020	ENF	4147100	371200	3	3	+	+	-	-	-	-	+	+	+	N
7Q-19	INY-3597	ENF	4141480	368020	4	3	+	+	+	-	-	-	+	-	+	N
7R-10	INY-2643	ENF	4144100	366520	4	1	+	-	-	-	-	-	-	-	+	N
7Y-12	MNO-2304	ENF	4156300	369520	1	3	+	+	-	-	-	-	+	+	+	N
7Z-2	MNO-2309	ENF	4153550	373590	3	3	+	+	-	-	-	-	+	-	+	N
8B-11	MNO-2581	ENF	4154980	372100	2	3	+	+	+	-	-	-	+	+	+	N
8B-15	MNO-2582	ENF	4154700	371810	2	3	+	+	-	-	-	-	+	-	+	N
8D-3	INY-3592	ENF	4142490	374850	3	2	+	+	-	-	-	-	-	-	+	N
8D-4	MNO-1753	ENF	4150480	373660	3	3	+	+	+	+	-	S	+	+	+	Y
8G-15	INY-3399	ENF	4143700	375300	3	2	+	+	-	-	-	-	-	-	+	Y
8H-11	INY-2653	ENF	4141360	370320	3	2	+	+	-	+	-	-	-	-	+	N
9G-4		ENF	4142980	366580	4	3	+	-	-	-	-	-	+	-	+	N
9M-9	INY-2527	ENF	4144420	368725	4	3	+	+	-	-	-	-	+	-	+	N
4I-20	INY-267	ENF	4142250	373790	3	3	+	+	+	+	-	-	+	-	+	N
5U-8B	INY-2775	ENF	4141940	367960	4	4	-	+	+	-	-	-	+	-	+	N
5B-18B	MNO-2572	ENF	4163370	372110	2	3	+	+	-	-	-	-	+	-	-	N
5X-9	MNO-2028	ENF	4148720	371320	3	2	+	+	-	-	+	-	-	-	+	N
R-17	MNO-2303	ENF	4155770	370150	1	1	+	-	-	+	-	-	-	-	-	N

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Site	Trinomial	Project	UTM North	UTM East	Quad	Site Type	FLK	GRN	SHE	PET	RS	M/S	RR	TF	BM	FSV
7Y-9	MNO-2306	ENF	4154680	371100	2	4	-	+	-	+	-	-	-	+	-	N
KO-A	MNO-2311	ENF	4154390	374570	2	3	+	+	-	-	-	-	+	-	+	N
L-14A	MNO-2564	ENF	4159600	374600	2	3	+	+	-	-	-	-	+	-	+	N
1Z-16	MNO-2568	ENF	4156260	373150	2	4	+	+	-	-	-	-	-	+	+	N
1Z-2	MNO-1745	ENF	4155625	373820	2	3	+	+	-	-	-	S	+	-	+	N
2D-5	INY-3386	ENF	4144100	376030	3	3	+	+	+	-	+	-	-	-	+	Y
2A-8	MNO-2335	ENF	4157240	374370	2	3	+	+	-	-	-	-	+	+	+	N
3R-5		ENF	4147380	370190	4	3	+	+	+	-	-	-	+	+	+	N
3D-8	INY-3598	ENF	4141690	372160	3	4	-	-	-	+	-	-	-	-	+	N
5B-9	MNO-2570	ENF	4164920	370400	1	3	+	+	+	-	-	-	+	-	+	N
4L-10	INY-2525	ENF	4145325	369475	4	3	+	+	-	-	-	-	+	-	+	N
5B-10	MNO-2591	ENF	4165140	370690	1	3	+	+	-	-	-	-	+	+	+	N
5R-13B		ENF	4149850	376800	3	4	+	+	+	-	-	-	-	+	+	N
5R-19A	MNO-2574	ENF	4160470	372770	2	3	+	+	-	-	+	-	+	-	+	N
5R-19B	MNO-2575	ENF	4161730	371790	2	4	-	-	-	-	-	-	-	+	+	N
5R-19C	MNO-2576	ENF	4161440	371540	2	3	+	+	-	-	-	-	+	-	-	N
5T-2	MNO-2577	ENF	4157200	367720	1	2	+	+	-	-	-	-	+	-	+	N
5T-19, A&B	MNO-2597	ENF	4166740	368190	1	3	+	+	-	-	+	-	-	-	-	N
5U-4E	MNO-2313	ENF	4153220	373420	3	3	+	+	-	-	-	-	+	-	+	N
5U-7	INY-3388	ENF	4146760	370480	4	4	+	-	-	-	-	-	-	+	+	N
5U-7A	INY-3389	ENF	4146100	370250	4	3	+	-	-	-	-	-	+	+	+	N
5U-16	MNO-2600	ENF	4167030	374900	2	1	+	+	-	-	-	-	-	-	-	N
5V-22	INY-3392	ENF	4145760	373650	3	4	+	+	-	-	-	-	-	-	+	N
5X-1	MNO-2011	ENF	4149940	368490	4	3	+	+	-	-	+	-	+	+	-	N
5X-3	INY-3394	ENF	4146240	369640	4	4	-	+	-	-	-	-	-	+	-	N
5X-3A	INY-4300	ENF	4146400	369780	4	4	-	+	-	-	-	-	-	+	-	N
5Y-15	MNO-2015	ENF	4149040	670540	4	4	-	-	-	-	-	-	-	-	+	N
5Z-5	INY-3401	ENF	4142040	372280	3	2	+	+	+	-	+	-	-	-	+	N
6Q-15	INY-3384	ENF	4144590	365120	4	3	+	+	-	-	-	-	+	-	+	N
6E-15	INY-3396	ENF	4142220	366240	4	4	-	+	-	-	-	-	-	-	+	N
6C-15	MNO-2580	ENF	4154190	370810	1	4	-	-	-	-	-	-	-	+	+	N
7Z-18	MNO-2308	ENF	4153620	373330	2	4	-	-	-	-	-	-	-	+	+	N
7Z-6	MNO-2307	ENF	4153740	373490	2	3	+	+	-	-	-	-	+	+	+	N

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Site	Trinomial	Project	UTM North	UTM East	Quad	Site Type	FLK	GRN	SHE	PET	RS	M/S	RR	TF	BM	FSV
7Q-11	INY-2644	ENF	4143600	368350	4	3	+	+	-	-	-	-	+	+	+	N
7E-19	MNO-2601	ENF	4167000	372800	2	1	+	+	-	-	-	-	-	-	-	N
7P-7	MNO-2302	ENF	4156280	374170	2	3	+	+	+	-	-	-	+	+	+	N
8G-20	INY-3591	ENF	4146520	376300	3	1	+	-	-	-	-	-	-	-	-	Y
8G-19	INY-2829	ENF	4144740	375930	3	2	+	+	+	-	-	-	-	-	+	Y
8B-15A	MNO-2583	ENF	4153520	373010	3	3	+	+	-	-	-	-	+	+	+	N
9NN-9	INY-3587	ENF	4143170	371000	3	1	+	-	-	-	-	-	-	-	-	N
9E-11	MNO-1751	ENF	4156460	371850	2	4	+	+	-	-	-	-	-	+	+	N
9N-4	MNO-2300	ENF	4156610	375550	2	3	+	+	-	-	-	-	+	+	+	N
9N-10	MNO-2584	ENF	4158380	375330	2	3	+	+	-	-	-	-	+	-	+	N
H-0	MNO-2328	ENF	4152170	374960	3	4	+	+	-	-	-	-	-	+	+	Y
5R-13, A	MNO-1992	FAR	4149050	376150	3	3	+	+	+	-	-	M,S	+	+	+	Y
5C-8A	MNO-2189	FAR	4167790	371300	2	3	+	+	+	+	-	M,S	+	-	+	N
5B-16	MNO-2190	FAR	4166150	372000	2	3	+	+	+	-	-	M,S	+	+	+	N
5B-6	MNO-2464	FAR	4165500	370150	1	2	+	+	-	-	-	-	-	-	+	N
5S-13	MNO-2465	FAR	4158750	367150	1	3	+	+	+	+	-	M,S	+	+	+	N
6S-1	INY-399	FAR	4143500	374600	3	3	+	+	+	+	+	M,S	-	-	-	N
FSCAVE	MNO-2381	FAR	4152000	376300	3	3	+	+	+	-	+	M,S	-	-	-	Y
4C-1		UCD	4155335	376085	2	4	+	+	-	-	-	-	-	+	+	N
10A-2		UCD	4152465	373925	3	2	+	+	-	+	-	-	-	-	-	N
10B-1		UCD	4152025	374400	3	1	+	-	-	-	-	S	-	-	-	Y
10B-2		UCD	4151975	375225	3	3	+	+	-	-	-	M,S	-	-	-	Y
12A-1		UCD	4151425	375000	3	2	+	+	-	-	-	S	-	-	-	Y
12A-2		UCD	4151275	375000	3	4	+	+	-	-	-	S	-	-	-	Y
12B-1		UCD	4151450	375130	3	1	+	-	-	-	-	-	-	-	-	Y
12C-1		UCD	4151375	377000	3	4	+	+	-	-	-	-	-	+	-	N
12C-2		UCD	4151450	376205	3	3	+	+	-	-	-	M,S	-	-	+	Y
14C-1		UCD	4150085	376300	3	3	+	+	-	-	-	M,S	-	-	-	Y
14C-2		UCD	4150215	376220	3	2	+	+	-	-	-	-	-	-	-	Y
14D-1		UCD	415035	376035	3	3	+	+	+	-	+	M,S	-	-	-	Y
16B-1		UCD	4149075	374625	3	1	+	-	-	-	-	-	-	-	-	Y
16B-2		UCD	4149275	374625	3	4	+	+	-	-	-	-	-	-	-	Y
16C-1		UCD	4149000	375000	3	1	+	+	-	-	-	-	-	-	-	Y

Appendix B - Site Characteristics Inventory

Site	Trinomial	Project	UTM North	UTM East	Quad	Site Type	FLK	GRN	SHE	PET	RS	M/S	RR	TF	BM	FSV
18C-1		UCD	4148375	376225	3	1	+	-	-	-	-	-	-	-	-	Y
18C-2		UCD	4148025	376915	3	1	+	-	-	-	-	-	-	-	-	Y
18C-3		UCD	4148025	376550	3	2	+	+	-	-	-	-	-	-	-	Y
18D-1		UCD	4148025	376550	3	1	+	-	-	-	-	-	-	-	-	Y
20A-1		UCD	4147100	374225	3	1	+	-	-	-	-	-	-	-	-	N
20C-1		UCD	4147375	376000	3	1	+	-	-	-	-	-	-	-	-	Y
20C-2		UCD	4147465	376850	3	3	+	+	+	-	-	M	+	+	+	N
20C-3		UCD	4147225	376950	3	4	-	+	-	-	-	-	+	+	+	N
22B-1		UCD	4146275	375925	3	1	+	-	-	-	-	-	-	-	-	Y
22C-1		UCD	4146225	376000	3	1	+	-	-	-	-	-	-	-	-	Y
24A-1		UCD	4145325	374725	3	2	+	+	+	-	-	-	-	-	+	N
24C-1		UCD	4145475	376915	3	4	-	+	-	-	-	-	-	+	+	N
26B-1		UCD	4144475	375725	3	2	+	+	-	-	-	-	-	-	-	Y
533		UCD	4147225	375865	3	3	+	+	-	-	-	-	-	-	-	Y
2-A	MNO-2588	CSU	4169125	369250	1	1	+	+	-	-	-	-	-	-	-	N
2-B		CSU	4169060	368830	1	2	+	+	-	-	-	-	-	-	-	N
4-A		CSU	4166025	367300	1	3	+	+	-	-	-	M,S	-	-	+	N
4-B		CSU	4166012	368840	1	1	+	-	-	-	-	-	-	-	-	N
6-A		CSU	4163000	366725	1	3	+	+	-	-	-	M	-	-	-	N
8-A		CSU	4163075	374600	2	3	+	+	-	+	-	-	+	-	+	N
9-A		CSU	4160100	368775	1	5	-	+	-	-	-	-	+	-	-	N
10-B		CSU	4160040	373960	2	1	+	-	-	-	-	-	-	-	-	N
16-A		CSU	4151060	364025	4	1	+	-	-	-	-	-	-	-	-	N
20-A		CSU	4148150	363350	4	3	+	+	+	+	-	M,S	+	+	+	N
23-A		CSU	4147085	375240	3	1	+	-	-	-	-	-	-	-	-	N
24-A		CSU	4147125	375975	3	1	+	-	-	-	-	-	-	-	-	Y
24-B		CSU	4147000	376000	3	1	+	-	-	-	-	-	-	-	-	Y
24-C		CSU	4147060	376025	3	1	+	-	-	-	-	-	-	-	-	Y
28-A	ENF 5C16	CSU	4142075	365815	4	3	+	+	-	-	-	M	+	+	+	N
30-A		CSU	4142060	374800	4	3	+	+	-	-	-	M	-	-	-	N
30-B		CSU	4142050	374050	4	2	+	+	-	-	-	-	-	-	-	N

APPENDIX C - OBSIDIAN SOURCE AND HYDRATION DATA

APPENDIX C - OBSIDIAN SOURCE AND HYDRATION DATA CODING SHEET

Site, state trinomial, Enfield site number, or temporary survey number; ACC, catalogue accession number; CAT#, artifact catalogue number; Unit Type, collection unit type; Artifact, description category; Visual, visual source assignment; XRF, XRF source assignment; Source, final source classification; H1M, hydration band 1 mean; H2M, hydration band 2 mean; Quad, Tableland spatial quadrant; Site Type, type classification; CSC, controlled surface collection unit; EXC, excavation unit;SS, surface scrape unit; SUR, piece-plot collection; BIFACE, biface; CORE, core; DBTG, debitage; DRILL, drill; FLKTL, simple flake tool; FRMFLKTL, formed flake tool; PRJPT, projectile point; PTBLNK, point blank; BO, Bodie Hills; CD, Casa Diablo; CO, Coso; FS, Fish Springs; I, indeterminate; M, undifferentiated Mono; MC, Mono Craters; MGM, Mono Glass Mountain; MH, Mt. Hicks; QI, Queen Impostor; SV, Saline Valley; TQ, Truman-Queen; multiple abbreviations in SOURCE column divided by / indicates indeterminate assignment; DH, diffuse hydration; Site Type "1", simple lithic scatter; Site Type "2", complex lithic scatter; Site Type "3", residential camp; Site Type "4", milling station; Site Type "5", isolated structure.

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
10A-2	455	1026	CSC	PRJPT	FS	FS	FS			3	2
10A-2	455	1027	CSC	FRMFLKTL	I	SV	SV	4.0		3	2
10A-2	455	1040	CSC	PRJPT	I	FS	FS	6.7		3	2
10A-2	455	1041	CSC	FLKTL	TQ	-	TQ			3	2
10A-2	455	1042	CSC	FLKTL	TQ	-	TQ			3	2
10A-2	455	1043A	CSC	DBTG	I	MC/MGM	M	10.4		3	2
10A-2	455	1043B	CSC	DBTG	I	CD	CD			3	2
10A-2	455	1043C	CSC	DBTG	I	MH	MH	10.0		3	2
10A-2	455	1043D	CSC	DBTG	I	CD	CD	6.4		3	2
10A-2	455	1043E	CSC	DBTG	I	TQ	TQ	6.3		3	2
10A-2	455	1043F	CSC	DBTG	I	TQ	TQ			3	2
10A-2	455	1043G	CSC	DBTG	I	MGM	MG	10.3		3	2
10A-2	455	1043H	CSC	DBTG	CD	-	CD	6.4		3	2
10A-2	455	1043I	CSC	DBTG	TQ	-	TQ	10.1		3	2
10A-2	455	1043J	CSC	DBTG	TQ	-	TQ			3	2
10A-2	455	1043K	CSC	DBTG	TQ	-	TQ			3	2
10A-2	455	1043L	CSC	DBTG	TQ	-	TQ			3	2
10A-2	455	1043M	CSC	DBTG	TQ	-	TQ			3	2
10A-2	455	1043N	CSC	DBTG	TQ	-	TQ			3	2
10A-2	455	1043O	CSC	DBTG	TQ	-	TQ			3	2
10A-2	455	1043P	CSC	DBTG	-	-	I	5.9		3	2
10A-2	455	1043Q	CSC	DBTG	-	-	I	DH		3	2
10A-2	455	1043R	CSC	DBTG	-	-	I	6.9		3	2
10-B	474	64A	CSC	DBTG	I	MGM	MG	1.7		2	1
10-B	474	64B	CSC	DBTG	I	CD	CD	1.7		2	1
10-B	474	64C	CSC	DBTG	I	CD	CD	1.5		2	1
10-B	474	64D	CSC	DBTG	I	CD	CD			2	1
10-B	474	64E	CSC	DBTG	I	CD	CD			2	1
10-B	474	64F	CSC	DBTG	I	CD	CD			2	1
10-B	474	64G	CSC	DBTG	I	CD	CD			2	1
10-B	474	64H	CSC	DBTG	CD	-	CD			2	1
10-B	474	64I	CSC	DBTG	CD	-	CD			2	1
10-B	474	64J	CSC	DBTG	CD	-	CD	2.0		2	1
10B-2	467	1	SUR	FLKTL	CD	-	CD			3	3
10B-2	455	1104	SUR	PRJPT	I	CD	CD			3	3
10B-2	455	1105	SUR	PRJPT	I	CD	CD			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
10B-2	455	1106	SUR	PRJPT	I	SV	SV			3	3
10B-2	455	1107	SUR	PRJPT	TQ	-	TQ	5.3		3	3
10B-2	455	1108	SUR	PRJPT	TQ	-	TQ	5.3		3	3
10B-2	467	115	EXC	BIFACE	TQ	-	TQ			3	3
10B-2	467	129	EXC	FLKTL	CD	-	CD			3	3
10B-2	467	14	SUR	PRJPT	I	SV/MH	I	8.8		3	3
10B-2	467	15	SUR	FLKTL	I	SV/CD	I			3	3
10B-2	467	152A	EXC	DBTG	-	-	I	4.3		3	3
10B-2	467	152B	EXC	DBTG	-	-	I	3.5		3	3
10B-2	467	152C	EXC	DBTG	-	-	I	6.4		3	3
10B-2	467	152D	EXC	DBTG	-	-	I	4.4		3	3
10B-2	467	152E	EXC	DBTG	-	-	I	4.7		3	3
10B-2	467	16	SUR	FLKTL	TQ	-	TQ			3	3
10B-2	467	162	CSC	PRJPT	I	TQ	TQ			3	3
10B-2	467	163	CSC	FRMFLKTL	CD	-	CD	4.6		3	3
10B-2	467	164	CSC	FLKTL	TQ	-	TQ			3	3
10B-2	467	165	CSC	FLKTL	I	SV	SV			3	3
10B-2	467	166	CSC	FLKTL	TQ	-	TQ			3	3
10B-2	467	167	CSC	FLKTL	I	MH/MGM	I			3	3
10B-2	467	168	CSC	FLKTL	I	MH	MH			3	3
10B-2	467	17	SUR	FLKTL	TQ	-	TQ			3	3
10B-2	467	175	CSC	PRJPT	TQ	-	TQ	5.3		3	3
10B-2	467	176	CSC	PRJPT	TQ	-	TQ	4.1		3	3
10B-2	467	177	CSC	PRJPT	TQ	-	TQ	5.3		3	3
10B-2	467	178	CSC	FLKTL	TQ	-	TQ			3	3
10B-2	467	179	CSC	FLKTL	CD	-	CD			3	3
10B-2	467	18	SUR	FLKTL	I	MH	MH			3	3
10B-2	467	180	CSC	BIFACE	I	MH	MH			3	3
10B-2	467	181	CSC	BIFACE	CD	-	CD			3	3
10B-2	467	182	CSC	FLKTL	I	CD	CD			3	3
10B-2	467	183	CSC	BIFACE	CD	-	CD	6.3		3	3
10B-2	467	184	CSC	BIFACE	I	TQ	TQ			3	3
10B-2	467	185	CSC	FLKTL	I	CD	CD			3	3
10B-2	467	186A	CSC	DBTG	TQ	-	TQ	3.8		3	3
10B-2	467	186B	CSC	DBTG	TQ	-	TQ	5.7		3	3
10B-2	467	186C	CSC	DBTG	TQ	-	TQ	5.8		3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
10B-2	467	186D	CSC	DBTG	TQ	-	TQ	4.6		3	3
10B-2	467	19	SUR	BIFACE	TQ	-	TQ			3	3
10B-2	467	191	CSC	PRJPT	TQ	-	TQ			3	3
10B-2	467	192	CSC	BIFACE	I	MGM	MG			3	3
10B-2	467	196	CSC	PRJPT	TQ	-	TQ			3	3
10B-2	467	199	CSC	BIFACE	TQ	-	TQ			3	3
10B-2	467	2	SUR	FLKTL	CD	-	CD			3	3
10B-2	467	200	CSC	BIFACE	TQ	-	TQ			3	3
10B-2	467	202	CSC	FLKTL	TQ	-	TQ			3	3
10B-2	467	203	CSC	FLKTL	I	MGM	MG			3	3
10B-2	467	204	CSC	FLKTL	I	MGM	MG			3	3
10B-2	467	207	CSC	PRJPT	I	SV	SV	4.8		3	3
10B-2	467	208	CSC	BIFACE	TQ	-	TQ	1.6		3	3
10B-2	467	209	CSC	BIFACE	I	MH/MGM	I	6.3		3	3
10B-2	467	210	CSC	BIFACE	TQ	-	TQ			3	3
10B-2	467	211	CSC	BIFACE	TQ	-	TQ			3	3
10B-2	467	212	CSC	BIFACE	I	MH	MH			3	3
10B-2	467	213	CSC	FLKTL	CD	-	CD			3	3
10B-2	467	214	CSC	FLKTL	CD	-	CD			3	3
10B-2	467	215	CSC	FLKTL	I	CD	CD			3	3
10B-2	467	216	CSC	PTBLNK	I	MH	MH	6.2		3	3
10B-2	467	217	CSC	FLKTL	I	CD	CD			3	3
10B-2	467	218	CSC	FLKTL	I	MH	MH			3	3
10B-2	467	223	CSC	BIFACE	TQ	-	TQ			3	3
10B-2	467	224	CSC	BIFACE	TQ	-	TQ			3	3
10B-2	467	225	CSC	FLKTL	TQ	-	TQ			3	3
10B-2	467	226	CSC	FLKTL	I	MGM	MG			3	3
10B-2	467	239	CSC	PRJPT	TQ	-	TQ	5.3		3	3
10B-2	467	24	SUR	PRJPT	TQ	-	TQ	5.3		3	3
10B-2	467	240	CSC	PRJPT	CD	-	CD	7.1		3	3
10B-2	467	241	CSC	PRJPT	TQ	-	TQ	5.3		3	3
10B-2	467	242	CSC	FLKTL	I	MGM	MG			3	3
10B-2	467	243	CSC	FLKTL	I	MGM	MG			3	3
10B-2	467	244	CSC	FLKTL	I	MC/MGM	M			3	3
10B-2	467	258	CSC	BIFACE	TQ	-	TQ	DH		3	3
10B-2	467	259	CSC	BIFACE	I	MGM	MG	5.2		3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
10B-2	467	26	SUR	FLKTL	I	SV	SV			3	3
10B-2	467	260	CSC	FLKTL	I	SV	SV			3	3
10B-2	467	261	CSC	BIFACE	I	MH/MGM	I			3	3
10B-2	467	262	CSC	BIFACE	I	MH	MH			3	3
10B-2	467	269	CSC	PRJPT	I	MH	MH	7.1		3	3
10B-2	467	27	SUR	PRJPT	TQ	-	TQ	4.1		3	3
10B-2	467	270	CSC	BIFACE	CD	-	CD			3	3
10B-2	467	271	CSC	FLKTL	CD	-	CD			3	3
10B-2	467	273	CSC	BIFACE	CD	-	CD			3	3
10B-2	467	28	SUR	BIFACE	CD	-	CD	3.7		3	3
10B-2	467	283	CSC	PRJPT	TQ	-	TQ	5.3		3	3
10B-2	467	284	CSC	PRJPT	CD	-	CD	5.4		3	3
10B-2	467	285	CSC	PRJPT	I	MH	MH	7.0		3	3
10B-2	467	286	CSC	BIFACE	TQ	-	TQ	5.2		3	3
10B-2	467	287	CSC	BIFACE	TQ	-	TQ			3	3
10B-2	467	289	CSC	FLKTL	I	MGM	MG			3	3
10B-2	467	29	SUR	BIFACE	CD	-	CD	2.2		3	3
10B-2	467	295	CSC	PRJPT	I	SV	SV	5.4		3	3
10B-2	467	296	CSC	PRJPT	I	MH	MH	5.8		3	3
10B-2	467	297	CSC	BIFACE	TQ	-	TQ			3	3
10B-2	467	298	CSC	BIFACE	I	MH	MH			3	3
10B-2	467	299	CSC	BIFACE	I	MH	MH			3	3
10B-2	467	3	SUR	PRJPT	I	SV	SV			3	3
10B-2	467	300	CSC	BIFACE	I	MGM	MG			3	3
10B-2	467	301	CSC	BIFACE	CD	-	CD			3	3
10B-2	467	302	CSC	FLKTL	TQ	-	TQ			3	3
10B-2	467	303	CSC	FLKTL	TQ	-	TQ			3	3
10B-2	467	312	CSC	PRJPT	I	MH	MH	1.8		3	3
10B-2	467	313	CSC	BIFACE	TQ	-	TQ			3	3
10B-2	467	317	CSC	PRJPT	TQ	-	TQ	5.6		3	3
10B-2	467	318	CSC	PRJPT	I	MH	MH	6.5		3	3
10B-2	467	319	CSC	PRJPT	I	MH	MH			3	3
10B-2	467	320	CSC	PRJPT	I	MH	MH			3	3
10B-2	467	321	CSC	BIFACE	I	MGM	MG	6.3		3	3
10B-2	467	322	CSC	BIFACE	I	MGM/MH	I			3	3
10B-2	467	323	CSC	BIFACE	I	SV	SV			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
10B-2	467	325	CSC	FLKTL	CD	-	CD			3	3
10B-2	467	326	CSC	FLKTL	CD	-	CD			3	3
10B-2	467	327	CSC	FLKTL	TQ	-	TQ			3	3
10B-2	467	33	EXC	BIFACE	CD	-	CD			3	3
10B-2	467	332	CSC	FLKTL	I	MGM	MG			3	3
10B-2	467	336	CSC	PRJPT	TQ	-	TQ	1.8		3	3
10B-2	467	337	CSC	PRJPT	I	MH	MH			3	3
10B-2	467	338	CSC	BIFACE	CD	-	CD	9.0		3	3
10B-2	467	339	CSC	FLKTL	CD	-	CD			3	3
10B-2	467	345	CSC	PRJPT	TQ	-	TQ	6.1		3	3
10B-2	467	346	CSC	PRJPT	I	MH	MH	5.4		3	3
10B-2	467	347	CSC	PRJPT	TQ	-	TQ			3	3
10B-2	467	348	CSC	BIFACE	CD	-	CD	5.3	3.1	3	3
10B-2	467	349	CSC	FLKTL	TQ	-	TQ			3	3
10B-2	467	34A	EXC	DBTG	I	CD	CD	8.4		3	3
10B-2	467	34B	EXC	DBTG	I	TQ	TQ	3.0		3	3
10B-2	467	34C	EXC	DBTG	I	CD	CD	3.4		3	3
10B-2	467	34D	EXC	DBTG	I	SV	SV			3	3
10B-2	467	34E	EXC	DBTG	I	CD	CD			3	3
10B-2	467	34F	EXC	DBTG	TQ	-	TQ			3	3
10B-2	467	34G	EXC	DBTG	TQ	-	TQ			3	3
10B-2	467	354	CSC	PRJPT	TQ	-	TQ	5.4		3	3
10B-2	467	355	CSC	PRJPT	I	MH	MH	6.5		3	3
10B-2	467	356	CSC	PRJPT	TQ	-	TQ	6.5		3	3
10B-2	467	357	CSC	PRJPT	I	MH	MH			3	3
10B-2	467	358	CSC	BIFACE	TQ	-	TQ			3	3
10B-2	467	363	CSC	PRJPT	TQ	-	TQ	5.2		3	3
10B-2	467	364	CSC	PRJPT	TQ	-	TQ			3	3
10B-2	467	365	CSC	BIFACE	CD	-	CD			3	3
10B-2	467	366	CSC	BIFACE	I	MGM	MG	4.4		3	3
10B-2	467	367	CSC	FLKTL	CD	-	CD			3	3
10B-2	467	368	CSC	FLKTL	CD	-	CD			3	3
10B-2	467	369	CSC	FLKTL	I	MGM	MG			3	3
10B-2	467	370	CSC	FLKTL	CD	-	CD			3	3
10B-2	467	380	CSC	BIFACE	I	MH	MH			3	3
10B-2	467	381	CSC	BIFACE	TQ	-	TQ			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
10B-2	467	382	CSC	FLKTL	TQ	-	TQ			3	3
10B-2	467	383	CSC	FLKTL	I	MGM	MG			3	3
10B-2	467	384	CSC	FLKTL	TQ	-	TQ			3	3
10B-2	467	385	CSC	FLKTL	TQ	-	TQ			3	3
10B-2	467	386	CSC	FLKTL	I	SV	SV			3	3
10B-2	467	387	CSC	FLKTL	TQ	-	TQ			3	3
10B-2	467	388	CSC	FLKTL	CD	-	CD			3	3
10B-2	467	389	CSC	FLKTL	CD	-	CD			3	3
10B-2	467	391A	CSC	DBTG	I	MGM	MG			3	3
10B-2	467	391B	CSC	DBTG	I	MGM/MC	M	5.3		3	3
10B-2	467	391C	CSC	DBTG	I	MGM	MG	5.7		3	3
10B-2	467	391D	CSC	DBTG	I	TQ	TQ	5.1		3	3
10B-2	467	391E	CSC	DBTG	I	CD/SV	I			3	3
10B-2	467	391F	CSC	DBTG	I	CD	CD	5.4		3	3
10B-2	467	391G	CSC	DBTG	I	CD	CD			3	3
10B-2	467	391H	CSC	DBTG	TQ	-	TQ	5.9		3	3
10B-2	467	391I	CSC	DBTG	TQ	-	TQ			3	3
10B-2	467	391J	CSC	DBTG	TQ	-	TQ			3	3
10B-2	467	391L	CSC	DBTG	TQ	-	TQ			3	3
10B-2	467	391M	CSC	DBTG	TQ	-	TQ			3	3
10B-2	467	391N	CSC	DBTG	TQ	-	TQ			3	3
10B-2	467	391O	CSC	DBTG	TQ	-	TQ			3	3
10B-2	467	39IK	CSC	DBTG	TQ	-	TQ			3	3
10B-2	467	4	SUR	BIFACE	I	MH	MH			3	3
10B-2	467	400	CSC	PRJPT	TQ	-	TQ	5.4		3	3
10B-2	467	401	CSC	BIFACE	TQ	-	TQ			3	3
10B-2	467	402	CSC	BIFACE	I	MGM	MG			3	3
10B-2	467	403	CSC	FLKTL	I	MH	MH			3	3
10B-2	467	410	CSC	PRJPT	I	TQ	TQ			3	3
10B-2	467	411	CSC	BIFACE	CD	-	CD			3	3
10B-2	467	412	CSC	BIFACE	I	MGM	MG	4.7		3	3
10B-2	467	419	CSC	FLKTL	I	SV	SV			3	3
10B-2	467	430	EXC	BIFACE	I	MH	MH			3	3
10B-2	467	431	EXC	BIFACE	CD	-	CD	5.0		3	3
10B-2	467	432	EXC	BIFACE	I	MH	MH			3	3
10B-2	467	443	EXC	PRJPT	TQ	-	TQ	DH		3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
10B-2	467	444	EXC	BIFACE	I	MGM/MC	M			3	3
10B-2	467	461	EXC	BIFACE	CD	-	CD			3	3
10B-2	467	462	EXC	BIFACE	CD	-	CD	4.6		3	3
10B-2	467	463	EXC	BIFACE	CD	-	CD			3	3
10B-2	467	469	EXC	PRJPT	TQ	-	TQ			3	3
10B-2	467	470A	EXC	DBTG	I	CD	CD			3	3
10B-2	467	470B	EXC	DBTG	I	MGM	MG			3	3
10B-2	467	470C	EXC	DBTG	I	CD	CD			3	3
10B-2	467	470D	EXC	DBTG	I	MGM	MG			3	3
10B-2	467	470E	EXC	DBTG	I	MGM	MG			3	3
10B-2	467	470F	EXC	DBTG	TQ	-	TQ			3	3
10B-2	467	470G	EXC	DBTG	TQ	-	TQ			3	3
10B-2	467	470H	EXC	DBTG	TQ	-	TQ			3	3
10B-2	467	470I	EXC	DBTG	TQ	-	TQ			3	3
10B-2	467	470J	EXC	DBTG	TQ	-	TQ			3	3
10B-2	467	470K	EXC	DBTG	TQ	-	TQ			3	3
10B-2	467	470L	EXC	DBTG	TQ	-	TQ			3	3
10B-2	467	470M	EXC	DBTG	TQ	-	TQ			3	3
10B-2	467	470N	EXC	DBTG	TQ	-	TQ			3	3
10B-2	467	470O	EXC	DBTG	TQ	-	TQ			3	3
10B-2	467	470P	EXC	DBTG	-	-	I	6.4		3	3
10B-2	467	470Q	EXC	DBTG	-	-	I	5.6		3	3
10B-2	467	470R	EXC	DBTG	-	-	I	5.1		3	3
10B-2	467	470S	EXC	DBTG	-	-	I	4.9		3	3
10B-2	467	470T	EXC	DBTG	-	-	I	5.2		3	3
10B-2	467	482	EXC	PTBLNK	CD	-	CD	3.6		3	3
10B-2	467	48A	EXC	DBTG	I	CD	CD			3	3
10B-2	467	48B	EXC	DBTG	TQ	-	TQ	5.2		3	3
10B-2	467	48C	EXC	DBTG	TQ	-	TQ			3	3
10B-2	467	48D	EXC	DBTG	TQ	-	TQ			3	3
10B-2	467	48E	EXC	DBTG	TQ	-	TQ			3	3
10B-2	467	501	CSC	PRJPT	TQ	-	TQ			3	3
10B-2	467	502	CSC	PRJPT	I	MH	MH	5.3		3	3
10B-2	467	503	CSC	BIFACE	TQ	-	TQ			3	3
10B-2	467	504	CSC	BIFACE	I	TQ	TQ			3	3
10B-2	467	505	CSC	BIFACE	I	CD	CD	5.5		3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
10B-2	467	506	CSC	FRMFLKTL	CD	-	CD	5.0		3	3
10B-2	467	507	CSC	FLKTL	TQ	-	TQ			3	3
10B-2	467	508	CSC	FLKTL	I	MH	MH			3	3
10B-2	467	509	CSC	FLKTL	TQ	-	TQ			3	3
10B-2	467	510	CSC	FLKTL	CD	-	CD			3	3
10B-2	467	511	CSC	FLKTL	I	MGM	MG			3	3
10B-2	467	512	CSC	FLKTL	I	MGM	MG			3	3
10B-2	467	516	CSC	PRJPT	TQ	-	TQ			3	3
10B-2	467	517	CSC	PRJPT	TQ	-	TQ	6.0		3	3
10B-2	467	518	CSC	PRJPT	TQ	-	TQ			3	3
10B-2	467	519	CSC	FLKTL	CD	-	CD			3	3
10B-2	467	520	CSC	FLKTL	TQ	-	TQ			3	3
10B-2	467	521	CSC	FLKTL	TQ	-	TQ			3	3
10B-2	467	522	CSC	FLKTL	TQ	-	TQ			3	3
10B-2	467	530	CSC	FLKTL	TQ	-	TQ			3	3
10B-2	467	531	CSC	FLKTL	TQ	-	TQ			3	3
10B-2	467	539	CSC	BIFACE	I	MH	MH			3	3
10B-2	467	540	CSC	FLKTL	TQ	-	TQ			3	3
10B-2	467	541	CSC	FLKTL	I	MGM	MG			3	3
10B-2	467	542	CSC	FLKTL	I	MGM	MG			3	3
10B-2	467	543	CSC	FLKTL	I	MGM	MG			3	3
10B-2	467	553	CSC	PRJPT	CD	-	CD	8.0		3	3
10B-2	467	554	CSC	PRJPT	I	MH/MGM	I	5.3		3	3
10B-2	467	555	CSC	BIFACE	TQ	-	TQ			3	3
10B-2	467	556	CSC	BIFACE	TQ	-	TQ			3	3
10B-2	467	557	CSC	BIFACE	TQ	-	TQ			3	3
10B-2	467	558A	CSC	DBTG	I	CD	CD	6.2		3	3
10B-2	467	558B	CSC	DBTG	I	MGM	MG	6.4		3	3
10B-2	467	558C	CSC	DBTG	I	CD	CD			3	3
10B-2	467	558D	CSC	DBTG	I	MGM	MG	7.0		3	3
10B-2	467	558E	CSC	DBTG	TQ	-	TQ	5.5		3	3
10B-2	467	558F	CSC	DBTG	TQ	-	TQ			3	3
10B-2	467	558G	CSC	DBTG	TQ	-	TQ			3	3
10B-2	467	558H	CSC	DBTG	TQ	-	TQ			3	3
10B-2	467	558I	CSC	DBTG	TQ	-	TQ			3	3
10B-2	467	558J	CSC	DBTG	TQ	-	TQ			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
10B-2	467	558K	CSC	DBTG	TQ	-	TQ			3	3
10B-2	467	558L	CSC	DBTG	TQ	-	TQ			3	3
10B-2	467	558M	CSC	DBTG	TQ	-	TQ			3	3
10B-2	467	567	CSC	BIFACE	TQ	-	TQ			3	3
10B-2	467	568	CSC	FLKTL	CD	-	CD			3	3
10B-2	467	569	CSC	FLKTL	I	MH	MH			3	3
10B-2	467	570	CSC	FLKTL	I	MGM	MG			3	3
10B-2	467	571	CSC	FLKTL	TQ	-	TQ			3	3
10B-2	467	581	CSC	BIFACE	TQ	-	TQ			3	3
10B-2	467	582	CSC	FLKTL	I	MGM	MG			3	3
10B-2	467	583	CSC	FLKTL	TQ	-	TQ			3	3
10B-2	467	589	CSC	PRJPT	TQ	-	TQ	5.7		3	3
10B-2	467	590	CSC	PRJPT	TQ	-	TQ	5.3		3	3
10B-2	467	591	CSC	BIFACE	TQ	-	TQ			3	3
10B-2	467	592	CSC	BIFACE	TQ	-	TQ			3	3
10B-2	467	593	CSC	BIFACE	CD	-	CD			3	3
10B-2	467	594	CSC	FLKTL	TQ	-	TQ			3	3
10B-2	467	603	CSC	PRJPT	CD	-	CD	5.4		3	3
10B-2	467	604	CSC	BIFACE	TQ	-	TQ			3	3
10B-2	467	605	CSC	BIFACE	CD	-	CD			3	3
10B-2	467	631	EXC	BIFACE	CD	-	CD			3	3
10B-2	467	642	EXC	FLKTL	TQ	-	TQ			3	3
10B-2	467	643	EXC	FLKTL	CD	-	CD			3	3
10B-2	467	644	EXC	FLKTL	I	SV	SV			3	3
10B-2	467	677A	EXC	DBTG	-	-	I	5.8		3	3
10B-2	467	677B	EXC	DBTG	-	-	I	7.2		3	3
10B-2	467	677C	EXC	DBTG	-	-	I	6.6		3	3
10B-2	467	677D	EXC	DBTG	-	-	I	7.4		3	3
10B-2	467	677E	EXC	DBTG	-	-	I	4.7		3	3
10B-2	467	687	EXC	PRJPT	CD	-	CD	6.0		3	3
10B-2	467	693	CSC	FLKTL	I	MH	MH			3	3
10B-2	467	695	CSC	BIFACE	TQ	-	TQ			3	3
10B-2	467	7	SUR	BIFACE	I	MGM	MG	5.3		3	3
10B-2	467	8	SUR	BIFACE	CD	-	CD			3	3
12C-2	455	1055A	CSC	DBTG	I	SV	SV			3	3
12C-2	455	1055B	CSC	DBTG	I	MGM	MG	7.3		3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
12C-2	455	1055C	CSC	DBTG	I	CD	CD	7.5		3	3
12C-2	455	1055D	CSC	DBTG	I	CD	CD	4.0		3	3
12C-2	455	1055E	CSC	DBTG	I	TQ	TQ	3.2		3	3
12C-2	455	1055F	CSC	DBTG	I	MGM	MG	3.1		3	3
12C-2	455	1055G	CSC	DBTG	I	CD	CD			3	3
12C-2	455	1055H	CSC	DBTG	I	MGM	MG			3	3
12C-2	455	1055I	CSC	DBTG	I	TQ	TQ			3	3
12C-2	455	1055J	CSC	DBTG	I	TQ	TQ			3	3
12C-2	455	1055K	CSC	DBTG	TQ	-	TQ			3	3
12C-2	455	1055L	CSC	DBTG	TQ	-	TQ			3	3
12C-2	455	1055M	CSC	DBTG	TQ	-	TQ			3	3
12C-2	455	1055N	CSC	DBTG	CD	-	CD			3	3
12C-2	455	1055O	CSC	DBTG	TQ	-	TQ			3	3
12C-2	455	1055P	CSC	DBTG	TQ	-	TQ	4.8		3	3
12C-2	455	1055Q	CSC	DBTG	TQ	-	TQ	10.1		3	3
12C-2	455	1055R	CSC	DBTG	TQ	-	TQ	7.0		3	3
12C-2	455	1055S	CSC	DBTG	TQ	-	TQ	3.6		3	3
12C-2	455	917	SUR	PRJPT	TQ	-	TQ	9.8		3	3
12C-2	455	920	CSC	PRJPT	I	MH	MH	1.9		3	3
12C-2	455	922	CSC	DRILL	I	-	I			3	3
12C-2	455	923	CSC	FLKTL	I	MGM/MC	M			3	3
12C-2	455	924	CSC	FLKTL	CD	-	CD			3	3
12C-2	455	925	CSC	FLKTL	I	TQ/FS	I			3	3
12C-2	455	928	CSC	FRMFLKTL	CD	-	CD	8.2	4.0	3	3
12C-2	455	930	SUR	PRJPT	CD	-	CD	6.0		3	3
12C-2	455	931	SUR	PRJPT	TQ	-	TQ	4.4		3	3
12C-2	455	933	CSC	FLKTL	TQ	-	TQ			3	3
14C-1	467	1400	SUR	PRJPT	TQ	-	TQ	6.3		3	3
14C-1	467	1401	SUR	PRJPT	I	MGM	MG			3	3
14C-1	467	1402	SUR	PRJPT	CD	-	CD			3	3
14C-1	467	1403	SUR	PRJPT	CD	-	CD	DH		3	3
14C-1	467	1405	SUR	PRJPT	I	SV	SV			3	3
14C-1	467	1406	SUR	BIFACE	CD	-	CD	5.7		3	3
14C-1	467	1407	SUR	BIFACE	CD	-	CD	6.0		3	3
14C-1	467	1408	SUR	DRILL	I	SV	SV			3	3
14C-1	467	1409	SUR	FRMFLKTL	I	MH	MH	7.2		3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
14C-1	467	1410	SUR	PRJPT	I	MH	MH	5.3		3	3
14C-1	467	1411	SUR	PRJPT	I	CD	CD			3	3
14C-1	467	1412	SUR	FLKTL	I	MH/MGM	I			3	3
14C-1	467	1413	SUR	BIFACE	TQ	-	TQ			3	3
14C-1	467	1414	SUR	BIFACE	TQ	-	TQ			3	3
14C-1	467	1415	SUR	PRJPT	TQ	-	TQ	5.5		3	3
14C-1	467	1416	SUR	BIFACE	TQ	-	TQ	5.5		3	3
14C-1	467	1417	SUR	BIFACE	I	MGM	MG	5.9		3	3
14C-1	467	1418	SUR	BIFACE	CD	-	CD	5.4		3	3
14C-1	467	1420	SUR	FLKTL	I	TQ	TQ			3	3
14C-1	467	1421	SUR	BIFACE	I	TQ	TQ			3	3
14C-1	467	1422	SUR	BIFACE	I	MGM	MG			3	3
14C-1	467	1423	SUR	BIFACE	I	MH	MH			3	3
14C-1	467	1424	SUR	PRJPT	TQ	-	TQ			3	3
14C-1	467	1425	SUR	PRJPT	TQ	-	TQ	5.3		3	3
14C-1	467	1426	SUR	PRJPT	TQ	-	TQ			3	3
14C-1	467	1435	CSC	BIFACE	CD	-	CD			3	3
14C-1	467	1436	CSC	BIFACE	TQ	-	TQ			3	3
14C-1	467	1442	CSC	BIFACE	TQ	-	TQ			3	3
14C-1	467	1443	CSC	BIFACE	I	MH	MH			3	3
14C-1	467	1444	CSC	BIFACE	TQ	-	TQ			3	3
14C-1	467	1447	CSC	FRMFLKTL	CD	-	CD	6.7		3	3
14C-1	467	1448	CSC	FLKTL	TQ	-	TQ			3	3
14C-1	467	1452	CSC	PTBLNK	I	MGM	MG	DH		3	3
14C-1	467	1453	CSC	BIFACE	TQ	-	TQ			3	3
14C-1	467	1456	CSC	BIFACE	I	TQ	TQ			3	3
14C-1	467	1457	CSC	BIFACE	TQ	-	TQ	4.1		3	3
14C-1	467	1461	CSC	PRJPT	I	MH	MH	2.5		3	3
14C-1	467	1463A	CSC	DBTG	I	TQ	TQ			3	3
14C-1	467	1463B	CSC	DBTG	I	CD	CD			3	3
14C-1	467	1463C	CSC	DBTG	TQ	-	TQ	5.4		3	3
14C-1	467	1463D	CSC	DBTG	TQ	-	TQ			3	3
14C-1	467	1463E	CSC	DBTG	TQ	-	TQ			3	3
14C-1	467	1463F	CSC	DBTG	TQ	-	TQ			3	3
14C-1	467	1466	CSC	PRJPT	TQ	-	TQ			3	3
14C-1	467	1467	CSC	FLKTL	I	CD	CD			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
14C-1	467	1469A	CSC	DBTG	I	MGM	MG	5.3		3	3
14C-1	467	1469B	CSC	DBTG	I	MGM/MC	M	5.4		3	3
14C-1	467	1469C	CSC	DBTG	I	TQ	TQ	4.0		3	3
14C-1	467	1469D	CSC	DBTG	I	CD	CD	6.9		3	3
14C-1	467	1469E	CSC	DBTG	TQ	-	TQ	5.3		3	3
14C-1	467	1469F	CSC	DBTG	TQ	-	TQ			3	3
14C-1	467	1469G	CSC	DBTG	TQ	-	TQ			3	3
14C-1	467	1469H	CSC	DBTG	TQ	-	TQ			3	3
14C-1	467	1469I	CSC	DBTG	-	-	I	7.1		3	3
14C-1	467	1469J	CSC	DBTG	-	-	I	5.8		3	3
14C-1	467	1469K	CSC	DBTG	-	-	I	4.7		3	3
14C-1	467	1469L	CSC	DBTG	-	-	I	6.1		3	3
14C-1	467	1470	CSC	PRJPT	TQ	-	TQ	5.1		3	3
14C-1	467	1471	CSC	BIFACE	CD	-	CD			3	3
14C-1	467	1472	CSC	BIFACE	I	MH/TQ	I			3	3
14C-1	467	1473	CSC	BIFACE	TQ	-	TQ			3	3
14C-1	467	1474	CSC	BIFACE	I	TQ	TQ			3	3
14C-1	467	1477	CSC	BIFACE	TQ	-	TQ			3	3
14C-1	467	1478	CSC	BIFACE	I	MH	MH			3	3
14C-1	467	1479	CSC	FLKTL	I	TQ	TQ			3	3
14C-1	467	1486	CSC	PRJPT	TQ	-	TQ			3	3
14C-1	467	1487	CSC	FLKTL	TQ	-	TQ			3	3
14C-1	467	1488	CSC	FLKTL	TQ	-	TQ			3	3
14C-1	467	1489	CSC	FLKTL	TQ	-	TQ			3	3
14C-1	467	1490	CSC	FLKTL	TQ	-	TQ			3	3
14C-1	467	1494	CSC	PRJPT	TQ	-	TQ	DH	1.4	3	3
14C-1	467	1495	CSC	BIFACE	I	MGM	MG			3	3
14C-1	467	1496	CSC	FLKTL	I	MGM/MH	I			3	3
14C-1	467	1502	CSC	BIFACE	CD	-	CD			3	3
14C-1	467	1503	CSC	FLKTL	TQ	-	TQ			3	3
14C-1	467	1507	CSC	FLKTL	TQ	-	TQ			3	3
14C-1	467	1507A	CSC	DBTG	TQ	-	TQ	3.6		3	3
14C-1	467	1507B	CSC	DBTG	TQ	-	TQ	3.5		3	3
14C-1	467	1507C	CSC	DBTG	TQ	-	TQ	4.0		3	3
14C-1	467	1507D	CSC	DBTG	TQ	-	TQ	3.9		3	3
14C-1	467	1510	CSC	FLKTL	CD	-	CD			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
14C-1	467	1525	CSC	BIFACE	TQ	-	TQ	4.7		3	3
14C-1	467	1526	CSC	BIFACE	I	MGM	MG			3	3
14C-1	467	1527	CSC	FRMFLKTL	I	MGM	MG	7.9		3	3
14C-1	467	1535	CSC	FRMFLKTL	FS	FS	FS	9.2		3	3
14C-1	467	1536	CSC	FLKTL	I	MGM	MG			3	3
14C-1	467	1537	CSC	FLKTL	TQ	-	TQ			3	3
14C-1	467	1541	CSC	PRJPT	CD	-	CD			3	3
14C-1	467	1542	CSC	BIFACE	CD	-	CD	7.4		3	3
14C-1	467	1543	CSC	BIFACE	TQ	-	TQ			3	3
14C-1	467	1544	CSC	BIFACE	I	SV/BH	I			3	3
14C-1	467	1545	CSC	BIFACE	CD	-	CD			3	3
14C-1	467	1546	CSC	BIFACE	CD	-	CD			3	3
14C-1	467	1548	CSC	FLKTL	I	MGM	MG			3	3
14C-1	467	1549	CSC	FLKTL	TQ	-	TQ			3	3
14C-1	467	1553	CSC	FLKTL	TQ	-	TQ			3	3
14C-1	467	1554	CSC	PTBLNK	TQ	-	TQ	3.7		3	3
14C-1	467	1558	CSC	BIFACE	TQ	-	TQ			3	3
14C-1	467	1559	CSC	BIFACE	CD	-	CD			3	3
14C-1	467	1560	CSC	BIFACE	TQ	-	TQ			3	3
14C-1	467	1561	CSC	FLKTL	TQ	-	TQ			3	3
14C-1	467	1562	CSC	FLKTL	TQ	-	TQ			3	3
14C-1	467	1563	CSC	FLKTL	I	MGM	MG			3	3
14C-1	467	1564	CSC	FLKTL	I	PG	PG			3	3
14C-1	467	1571	EXC	PRJPT	TQ	-	TQ			3	3
14C-1	467	1572	EXC	FLKTL	CD	-	CD			3	3
14C-1	467	1590	EXC	BIFACE	I	FS	FS			3	3
14C-1	467	1591	EXC	BIFACE	I	SV	SV			3	3
14C-1	467	1592	EXC	BIFACE	I	MGM	MG			3	3
14C-1	467	1593A	EXC	DBTG	-	-	I	6.7		3	3
14C-1	467	1593B	EXC	DBTG	-	-	I	5.9		3	3
14C-1	467	1593C	EXC	DBTG	-	-	I	6.4		3	3
14C-1	467	1593D	EXC	DBTG	-	-	I	6.7		3	3
14C-1	467	1593E	EXC	DBTG	-	-	I	8.0		3	3
14C-1	467	1615	EXC	FLKTL	CD	-	CD			3	3
14C-1	467	1631	EXC	BIFACE	I	MGM	MG			3	3
14C-1	467	1640	EXC	BIFACE	I	PG/SV	I			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
14C-1	467	1641	EXC	BIFACE	TQ	-	TQ			3	3
14C-1	467	1642	EXC	FRMFLKTL	TQ	-	TQ	1.3		3	3
14C-1	467	1643	EXC	FLKTL	TQ	-	TQ			3	3
14C-1	467	1647	EXC	BIFACE	I	-	I			3	3
14C-1	467	1649A	EXC	DBTG	I	CD	CD			3	3
14C-1	467	1649B	EXC	DBTG	I	TQ	TQ			3	3
14C-1	467	1649C	EXC	DBTG	I	FS	FS			3	3
14C-1	467	1649D	EXC	DBTG	I	CD	CD			3	3
14C-1	467	1649E	EXC	DBTG	TQ	-	TQ			3	3
14C-1	467	1649F	EXC	DBTG	TQ	-	TQ			3	3
14C-1	467	1649G	EXC	DBTG	TQ	-	TQ			3	3
14C-1	467	1649H	EXC	DBTG	CD	-	CD			3	3
14C-1	467	1649I	EXC	DBTG	TQ	-	TQ			3	3
14C-1	467	1649J	EXC	DBTG	TQ	-	TQ			3	3
14C-1	467	1649K	EXC	DBTG	TQ	-	TQ			3	3
14C-1	467	1649L	EXC	DBTG	TQ	-	TQ			3	3
14C-1	467	1649M	EXC	DBTG	TQ	-	TQ			3	3
14C-1	467	1649N	EXC	DBTG	TQ	-	TQ			3	3
14C-1	467	1649O	EXC	DBTG	TQ	-	TQ			3	3
14C-1	467	1649P	EXC	DBTG	-	-	I	5.7		3	3
14C-1	467	1649Q	EXC	DBTG	-	-	I	4.6		3	3
14C-1	467	1649R	EXC	DBTG	-	-	I	4.9		3	3
14C-1	467	1649S	EXC	DBTG	-	-	I	4.7		3	3
14C-1	467	1649T	EXC	DBTG	-	-	I	4.9		3	3
14C-2	455	1072	SUR	BIFACE	I	CD	CD			3	1
14C-2	455	1073	SUR	PRJPT	CD	-	CD			3	1
14C-2	455	1074	CSC	PRJPT	TQ	-	TQ	6.1		3	1
14C-2	455	1075	CSC	PRJPT	TQ	-	TQ			3	1
14C-2	455	1076	CSC	PRJPT	TQ	-	TQ			3	1
14C-2	455	1077	CSC	BIFACE	CD	-	CD			3	1
14C-2	455	1078	CSC	BIFACE	TQ	-	TQ			3	1
14C-2	455	1079	CSC	BIFACE	CD	-	CD			3	1
14C-2	455	1080	CSC	BIFACE	TQ	-	TQ			3	1
14C-2	455	1081	CSC	FRMFLKTL	I	SV	SV	9.2		3	1
14C-2	455	1082	CSC	FRMFLKTL	I	SV/CD	I	8.7		3	1
14C-2	455	1083	CSC	FLKTL	TQ	-	TQ			3	1

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
14C-2	455	1084	CSC	FLKTL	CD	-	CD			3	1
14C-2	455	1085	CSC	FLKTL	I	MGM	MG			3	1
14C-2	455	1086	CSC	FLKTL	I	MGM	MG			3	1
14C-2	455	1087	CSC	FLKTL	I	MH	MH			3	1
14C-2	455	1088	CSC	BIFACE	CD	-	CD	7.9		3	1
14C-2	455	1089A	CSC	DBTG	TQ	-	TQ	7.3		3	1
14C-2	455	1089B	CSC	DBTG	TQ	-	TQ	5.9		3	1
14C-2	455	1089C	CSC	DBTG	TQ	-	TQ	10.1		3	1
14C-2	455	1089D	CSC	DBTG	TQ	-	TQ	6.6		3	1
14C-2	455	1094	CSC	BIFACE	I	TQ	TQ			3	1
14C-2	455	1095	CSC	BIFACE	I	SV	SV			3	1
14C-2	455	1096	CSC	FRMFLKTL	CD	-	CD	8.9		3	1
14C-2	455	1097	CSC	FLKTL	TQ	-	TQ			3	1
14C-2	455	1098	CSC	FLKTL	I	MH	MH			3	1
14C-2	467	1102	CSC	PRJPT	I	MH	MH			3	1
14C-2	467	1124	EXC	BIFACE	TQ	-	TQ			3	1
14C-2	467	1125	EXC	FLKTL	CD	-	CD			3	1
14C-2	467	1126	EXC	FLKTL	I	MGM	MG			3	1
14C-2	467	1127	EXC	FLKTL	TQ	-	TQ			3	1
14C-2	467	1128	EXC	FLKTL	CD	-	CD			3	1
14C-2	467	1136A	EXC	DBTG	I	MGM/MC	M	10.0		3	1
14C-2	467	1136B	EXC	DBTG	I	MGM	MG	8.7		3	1
14C-2	467	1136C	EXC	DBTG	I	SV/CD	I	8.3		3	1
14C-2	467	1136D	EXC	DBTG	I	MGM/MC	M			3	1
14C-2	467	1136E	EXC	DBTG	I	MGM	MG			3	1
14C-2	467	1136F	EXC	DBTG	TQ	-	TQ			3	1
14C-2	467	1136G	EXC	DBTG	TQ	-	TQ	6.3		3	1
14C-2	467	1136H	EXC	DBTG	TQ	-	TQ	7.8		3	1
14C-2	467	1136I	EXC	DBTG	TQ	-	TQ			3	1
14C-2	467	1136J	EXC	DBTG	TQ	-	TQ			3	1
14C-2	467	1136K	EXC	DBTG	TQ	-	TQ			3	1
14C-2	467	1136L	EXC	DBTG	TQ	-	TQ			3	1
14C-2	467	1136M	EXC	DBTG	TQ	-	TQ			3	1
14C-2	467	1136N	EXC	DBTG	TQ	-	TQ			3	1
14C-2	467	1136O	EXC	DBTG	TQ	-	TQ	7.7		3	1
14C-2	467	1136P	EXC	DBTG	-	-	I	11.7		3	1

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
14C-2	467	1136Q	EXC	DBTG	-	-	I	DH		3	1
14C-2	467	1136R	EXC	DBTG	-	-	I	8.8		3	1
14C-2	467	1136S	EXC	DBTG	-	-	I	11.3		3	1
14C-2	467	1136T	EXC	DBTG	-	-	I	6.6		3	1
14C-2	467	1142	EXC	BIFACE	TQ	-	TQ			3	1
14C-2	467	1143	EXC	BIFACE	CD	-	CD			3	1
14C-2	467	1144	EXC	FRMFLKTL	CD	-	CD	6.6		3	1
14C-2	467	1145	EXC	FLKTL	TQ	-	TQ			3	1
14C-2	467	1146	EXC	FLKTL	TQ	-	TQ			3	1
14C-2	467	1161	EXC	PRJPT	CD	-	CD	6.3		3	1
14D-1	467	2500	SUR	BIFACE	I	CD	CD			3	3
14D-1	467	2501	SUR	PRJPT	CD	-	CD			3	3
14D-1	467	2502	SUR	PRJPT	I	SV	SV	7.6		3	3
14D-1	467	2503	SUR	PRJPT	I	MGM	MG	6.0		3	3
14D-1	467	2504	SUR	CORE	TQ	-	TQ	7.8		3	3
14D-1	467	2506	SUR	PRJPT	I	TQ	TQ	4.2		3	3
14D-1	467	2507	SUR	PRJPT	TQ	-	TQ	6.0		3	3
14D-1	467	2508	SUR	PRJPT	I	MH/MGM	I	10.2		3	3
14D-1	467	2509	SUR	PRJPT	CD	-	CD	8.0		3	3
14D-1	467	2510	SUR	BIFACE	CD	-	CD	3.9		3	3
14D-1	467	2511	SUR	PTBLNK	CD	-	CD	1.3		3	3
14D-1	467	2512	SUR	PRJPT	TQ	-	TQ			3	3
14D-1	467	2515	SUR	FLKTL	I	MGM	MG			3	3
14D-1	467	2516	SUR	PRJPT	TQ	-	TQ	DH		3	3
14D-1	467	2517	SUR	BIFACE	CD	-	CD	3.9		3	3
14D-1	467	2519	SUR	BIFACE	CD	-	CD	4.8		3	3
14D-1	467	2520	SUR	BIFACE	CD	-	CD	6.0		3	3
14D-1	467	2521	SUR	BIFACE	I	MGM	MG			3	3
14D-1	467	2522	SUR	FRMFLKTL	TQ	-	TQ	4.7		3	3
14D-1	467	2523	SUR	PRJPT	CD	-	CD	1.9		3	3
14D-1	467	2524	SUR	BIFACE	I	MGM	MG			3	3
14D-1	467	2525	SUR	PRJPT	TQ	-	TQ	2.7		3	3
14D-1	467	2527	SUR	FLKTL	I	MGM	MG			3	3
14D-1	467	2528	SUR	DRILL	CD	-	CD			3	3
14D-1	467	2529	SUR	PRJPT	I	MGM	MG	2.0		3	3
14D-1	467	2531	CSC	BIFACE	I	MH/MGM	I			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
14D-1	467	2539	CSC	PRJPT	CD	-	CD			3	3
14D-1	467	2540	CSC	PRJPT	TQ	-	TQ			3	3
14D-1	467	2541	CSC	BIFACE	CD	-	CD	6.8		3	3
14D-1	467	2542	CSC	BIFACE	I	MGM	MG	6.4		3	3
14D-1	467	2543	CSC	BIFACE	TQ	-	TQ			3	3
14D-1	467	2544	CSC	BIFACE	TQ	-	TQ			3	3
14D-1	467	2550	CSC	BIFACE	I	MH	MH			3	3
14D-1	467	2551	CSC	FLKTL	TQ	-	TQ			3	3
14D-1	467	2552	CSC	FLKTL	I	MH	MH			3	3
14D-1	467	2554	CSC	DRILL	TQ	-	TQ			3	3
14D-1	467	2562	CSC	BIFACE	I	TQ	TQ			3	3
14D-1	467	2568	CSC	BIFACE	I	MGM	MG			3	3
14D-1	467	2569	CSC	BIFACE	CD	-	CD			3	3
14D-1	467	2570	CSC	BIFACE	TQ	-	TQ			3	3
14D-1	467	2572	CSC	FRMFLKTL	CD	-	CD	NMB		3	3
14D-1	467	2578	CSC	BIFACE	TQ	-	TQ			3	3
14D-1	467	2579	CSC	BIFACE	TQ	-	TQ			3	3
14D-1	467	2581	CSC	FLKTL	I	MGM	MG			3	3
14D-1	467	2582	CSC	FLKTL	TQ	-	TQ			3	3
14D-1	467	2583	CSC	FLKTL	I	CD	CD			3	3
14D-1	467	2584	CSC	BIFACE	TQ	-	TQ			3	3
14D-1	467	2592	CSC	FLKTL	TQ	-	TQ			3	3
14D-1	467	2594	CSC	PRJPT	TQ	-	TQ	5.0		3	3
14D-1	467	2595	CSC	BIFACE	I	MH	MH			3	3
14D-1	467	2596	CSC	FLKTL	TQ	-	TQ			3	3
14D-1	467	2597	CSC	FLKTL	TQ	-	TQ			3	3
14D-1	467	2598	CSC	FLKTL	TQ	-	TQ			3	3
14D-1	467	2604	CSC	BIFACE	I	MGM	MG			3	3
14D-1	467	2605	CSC	BIFACE	I	MH	MH			3	3
14D-1	467	2609	EXC	BIFACE	CD	-	CD			3	3
14D-1	467	2610	EXC	FLKTL	TQ	-	TQ			3	3
14D-1	467	2648	EXC	FLKTL	I	MGM	MG			3	3
14D-1	467	2653	EXC	FLKTL	I	MGM	MG			3	3
14D-1	467	2664	EXC	BIFACE	I	MGM	MG	5.2		3	3
14D-1	467	2669	EXC	BIFACE	TQ	-	TQ			3	3
14D-1	467	2670	EXC	BIFACE	TQ	-	TQ			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
14D-1	467	2671	EXC	BIFACE	CD	-	CD			3	3
14D-1	467	2672	EXC	BIFACE	I	SV	SV			3	3
14D-1	467	2673	EXC	BIFACE	CD	-	CD			3	3
14D-1	467	2674	EXC	FLKTL	TQ	-	TQ			3	3
14D-1	467	2677	EXC	PTBLNK	CD	-	CD	2.0	12.4	3	3
14D-1	467	2678A	EXC	DBTG	I	SV	SV			3	3
14D-1	467	2678B	EXC	DBTG	I	MGM/MC	M			3	3
14D-1	467	2678C	EXC	DBTG	I	SV	SV			3	3
14D-1	467	2678D	EXC	DBTG	I	MGM	MG			3	3
14D-1	467	2678E	EXC	DBTG	I	MGM	MG			3	3
14D-1	467	2678F	EXC	DBTG	I	MGM	MG			3	3
14D-1	467	2678G	EXC	DBTG	I	MGM/MC	M			3	3
14D-1	467	2678H	EXC	DBTG	I	TQ	TQ			3	3
14D-1	467	2678I	EXC	DBTG	I	TQ	TQ			3	3
14D-1	467	2678J	EXC	DBTG	TQ	-	TQ			3	3
14D-1	467	2678K	EXC	DBTG	TQ	-	TQ			3	3
14D-1	467	2678L	EXC	DBTG	CD	-	CD			3	3
14D-1	467	2678M	EXC	DBTG	TQ	-	TQ			3	3
14D-1	467	2678N	EXC	DBTG	TQ	-	TQ			3	3
14D-1	467	2678O	EXC	DBTG	TQ	-	TQ			3	3
14D-1	467	2688	EXC	BIFACE	TQ	-	TQ			3	3
14D-1	467	2694	EXC	BIFACE	I	MH	MH			3	3
14D-1	467	2695	EXC	BIFACE	I	MH	MH			3	3
14D-1	467	2696	EXC	BIFACE	CD	-	CD			3	3
14D-1	467	2697	EXC	FLKTL	TQ	-	TQ			3	3
14D-1	467	2699	EXC	BIFACE	TQ	-	TQ			3	3
14D-1	467	2715	EXC	BIFACE	TQ	-	TQ			3	3
14D-1	467	2716	EXC	BIFACE	I	MH	MH			3	3
14D-1	467	2720	EXC	PRJPT	TQ	-	TQ			3	3
14D-1	467	2721	EXC	PRJPT	TQ	-	TQ	3.1		3	3
14D-1	467	2722	EXC	PRJPT	TQ	-	TQ	5.1		3	3
14D-1	467	2723	EXC	FLKTL	CD	-	CD			3	3
14D-1	467	2724	EXC	FLKTL	TQ	-	TQ			3	3
14D-1	467	2725	EXC	FLKTL	I	MH	MH			3	3
14D-1	467	2734	EXC	PRJPT	TQ	-	TQ			3	3
14D-1	467	2735	EXC	BIFACE	I	MH	MH			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
14D-1	467	2740	EXC	PRJPT	TQ	-	TQ			3	3
14D-1	467	2741	EXC	PRJPT	TQ	-	TQ	10.6		3	3
14D-1	467	2742	EXC	BIFACE	CD	-	CD			3	3
14D-1	467	2743	EXC	FLKTL	TQ	-	TQ			3	3
14D-1	467	2744	EXC	FLKTL	TQ	-	TQ			3	3
14D-1	467	2756	EXC	BIFACE	TQ	-	TQ			3	3
14D-1	467	2757A	EXC	DBTG	I	BH	BH			3	3
14D-1	467	2757B	EXC	DBTG	I	CD	CD			3	3
14D-1	467	2757C	EXC	DBTG	I	TQ	TQ			3	3
14D-1	467	2757D	EXC	DBTG	TQ	-	TQ			3	3
14D-1	467	2757E	EXC	DBTG	TQ	-	TQ			3	3
14D-1	467	2757F	EXC	DBTG	TQ	-	TQ			3	3
14D-1	467	2757G	EXC	DBTG	CD	-	CD			3	3
14D-1	467	2768	EXC	BIFACE	TQ	-	TQ			3	3
14D-1	467	2769	EXC	FLKTL	TQ	-	TQ			3	3
14D-1	467	2770A	EXC	DBTG	I	TQ	TQ			3	3
14D-1	467	2770B	EXC	DBTG	I	MGM	MG			3	3
14D-1	467	2770C	EXC	DBTG	I	TQ	TQ			3	3
14D-1	467	2770D	EXC	DBTG	I	SV	SV			3	3
14D-1	467	2770E	EXC	DBTG	I	TQ	TQ			3	3
14D-1	467	2770F	EXC	DBTG	TQ	-	TQ			3	3
14D-1	467	2770G	EXC	DBTG	TQ	-	TQ			3	3
14D-1	467	2770H	EXC	DBTG	TQ	-	TQ			3	3
14D-1	467	2770I	EXC	DBTG	-	-	I	4.4		3	3
14D-1	467	2770J	EXC	DBTG	-	-	I	8.7		3	3
14D-1	467	2770K	EXC	DBTG	-	-	I	3.2		3	3
14D-1	467	2770L	EXC	DBTG	-	-	I	11.5		3	3
14D-1	467	2770M	EXC	DBTG	-	-	I	9.3		3	3
14D-1	467	2778	EXC	BIFACE	I	FS	FS			3	3
14D-1	467	2791	EXC	BIFACE	CD	-	CD			3	3
14D-1	467	2797	EXC	BIFACE	CD	-	CD	5.1		3	3
14D-1	467	2798	EXC	BIFACE	TQ	-	TQ	4.5		3	3
14D-1	467	2799	EXC	FLKTL	I	MH/MGM	I			3	3
14D-1	467	2817	EXC	FLKTL	I	MGM	MG			3	3
14D-1	467	2855	EXC	BIFACE	I	MGM	MG			3	3
14D-1	467	2856	EXC	FLKTL	CD	-	CD			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
14D-1	467	2867	EXC	PRJPT	I	SV	SV	4.7		3	3
14D-1	467	2868	EXC	BIFACE	I	MH/TQ	I			3	3
14D-1	467	2869	EXC	FLKTL	CD	-	CD			3	3
14D-1	467	2870A	EXC	DBTG	I	MGM	MG	5.0		3	3
14D-1	467	2870B	EXC	DBTG	I	CD	CD	3.2		3	3
14D-1	467	2870C	EXC	DBTG	I	SV	SV			3	3
14D-1	467	2870D	EXC	DBTG	I	CD	CD	NVB		3	3
14D-1	467	2870E	EXC	DBTG	I	TQ	TQ	5.1		3	3
14D-1	467	2870F	EXC	DBTG	I	MGM	MG	7.0		3	3
14D-1	467	2870G	EXC	DBTG	TQ	-	TQ			3	3
14D-1	467	2870H	EXC	DBTG	TQ	-	TQ			3	3
14D-1	467	2870I	EXC	DBTG	TQ	-	TQ			3	3
14D-1	467	2870J	EXC	DBTG	TQ	-	TQ			3	3
14D-1	467	2870K	EXC	DBTG	TQ	-	TQ			3	3
14D-1	467	2870L	EXC	DBTG	TQ	-	TQ			3	3
14D-1	467	2870M	EXC	DBTG	TQ	-	TQ			3	3
14D-1	467	2870N	EXC	DBTG	TQ	-	TQ			3	3
14D-1	467	2870O	EXC	DBTG	TQ	-	TQ			3	3
14D-1	467	2882	EXC	BIFACE	TQ	-	TQ			3	3
14D-1	467	2883	EXC	FLKTL	TQ	-	TQ			3	3
14D-1	467	2888	EXC	BIFACE	I	MH	MH			3	3
14D-1	467	2889	EXC	FLKTL	CD	-	CD			3	3
14D-1	467	2890	EXC	FLKTL	I	MGM	MG			3	3
14D-1	467	2891	EXC	FLKTL	CD	-	CD			3	3
14D-1	467	2892	EXC	FLKTL	CD	-	CD			3	3
14D-1	467	2900	EXC	BIFACE	I	MH	MH			3	3
14D-1	467	2901	EXC	BIFACE	TQ	-	TQ			3	3
14D-1	467	2902	EXC	BIFACE	TQ	-	TQ			3	3
14D-1	467	2911	EXC	PRJPT	TQ	-	TQ			3	3
14D-1	467	2919	EXC	FLKTL	I	MGM/QI	I			3	3
14D-1	467	2928	EXC	PRJPT	TQ	-	TQ			3	3
14D-1	467	2929A	EXC	DBTG	I	CD	CD			3	3
14D-1	467	2929B	EXC	DBTG	I	MGM	MG			3	3
14D-1	467	2929C	EXC	DBTG	I	MGM	MG			3	3
14D-1	467	2929D	EXC	DBTG	I	SV	SV			3	3
14D-1	467	2929E	EXC	DBTG	I	CD	CD			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
14D-1	467	2929F	EXC	DBTG	I	CD	CD			3	3
14D-1	467	2929G	EXC	DBTG	I	CD	CD			3	3
14D-1	467	2929H	EXC	DBTG	I	MGM	MG			3	3
14D-1	467	2929I	EXC	DBTG	I	CD	CD			3	3
14D-1	467	2929J	EXC	DBTG	I	MGM	MG			3	3
14D-1	467	2929K	EXC	DBTG	TQ	-	TQ			3	3
14D-1	467	2929L	EXC	DBTG	TQ	-	TQ			3	3
14D-1	467	2929M	EXC	DBTG	TQ	-	TQ			3	3
14D-1	467	2929N	EXC	DBTG	TQ	-	TQ			3	3
14D-1	467	2929O	EXC	DBTG	TQ	-	TQ			3	3
14D-1	467	2929P	EXC	DBTG	-	-	I	3.4		3	3
14D-1	467	2929Q	EXC	DBTG	-	-	I	8.4		3	3
14D-1	467	2929R	EXC	DBTG	-	-	I	5.3		3	3
14D-1	467	2929S	EXC	DBTG	-	-	I	7.9		3	3
14D-1	467	2929T	EXC	DBTG	-	-	I	9.0		3	3
14D-1	467	2934	EXC	BIFACE	I	MH	MH			3	3
14D-1	455	885	SUR	PRJPT	I	MC/MGM	M	10.9		3	3
14D-1	455	886	SUR	PRJPT	TQ	-	TQ	2.7		3	3
14D-1	455	940	CSC	PRJPT	TQ	-	TQ	2.0	9.6	3	3
14D-1	455	941	CSC	BIFACE	I	CD	CD			3	3
14D-1	455	943	CSC	FLKTL	I	SV/CD	I			3	3
14D-1	455	944	CSC	FLKTL	I	SV	SV			3	3
14D-1	455	945	CSC	FLKTL	TQ	-	TQ			3	3
14D-1	455	946	CSC	FLKTL	I	CD	CD			3	3
14D-1	455	947	CSC	FLKTL	I	SV	SV			3	3
14D-1	455	948	CSC	FLKTL	TQ	-	TQ			3	3
14D-1	455	949	CSC	FLKTL	TQ	-	TQ			3	3
16-A	474	15	SUR	FRMFLKTL	I	TQ	TQ	9.5		4	1
16-A	474	22	SUR	PRJPT	CD	-	CD	8.2		4	1
16-A	474	32	SUR	FRMFLKTL	TQ	-	TQ	8.0		4	1
16-A	474	77A	CSC	DBTG	I	MC	MC	9.9		4	1
16-A	474	77B	CSC	DBTG	TQ	-	TQ	8.5		4	1
16-A	474	77C	CSC	DBTG	TQ	-	TQ			4	1
16-A	474	77D	CSC	DBTG	TQ	-	TQ			4	1
16-A	474	77E	CSC	DBTG	TQ	-	TQ			4	1
16-A	474	77F	CSC	DBTG	TQ	-	TQ			4	1

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
16-A	474	77G	CSC	DBTG	TQ	-	TQ			4	1
16-A	474	77H	CSC	DBTG	TQ	-	TQ	9.1		4	1
16-A	474	77I	CSC	DBTG	TQ	-	TQ	9.1		4	1
16-A	474	77J	CSC	DBTG	TQ	-	TQ			4	1
16-A	474	77K	CSC	DBTG	TQ	-	TQ			4	1
16-A	474	77L	CSC	DBTG	TQ	-	TQ			4	1
16-A	474	77M	CSC	DBTG	TQ	-	TQ			4	1
16-A	474	77N	CSC	DBTG	TQ	-	TQ			4	1
16-A	474	77O	CSC	DBTG	CD	-	CD	8.9		4	1
16-A	474	78A	EXC	DBTG	-	-	I	7.9		4	1
16-A	474	78B	EXC	DBTG	-	-	I	10.1		4	1
16-A	474	78C	EXC	DBTG	-	-	I	9.8		4	1
16-A	474	78D	EXC	DBTG	-	-	I	13.7		4	1
16-A	474	78E	EXC	DBTG	-	-	I	18.9		4	1
18C-1	455	1017A	CSC	DBTG	I	MGM	MG	DH		3	1
18C-1	455	1017B	CSC	DBTG	I	TQ	TQ	11.1		3	1
18C-1	455	1017C	CSC	DBTG	I	CD	CD	NMB		3	1
18C-1	455	1017D	CSC	DBTG	I	CD	CD			3	1
18C-1	455	1017E	CSC	DBTG	I	CD	CD	10.9		3	1
18C-1	455	1017F	CSC	DBTG	I	CD	CD			3	1
18C-1	455	1017G	CSC	DBTG	I	CD	CD			3	1
18C-1	455	1017H	CSC	DBTG	I	TQ	TQ	7.4		3	1
18C-1	455	1017I	CSC	DBTG	I	TQ	TQ			3	1
18C-1	455	1017J	CSC	DBTG	TQ	-	TQ	10.1		3	1
18C-1	455	1017K	CSC	DBTG	TQ	-	TQ			3	1
18C-1	455	1017L	CSC	DBTG	CD	-	CD			3	1
18C-1	455	1017M	CSC	DBTG	CD	-	CD			3	1
18C-1	455	1017N	CSC	DBTG	TQ	-	TQ	7.6		3	1
18C-1	455	1017O	CSC	DBTG	TQ	-	TQ	7.6		3	1
18C-1	455	1017P	CSC	DBTG	TQ	-	TQ	8.6		3	1
18C-1	455	1017Q	CSC	DBTG	TQ	-	TQ	7.4		3	1
18C-1	455	890	SUR	PRJPT	TQ	-	TQ	7.8		3	1
18C-1	455	891	SUR	PRJPT	I	QI/SV	I	9.7		3	1
18C-1	455	959	CSC	BIFACE	I	SV/CD	I			3	1
18C-1	455	960	CSC	BIFACE	TQ	-	TQ			3	1
18C-2	455	1019A	CSC	DBTG	I	MGM	MG			3	1

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
18C-2	455	1019B	CSC	DBTG	I	MGM/MC	M			3	1
18C-2	455	1019C	CSC	DBTG	I	MGM	MG	8.6		3	1
18C-2	455	1019D	CSC	DBTG	I	TQ	TQ	7.9		3	1
18C-2	455	1019E	CSC	DBTG	I	TQ	TQ			3	1
18C-2	455	1019F	CSC	DBTG	I	MGM	MG			3	1
18C-2	455	1019G	CSC	DBTG	I	CD	CD	DH		3	1
18C-2	455	1019H	CSC	DBTG	TQ	-	TQ	8.7		3	1
18C-2	455	1019I	CSC	DBTG	TQ	-	TQ			3	1
18C-2	455	1019J	CSC	DBTG	TQ	-	TQ	8.6		3	1
18C-2	455	1019K	CSC	DBTG	TQ	-	TQ			3	1
18C-2	455	1019L	CSC	DBTG	TQ	-	TQ			3	1
18C-2	455	1019M	CSC	DBTG	TQ	-	TQ			3	1
18C-2	455	1019N	CSC	DBTG	TQ	-	TQ			3	1
18C-2	455	1019O	CSC	DBTG	TQ	-	TQ			3	1
18C-2	455	1019P	CSC	DBTG	TQ	-	TQ	7.6		3	1
18C-2	455	1019Q	CSC	DBTG	TQ	-	TQ	10.2		3	1
18C-2	455	1019R	CSC	DBTG	-	-	I	10.1		3	1
18C-2	455	1019S	CSC	DBTG	-	-	I	10.1		3	1
18C-2	455	1019T	CSC	DBTG	-	-	I	10.3		3	1
18C-2	455	1019U	CSC	DBTG	-	-	I	8.7		3	1
18C-2	455	1019V	CSC	DBTG	-	-	I	9.1		3	1
18C-2	455	1061A	CSC	DBTG	I	MH	MH			3	1
18C-2	455	1061B	CSC	DBTG	I	CD	CD			3	1
18C-2	455	1061C	CSC	DBTG	I	TQ	TQ			3	1
18C-2	455	1061D	CSC	DBTG	I	TQ	TQ			3	1
18C-2	455	1061E	CSC	DBTG	I	MGM	MG			3	1
18C-2	455	1061F	CSC	DBTG	TQ	-	TQ	10.2		3	1
18C-2	455	1061G	CSC	DBTG	CD	-	CD			3	1
18C-2	455	1061H	CSC	DBTG	CD	-	CD			3	1
18C-2	455	1061I	CSC	DBTG	CD	-	CD			3	1
18C-2	455	1061J	CSC	DBTG	TQ	-	TQ			3	1
18C-2	455	1061K	CSC	DBTG	TQ	-	TQ	4.0		3	1
18C-2	455	1061L	CSC	DBTG	TQ	-	TQ	7.8		3	1
18C-2	455	1063	CSC	BIFACE	I	CD	CD			3	1
18C-2	455	1064	CSC	FLKTL	I	SV	SV			3	1
18C-2	455	1065	CSC	FLKTL	I	CD	CD			3	1

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
18C-2	455	1071	SUR	BIFACE	I	MGM/MC	M			3	1
18C-2	467	875	SUR	BIFACE	I	MGM	MG	7.8		3	1
18C-2	467	883	EXC	PRJPT	I	MH	MH			3	1
18C-3	455	1021A	CSC	DBTG	I	MC/MGM	M	10.4		3	2
18C-3	455	1021B	CSC	DBTG	TQ	-	TQ	8.6		3	2
18C-3	455	1021C	CSC	DBTG	TQ	-	TQ	13.9		3	2
18C-3	455	1021D	CSC	DBTG	TQ	-	TQ	9.2		3	2
18C-3	455	1021E	CSC	DBTG	TQ	-	TQ	8.0		3	2
18C-3	455	1021F	CSC	DBTG	TQ	-	TQ	14.8		3	2
18C-3	455	1021G	CSC	DBTG	TQ	-	TQ			3	2
18C-3	455	1021H	CSC	DBTG	TQ	-	TQ			3	2
18C-3	455	1021I	CSC	DBTG	TQ	-	TQ			3	2
18C-3	455	1021J	CSC	DBTG	TQ	-	TQ	8.9		3	2
18C-3	455	1021K	CSC	DBTG	TQ	-	TQ	7.6		3	2
18C-3	455	1021L	CSC	DBTG	TQ	-	TQ	0.6		3	2
18C-3	455	1021M	CSC	DBTG	TQ	-	TQ	5.9		3	2
18C-3	455	1021N	CSC	DBTG	-	-	I	10.1		3	2
18C-3	455	1021O	CSC	DBTG	-	-	I	DH		3	2
18C-3	455	1021P	CSC	DBTG	-	-	I	12.3		3	2
18C-3	455	1021Q	CSC	DBTG	-	-	I	DH		3	2
18C-3	455	1021R	CSC	DBTG	-	-	I	8.8		3	2
18C-3	455	1057	CSC	FLKTL	I	MGM	MG			3	2
18C-3	455	1058	CSC	BIFACE	TQ	-	TQ			3	2
18C-3	455	1059	SUR	PRJPT	I	MGM/MC	M			3	2
18C-3	455	1060	SUR	BIFACE	TQ	-	TQ			3	2
18C-3	455	892	SUR	PRJPT	I	FS	FS	7.0		3	2
18C-3	455	961	SUR	FRMFLKTL	TQ	-	TQ	9.0		3	2
18C-3	455	962	SUR	FLKTL	TQ	-	TQ			3	2
18D-1	467	1000	SUR	FLKTL	TQ	-	TQ			3	1
18D-1	467	1001	SUR	FLKTL	CD	-	CD			3	1
18D-1	467	1002	SUR	FLKTL	CD	-	CD			3	1
18D-1	467	1010A	EXC	DBTG	I	MGM	MG	10.6		3	1
18D-1	467	1010B	EXC	DBTG	I	CD	CD			3	1
18D-1	467	1010C	EXC	DBTG	I	CD	CD	10.6		3	1
18D-1	467	1010D	EXC	DBTG	I	CD	CD			3	1
18D-1	467	1010E	EXC	DBTG	I	MGM	MG			3	1

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
18D-1	467	1010F	EXC	DBTG	I	TQ	TQ			3	1
18D-1	467	1010G	EXC	DBTG	I	CD	CD			3	1
18D-1	467	1010H	EXC	DBTG	I	CD/SV	I			3	1
18D-1	467	1010I	EXC	DBTG	I	CD	CD			3	1
18D-1	467	1010J	EXC	DBTG	I	CD	CD			3	1
18D-1	467	1010K	EXC	DBTG	I	BH	BH	7.0		3	1
18D-1	467	1010L	EXC	DBTG	I	BH	BH	10.3		3	1
18D-1	467	1010M	EXC	DBTG	TQ	-	TQ			3	1
18D-1	467	1010N	EXC	DBTG	TQ	-	TQ			3	1
18D-1	467	1010O	EXC	DBTG	TQ	-	TQ			3	1
18D-1	467	1010P	EXC	DBTG	TQ	-	TQ	8.8		3	1
18D-1	467	1010Q	EXC	DBTG	TQ	-	TQ	7.7		3	1
18D-1	467	1010R	EXC	DBTG	-	-	I	6.1		3	1
18D-1	467	1010S	EXC	DBTG	-	-	I	8.5		3	1
18D-1	467	1010T	EXC	DBTG	-	-	I	10.1		3	1
18D-1	467	1010U	EXC	DBTG	-	-	I	11.0		3	1
18D-1	467	1010V	EXC	DBTG	-	-	I	9.0		3	1
18D-1	467	1029A	CSC	DBTG	I	SV/CD	I			3	1
18D-1	467	1029B	CSC	DBTG	I	MGM	MG			3	1
18D-1	467	1030A	CSC	DBTG	TQ	-	TQ			3	1
18D-1	467	1031	CSC	BIFACE	TQ	-	TQ	10.0		3	1
18D-1	467	1037A	CSC	DBTG	I	FS	FS			3	1
18D-1	467	1037B	CSC	DBTG	I	QI	QI			3	1
18D-1	467	1037C	CSC	DBTG	I	MGM	MG			3	1
18D-1	467	1037D	CSC	DBTG	I	MGM	MG			3	1
18D-1	467	1037E	CSC	DBTG	I	CD	CD			3	1
18D-1	467	1037F	CSC	DBTG	I	PG	PG			3	1
18D-1	467	1037G	CSC	DBTG	I	CD	CD			3	1
18D-1	467	1037H	CSC	DBTG	TQ	-	TQ			3	1
18D-1	467	1037I	CSC	DBTG	TQ	-	TQ			3	1
18D-1	467	1041A	CSC	DBTG	I	CD	CD			3	1
18D-1	467	1041B	CSC	DBTG	I	CD	CD			3	1
18D-1	467	1041C	CSC	DBTG	TQ	-	TQ			3	1
18D-1	455	963	CSC	BIFACE	I	CD	CD			3	1
18D-1	455	964	CSC	BIFACE	TQ	-	TQ			3	1
18D-1	455	965	CSC	BIFACE	TQ	-	TQ			3	1

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
18D-1	455	966	CSC	FLKTL	I	TQ	TQ			3	1
18D-1	455	967	CSC	FLKTL	I	CO	CO			3	1
18D-1	455	968	CSC	FLKTL	TQ	-	TQ			3	1
18D-1	455	969	CSC	FLKTL	I	CD	CD			3	1
18D-1	455	970	CSC	FLKTL	CD	-	CD			3	1
18D-1	455	999A	CSC	DBTG	I	CD	CD			3	1
18D-1	455	999B	CSC	DBTG	I	CO	CO			3	1
18D-1	455	999C	CSC	DBTG	I	TQ	TQ			3	1
18D-1	455	999D	CSC	DBTG	I	CD	CD			3	1
18D-1	455	999E	CSC	DBTG	I	MC/MGM	M			3	1
18D-1	455	999F	CSC	DBTG	I	SV	SV			3	1
18D-1	455	999G	CSC	DBTG	I	CD	CD			3	1
18D-1	455	999H	CSC	DBTG	I	CD	CD			3	1
18D-1	455	999I	CSC	DBTG	I	MH	MH			3	1
18D-1	455	999J	CSC	DBTG	CD	-	CD			3	1
18D-1	455	999K	CSC	DBTG	CD	-	CD			3	1
18D-1	455	999L	CSC	DBTG	CD	-	CD			3	1
18D-1	455	999M	CSC	DBTG	CD	-	CD			3	1
18D-1	455	999N	CSC	DBTG	TQ	-	TQ			3	1
18D-1	455	999O	CSC	DBTG	TQ	-	TQ			3	1
18D-1	455	999P	CSC	DBTG	TQ	-	TQ	10.2		3	1
18D-1	455	999Q	CSC	DBTG	TQ	-	TQ	12.9		3	1
18D-1	455	999R	CSC	DBTG	-	-	I	8.3		3	1
18D-1	455	999S	CSC	DBTG	-	-	I	9.0		3	1
18D-1	455	999T	CSC	DBTG	-	-	I	9.6		3	1
18D-1	455	999U	CSC	DBTG	-	-	I	11.3		3	1
1992	ENF	1	SUR	PRJPT	CD	-	CD	10.5	DH	3	3
1992	ENF	10	SUR	FLKTL	TQ	-	TQ			3	3
1992	392	10077	SUR	PRJPT	TQ	-	TQ	8.6		3	3
1992	392	10078	SUR	PRJPT	TQ	-	TQ	8.4		3	3
1992	392	10079	SUR	PRJPT	TQ	-	TQ	9.0		3	3
1992	392	10080	SUR	PRJPT	TQ	-	TQ	8.9		3	3
1992	392	10081	SUR	PRJPT	TQ	-	TQ	9.5		3	3
1992	455	108	EXC	BIFACE	TQ	-	TQ			3	3
1992	455	109	EXC	FRMFLKTL	I	MGM	MG	8.6		3	3
1992	ENF	11	SUR	BIFACE	TQ	-	TQ			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
1992	455	12	SUR	FRMFLKTL	CD	-	CD	9.6		3	3
1992	455	13	SUR	FRMFLKTL	I	SV	SV	9.7		3	3
1992	455	132	EXC	BIFACE	TQ	-	TQ			3	3
1992	455	133	EXC	BIFACE	TQ	-	TQ			3	3
1992	455	134	EXC	BIFACE	I	TQ	TQ	9.1		3	3
1992	455	135	EXC	FRMFLKTL	TQ	-	TQ	5.1		3	3
1992	455	14	SUR	PRJPT	TQ	-	TQ	11.7		3	3
1992	455	16	SUR	FRMFLKTL	I	MGM	MG	9.9		3	3
1992	455	160	EXC	BIFACE	CD	-	CD			3	3
1992	455	161	EXC	DRILL	I	-	I			3	3
1992	455	167	EXC	PRJPT	CD	-	CD	5.8		3	3
1992	455	17	SUR	FLKTL	TQ	-	TQ			3	3
1992	455	182	EXC	PRJPT	TQ	MH	MH	5.8		3	3
1992	455	19	SUR	BIFACE	I	CD/SV	I			3	3
1992	ENF	2	SUR	PRJPT	I	MC/MGM	M	9.8		3	3
1992	455	20	SUR	FLKTL	CD	-	CD			3	3
1992	455	21	SUR	BIFACE	CD	-	CD			3	3
1992	455	22	SUR	FRMFLKTL	TQ	-	TQ	5.9		3	3
1992	455	222	SUR	PTBLNK	TQ	-	TQ	3.6		3	3
1992	455	23	SUR	PRJPT	CD	-	CD	11.6		3	3
1992	455	233	EXC	BIFACE	I	MH	MH			3	3
1992	455	25A	EXC	DBTG	TQ	-	TQ	8.4		3	3
1992	455	25B	EXC	DBTG	TQ	-	TQ	9.4		3	3
1992	455	275A	EXC	DBTG	I	CD	CD			3	3
1992	455	275B	EXC	DBTG	I	QI/TQ	I			3	3
1992	455	275C	EXC	DBTG	I	MGM	MG			3	3
1992	455	275D	EXC	DBTG	I	TQ	TQ			3	3
1992	455	275E	EXC	DBTG	I	SV/CD	I			3	3
1992	455	275F	EXC	DBTG	I	CD	CD			3	3
1992	455	275G	EXC	DBTG	I	TQ	TQ			3	3
1992	455	275H	EXC	DBTG	I	TQ	TQ			3	3
1992	455	275I	EXC	DBTG	I	CD	CD			3	3
1992	455	275J	EXC	DBTG	I	CD	CD			3	3
1992	455	275K	EXC	DBTG	TQ	-	TQ			3	3
1992	455	275L	EXC	DBTG	TQ	-	TQ			3	3
1992	455	275M	EXC	DBTG	TQ	-	TQ			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
1992	455	275N	EXC	DBTG	TQ	-	TQ			3	3
1992	455	275O	EXC	DBTG	TQ	-	TQ			3	3
1992	455	29	EXC	BIFACE	I	MGM	MG			3	3
1992	ENF	3	SUR	PRJPT	TQ	-	TQ	13.2		3	3
1992	455	303	EXC	BIFACE	I	TQ	TQ			3	3
1992	455	335	EXC	PRJPT	I	MGM	MG	4.5		3	3
1992	455	336	EXC	BIFACE	TQ	-	TQ			3	3
1992	455	337	EXC	PRJPT	CD	-	CD	3.1		3	3
1992	455	339	EXC	PTBLNK	TQ	-	TQ	3.3		3	3
1992	455	346	EXC	PRJPT	I	MH	MH	4.7		3	3
1992	455	347	EXC	PRJPT	I	CD	CD	5.4		3	3
1992	455	348	EXC	BIFACE	TQ	-	TQ			3	3
1992	455	350	EXC	BIFACE	TQ	-	TQ			3	3
1992	455	351	EXC	FLKTL	TQ	-	TQ			3	3
1992	455	352	EXC	FLKTL	I	CD	CD			3	3
1992	455	360	EXC	BIFACE	TQ	-	TQ			3	3
1992	455	361	EXC	BIFACE	I	MH	MH			3	3
1992	455	362	EXC	BIFACE	TQ	-	TQ			3	3
1992	455	374	EXC	DRILL	I	-	I			3	3
1992	455	375	EXC	BIFACE	CD	-	CD			3	3
1992	455	376A	EXC	DBTG	TQ	-	TQ	7.0		3	3
1992	455	376B	EXC	DBTG	TQ	-	TQ	3.1		3	3
1992	455	37A	EXC	DBTG	TQ	-	TQ	9.3		3	3
1992	455	37B	EXC	DBTG	TQ	-	TQ	5.6		3	3
1992	455	391	EXC	BIFACE	TQ	-	TQ			3	3
1992	455	399	EXC	BIFACE	I	-	I			3	3
1992	ENF	4	SUR	BIFACE	TQ	-	TQ			3	3
1992	455	400	EXC	BIFACE	I	TQ	TQ			3	3
1992	455	413A	EXC	DBTG	TQ	-	TQ	9.1		3	3
1992	455	413B	EXC	DBTG	TQ	-	TQ	10.1		3	3
1992	455	420	EXC	BIFACE	I	SV	SV			3	3
1992	455	421	EXC	BIFACE	CD	-	CD			3	3
1992	455	422	EXC	PRJPT	TQ	-	TQ	3.7		3	3
1992	455	423	EXC	BIFACE	I	MH	MH			3	3
1992	455	424	EXC	BIFACE	I	MH	MH			3	3
1992	455	425A	EXC	DBTG	I	CD/SV	I			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
1992	455	425B	EXC	DBTG	I	MGM	MG			3	3
1992	455	425C	EXC	DBTG	I	MH	MH			3	3
1992	455	425D	EXC	DBTG	TQ	-	TQ			3	3
1992	455	425E	EXC	DBTG	TQ	-	TQ			3	3
1992	455	425F	EXC	DBTG	TQ	-	TQ	4.0		3	3
1992	455	425G	EXC	DBTG	TQ	-	TQ	3.5		3	3
1992	455	43	EXC	PRJPT	I	MH	MH	11.6		3	3
1992	455	431A	EXC	DBTG	I	TQ	TQ			3	3
1992	455	431B	EXC	DBTG	I	MGM/MC	M			3	3
1992	455	431C	EXC	DBTG	I	TQ	TQ			3	3
1992	455	431D	EXC	DBTG	I	TQ	TQ			3	3
1992	455	431E	EXC	DBTG	I	SV/CD	I			3	3
1992	455	431F	EXC	DBTG	TQ	-	TQ			3	3
1992	455	431G	EXC	DBTG	TQ	-	TQ			3	3
1992	455	431H	EXC	DBTG	TQ	-	TQ			3	3
1992	455	431I	EXC	DBTG	TQ	-	TQ			3	3
1992	455	431J	EXC	DBTG	TQ	-	TQ			3	3
1992	455	444	EXC	BIFACE	I	TQ	TQ			3	3
1992	455	448	EXC	BIFACE	TQ	-	TQ			3	3
1992	455	449	EXC	BIFACE	TQ	-	TQ			3	3
1992	455	456	EXC	BIFACE	TQ	-	TQ			3	3
1992	455	457	EXC	BIFACE	I	-	I			3	3
1992	455	479	EXC	BIFACE	TQ	-	TQ			3	3
1992	455	480	EXC	FRMFLKTL	TQ	-	TQ	9.2		3	3
1992	455	489A	EXC	DBTG	I	CD	CD			3	3
1992	455	489B	EXC	DBTG	I	TQ	TQ			3	3
1992	455	489C	EXC	DBTG	I	TQ	TQ			3	3
1992	455	489D	EXC	DBTG	I	PG	PG			3	3
1992	455	489E	EXC	DBTG	I	MGM	MG			3	3
1992	455	489F	EXC	DBTG	I	CD	CD			3	3
1992	455	489G	EXC	DBTG	I	TQ	TQ			3	3
1992	455	489H	EXC	DBTG	I	CD	CD			3	3
1992	455	489I	EXC	DBTG	I	PG	PG			3	3
1992	455	489J	EXC	DBTG	TQ	-	TQ			3	3
1992	455	489K	EXC	DBTG	TQ	-	TQ			3	3
1992	455	489L	EXC	DBTG	TQ	-	TQ			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
1992	455	489M	EXC	DBTG	TQ	-	TQ			3	3
1992	455	489N	EXC	DBTG	TQ	-	TQ			3	3
1992	455	489O	EXC	DBTG	TQ	-	TQ			3	3
1992	455	492	EXC	BIFACE	I	TQ	TQ			3	3
1992	ENF	5	SUR	FRMFLKTL	I	MH	MH	12.9		3	3
1992	392	5002	CSC	PRJPT	TQ	TQ	TQ	3.5		3	3
1992	392	5003	CSC	BIFACE	CD	-	CD			3	3
1992	392	5004	CSC	BIFACE	I	MGM	MG			3	3
1992	392	5005	CSC	BIFACE	I	CD	CD			3	3
1992	392	5006	CSC	BIFACE	I	CD	CD	5.5		3	3
1992	392	5007	CSC	FRMFLKTL	CD	-	CD	11.1		3	3
1992	392	5008	CSC	FLKTL	I	TQ/MH	I			3	3
1992	392	5009	CSC	FLKTL	I	BH	BH			3	3
1992	392	5010	CSC	FLKTL	TQ	-	TQ			3	3
1992	392	5013	CSC	BIFACE	-	-	-			3	3
1992	392	5015	CSC	CORE	I	SV	SV	10.4		3	3
1992	392	5016	CSC	FLKTL	-	-	-			3	3
1992	392	5017	CSC	PRJPT	TQ	-	TQ	4.1		3	3
1992	392	5018	CSC	BIFACE	I	CD	CD			3	3
1992	392	5019	CSC	BIFACE	TQ	-	TQ			3	3
1992	392	5020	CSC	FLKTL	I	CD	CD			3	3
1992	392	5021	CSC	FLKTL	TQ	-	TQ			3	3
1992	392	5022	CSC	FLKTL	TQ	-	TQ			3	3
1992	392	5023	CSC	FLKTL	I	TQ	TQ			3	3
1992	392	5025	CSC	FLKTL	-	-	-			3	3
1992	392	5026	CSC	FLKTL	-	-	-			3	3
1992	392	5027	CSC	FRMFLKTL	I	MC	MC	11.5		3	3
1992	392	5029	CSC	PRJPT	I	-	I			3	3
1992	392	5030	CSC	BIFACE	I	TQ	TQ			3	3
1992	392	5031	CSC	DRILL	CD	-	CD			3	3
1992	392	5032	CSC	BIFACE	I	TQ	TQ			3	3
1992	392	5033	CSC	FLKTL	TQ	-	TQ			3	3
1992	392	5034	CSC	FLKTL	TQ	-	TQ			3	3
1992	392	5039	CSC	BIFACE	-	-	-			3	3
1992	392	5040	CSC	FLKTL	-	-	-			3	3
1992	392	5041	CSC	PRJPT	CD	-	CD	DH		3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
1992	392	5042	CSC	BIFACE	CD	-	CD			3	3
1992	392	5044	CSC	BIFACE	TQ	-	TQ			3	3
1992	392	5045	CSC	BIFACE	I	FS	FS			3	3
1992	392	5046	CSC	BIFACE	TQ	-	TQ			3	3
1992	392	5048	CSC	FLKTL	-	-	-			3	3
1992	392	5049	CSC	FLKTL	-	-	-			3	3
1992	392	5054	CSC	PRJPT	CD	-	CD			3	3
1992	392	5055	CSC	BIFACE	-	-	-			3	3
1992	392	5056	CSC	FLKTL	-	-	-			3	3
1992	392	5057	CSC	BIFACE	-	-	-			3	3
1992	392	5058	CSC	FRMFLKTL	CD	-	CD	NVB		3	3
1992	392	5059	CSC	FLKTL	-	-	-			3	3
1992	392	5060	CSC	FLKTL	-	-	-			3	3
1992	392	5061	CSC	FLKTL	-	-	-			3	3
1992	392	5064	CSC	FRMFLKTL	TQ	-	TQ	11.4		3	3
1992	392	5066	CSC	BIFACE	-	-	-			3	3
1992	392	5067	CSC	FLKTL	-	-	-			3	3
1992	392	5068	CSC	FLKTL	-	-	-			3	3
1992	392	5069	CSC	FLKTL	-	-	-			3	3
1992	392	5077	CSC	PRJPT	I	MGM/MC	M			3	3
1992	392	5080	CSC	PRJPT	I	I	I			3	3
1992	392	5081	CSC	PRJPT	I	TQ	TQ			3	3
1992	392	5082	CSC	BIFACE	-	-	-			3	3
1992	392	5083	CSC	BIFACE	-	-	-			3	3
1992	392	5085	CSC	BIFACE	-	-	-			3	3
1992	392	5086	CSC	BIFACE	-	-	-			3	3
1992	392	5087	CSC	BIFACE	-	-	-			3	3
1992	392	5088	CSC	BIFACE	-	-	-			3	3
1992	392	5090	CSC	BIFACE	-	-	-			3	3
1992	392	5091	CSC	FRMFLKTL	CD	-	CD	7.5		3	3
1992	392	5092	CSC	FRMFLKTL	CD	-	CD	5.2		3	3
1992	392	5093	CSC	FLKTL	-	-	-			3	3
1992	392	5095	CSC	FLKTL	-	-	-			3	3
1992	392	5096	CSC	FLKTL	-	-	-			3	3
1992	392	5097	CSC	FLKTL	-	-	-			3	3
1992	392	5098	CSC	FLKTL	-	-	-			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
1992	392	5099	CSC	FLKTL	-	-	-			3	3
1992	392	5100	CSC	FLKTL	-	-	-			3	3
1992	392	5101	CSC	FLKTL	-	-	-			3	3
1992	392	5102	CSC	FLKTL	-	-	-			3	3
1992	392	5103	CSC	FLKTL	-	-	-			3	3
1992	392	5104	CSC	FLKTL	-	-	-			3	3
1992	392	5115	CSC	BIFACE	-	-	-			3	3
1992	392	5116	CSC	FLKTL	-	-	-			3	3
1992	392	5117	CSC	BIFACE	-	-	-			3	3
1992	392	5118	CSC	BIFACE	-	-	-			3	3
1992	392	5119	CSC	FLKTL	-	-	-			3	3
1992	392	5120	CSC	FRMFLKTL	CD	-	CD	4.7		3	3
1992	392	5121	CSC	FRMFLKTL	TQ	-	TQ	9.7		3	3
1992	392	5122	CSC	FLKTL	-	-	-			3	3
1992	392	5123	CSC	FLKTL	-	-	-			3	3
1992	392	5129	CSC	BIFACE	-	-	-			3	3
1992	392	5130	CSC	BIFACE	-	-	-			3	3
1992	392	5131	CSC	BIFACE	-	-	-			3	3
1992	392	5132	CSC	FLKTL	-	-	-			3	3
1992	392	5135	CSC	FLKTL	-	-	-			3	3
1992	392	5136	CSC	BIFACE	-	-	-			3	3
1992	392	5137	CSC	BIFACE	-	-	-			3	3
1992	392	5138	CSC	BIFACE	-	-	-			3	3
1992	392	5139	CSC	BIFACE	-	-	-			3	3
1992	392	5140	CSC	PRJPT	I	-	I			3	3
1992	392	5141	CSC	PRJPT	I	-	I			3	3
1992	392	5142	CSC	BIFACE	-	-	-			3	3
1992	392	5143	CSC	FLKTL	-	-	-			3	3
1992	392	5144	CSC	BIFACE	-	-	-			3	3
1992	392	5145	CSC	FLKTL	-	-	-			3	3
1992	392	5147	CSC	FLKTL	-	-	-			3	3
1992	392	5154	CSC	PRJPT	TQ	-	TQ	7.6		3	3
1992	392	5155	CSC	PRJPT	I	MGM/MC	M			3	3
1992	392	5156	CSC	BIFACE	TQ	-	TQ	3.1		3	3
1992	392	5157	CSC	BIFACE	TQ	-	TQ			3	3
1992	392	5158	CSC	BIFACE	CD	-	CD			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
1992	392	5159	CSC	BIFACE	FS	FS	FS			3	3
1992	392	5160	CSC	BIFACE	FS	-	FS	8.7		3	3
1992	392	5161	CSC	FLKTL	CD	-	CD			3	3
1992	392	5162	CSC	FLKTL	TQ	-	TQ			3	3
1992	392	5163	CSC	FLKTL	TQ	-	TQ			3	3
1992	392	5167	CSC	PRJPT	FS	-	FS			3	3
1992	392	5168	CSC	BIFACE	TQ	-	TQ			3	3
1992	392	5169	CSC	BIFACE	TQ	-	TQ			3	3
1992	392	5170	CSC	BIFACE	TQ	-	TQ			3	3
1992	392	5171	CSC	BIFACE	I	SV	SV			3	3
1992	392	5172	CSC	BIFACE	I	MGM/MH	I			3	3
1992	392	5173	CSC	BIFACE	TQ	-	TQ			3	3
1992	392	5174	CSC	BIFACE	I	SV	SV			3	3
1992	392	5175	CSC	BIFACE	TQ	-	TQ			3	3
1992	392	5176	CSC	BIFACE	I	MH	MH			3	3
1992	392	5177	CSC	BIFACE	CD	-	CD			3	3
1992	392	5178	CSC	FLKTL	TQ	-	TQ			3	3
1992	392	5179	CSC	FRMFLKTL	I	MH/TQ	I	7.3		3	3
1992	392	5180	CSC	FRMFLKTL	TQ	-	TQ	9.8		3	3
1992	392	5181	CSC	FLKTL	TQ	-	TQ			3	3
1992	392	5182	CSC	FRMFLKTL	I	TQ	TQ	9.8		3	3
1992	392	5183	CSC	FLKTL	TQ	-	TQ			3	3
1992	392	5184	CSC	FLKTL	CD	-	CD			3	3
1992	392	5185	CSC	FLKTL	TQ	-	TQ			3	3
1992	392	5186	CSC	FLKTL	I	MH	MH			3	3
1992	392	5187	CSC	FLKTL	I	TQ/QI	I			3	3
1992	392	5188	CSC	FLKTL	TQ	-	TQ			3	3
1992	392	5189	CSC	FLKTL	I	MGM	MG			3	3
1992	392	5190	CSC	FLKTL	I	MH	MH			3	3
1992	392	5191	CSC	FLKTL	CD	-	CD			3	3
1992	392	5197	CSC	BIFACE	CD	-	CD			3	3
1992	392	5198	CSC	BIFACE	TQ	-	TQ			3	3
1992	392	5199	CSC	BIFACE	I	MH	MH			3	3
1992	392	5200	CSC	BIFACE	CD	-	CD			3	3
1992	392	5201	CSC	BIFACE	TQ	-	TQ			3	3
1992	392	5202	CSC	BIFACE	I	MH	MH			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
1992	392	5203	CSC	BIFACE	I	MH	MH			3	3
1992	392	5204	CSC	DRILL	TQ	-	TQ			3	3
1992	392	5205	CSC	FRMFLKTL	TQ	-	TQ	14.8		3	3
1992	392	5206	CSC	FLKTL	TQ	-	TQ			3	3
1992	392	5207	CSC	FLKTL	TQ	-	TQ			3	3
1992	392	5210	CSC	PRJPT	FS	-	FS	5.7		3	3
1992	392	5211	CSC	PRJPT	CD	-	CD	9.3		3	3
1992	392	5212	CSC	BIFACE	CD	-	CD			3	3
1992	392	5213	CSC	FLKTL	CD	-	CD			3	3
1992	392	5214	CSC	FLKTL	I	MGM	MG			3	3
1992	392	5216	CSC	FLKTL	I	SV	SV			3	3
1992	392	5219	CSC	BIFACE	-	-	-			3	3
1992	392	5220	CSC	BIFACE	-	-	-			3	3
1992	392	5221	CSC	FLKTL	-	-	-			3	3
1992	392	5222	CSC	PTBLNK	-	-	-	NA		3	3
1992	392	5223	CSC	PRJPT	I	-	I			3	3
1992	392	5224	CSC	FLKTL	-	-	-			3	3
1992	392	5225	CSC	FRMFLKTL	I	MGM	MG	DH		3	3
1992	392	5226	CSC	FLKTL	-	-	-			3	3
1992	392	5227	CSC	FLKTL	-	-	-			3	3
1992	392	5230	CSC	PRJPT	CD	-	CD	9.6		3	3
1992	392	5231	CSC	BIFACE	TQ	-	TQ			3	3
1992	392	5232	CSC	FLKTL	TQ	-	TQ			3	3
1992	392	5233	CSC	FLKTL	I	CD	CD			3	3
1992	392	5234	CSC	FLKTL	TQ	-	TQ			3	3
1992	392	5237	CSC	PRJPT	CD	-	CD	DH		3	3
1992	392	5238	CSC	BIFACE	TQ	-	TQ			3	3
1992	392	5239	CSC	BIFACE	TQ	-	TQ			3	3
1992	392	5240	CSC	BIFACE	TQ	-	TQ			3	3
1992	392	5241	CSC	BIFACE	TQ	-	TQ			3	3
1992	392	5242	CSC	FRMFLKTL	I	MGM	MG	8.7		3	3
1992	392	5243	CSC	FLKTL	CD	-	CD			3	3
1992	392	5246	CSC	PRJPT	CD	-	CD	11.7		3	3
1992	392	5247	CSC	PRJPT	I	-	I			3	3
1992	392	5248	CSC	BIFACE	TQ	-	TQ			3	3
1992	392	5249	CSC	FRMFLKTL	TQ	-	TQ	DH		3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
1992	392	5250	CSC	FRMFLKTL	CD	-	CD	9.2		3	3
1992	392	5251	CSC	FRMFLKTL	TQ	-	TQ	1.6		3	3
1992	392	5252	CSC	FLKTL	TQ	-	TQ			3	3
1992	392	5253	CSC	FLKTL	TQ	-	TQ			3	3
1992	392	5254	CSC	FLKTL	CD	-	CD			3	3
1992	392	5256	CSC	FLKTL	I	MH	MH			3	3
1992	392	5258	CSC	BIFACE	TQ	-	TQ			3	3
1992	392	5259	CSC	FLKTL	TQ	-	TQ			3	3
1992	392	5260	CSC	FLKTL	TQ	-	TQ			3	3
1992	392	5261	CSC	FLKTL	I	SV	SV			3	3
1992	392	5263	CSC	BIFACE	I	TQ	TQ			3	3
1992	392	5266	CSC	FLKTL	TQ	-	TQ			3	3
1992	392	5274	CSC	PRJPT	I	-	I			3	3
1992	392	5275	CSC	BIFACE	I	MH	MH			3	3
1992	392	5276	CSC	BIFACE	TQ	-	TQ			3	3
1992	392	5277	CSC	BIFACE	CD	-	CD			3	3
1992	392	5278	CSC	BIFACE	TQ	-	TQ			3	3
1992	392	5279	CSC	BIFACE	I	MGM	MG			3	3
1992	392	5280	CSC	BIFACE	FS	CD	CD	2.3		3	3
1992	392	5281	CSC	FLKTL	TQ	-	TQ			3	3
1992	392	5294	CSC	DRILL	I	-	I			3	3
1992	392	5303	CSC	BIFACE	I	MGM	MG			3	3
1992	392	5304	CSC	BIFACE	TQ	-	TQ			3	3
1992	392	5311	CSC	PRJPT	I	-	I			3	3
1992	392	5312	CSC	FLKTL	TQ	-	TQ			3	3
1992	392	5313	CSC	BIFACE	I	MH	MH			3	3
1992	392	5314	CSC	CORE	I	MGM	MG	DH		3	3
1992	455	532	EXC	BIFACE	CD	-	CD			3	3
1992	392	5320	CSC	FRMFLKTL	CD	-	CD	5.9		3	3
1992	392	5321	CSC	BIFACE	I	TQ	TQ			3	3
1992	392	5322	CSC	FLKTL	I	MGM	MG			3	3
1992	392	5324	CSC	BIFACE	TQ	-	TQ			3	3
1992	392	5325	CSC	PTBLNK	I	PG	PG	3.2	11.0	3	3
1992	392	5332	CSC	BIFACE	TQ	-	TQ			3	3
1992	392	5344	CSC	BIFACE	FS	FS	FS			3	3
1992	392	5351	CSC	PRJPT	TQ	TQ	TQ	2.0	7.4	3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
1992	392	5352	CSC	PRJPT	TQ	-	TQ			3	3
1992	392	5353	CSC	PTBLNK	CD	-	CD	4.1	7.6	3	3
1992	392	5354	CSC	FRMFLKTL	TQ	-	TQ	13.1		3	3
1992	392	5363	CSC	BIFACE	TQ	-	TQ			3	3
1992	392	5367	CSC	BIFACE	TQ	-	TQ			3	3
1992	455	537	EXC	PRJPT	I	MH	MH	8.7	6.8	3	3
1992	392	5372	CSC	BIFACE	TQ	-	TQ			3	3
1992	392	5373	CSC	BIFACE	I	TQ	TQ			3	3
1992	392	5374	CSC	FLKTL	TQ	-	TQ			3	3
1992	392	5375	CSC	BIFACE	CD	-	CD			3	3
1992	392	5378	CSC	PRJPT	CD	-	CD	DH		3	3
1992	392	5379	CSC	BIFACE	TQ	-	TQ			3	3
1992	392	5386	CSC	PRJPT	I	-	I			3	3
1992	392	5391	CSC	PRJPT	I	-	I			3	3
1992	392	5392	CSC	BIFACE	CD	-	CD			3	3
1992	392	5393	CSC	BIFACE	TQ	-	TQ			3	3
1992	392	5394	CSC	BIFACE	TQ	-	TQ			3	3
1992	455	540	EXC	PRJPT	I	TQ	TQ	9.9		3	3
1992	392	5400	CSC	PRJPT	I	TQ	TQ			3	3
1992	392	5401	CSC	PTBLNK	TQ	-	TQ	10.3		3	3
1992	392	5402	CSC	BIFACE	CD	-	CD			3	3
1992	392	5404	CSC	FLKTL	CD	-	CD			3	3
1992	392	5405	CSC	FLKTL	TQ	-	TQ			3	3
1992	392	5406	CSC	FLKTL	I	MGM	MG			3	3
1992	455	541	SUR	PRJPT	I	BH/PG	I	DH		3	3
1992	392	5410	CSC	BIFACE	I	MGM	MG			3	3
1992	392	5411	CSC	FRMFLKTL	I	MH	MH	9.0		3	3
1992	392	5412	CSC	FLKTL	-	-	-			3	3
1992	392	5416	CSC	PRJPT	I	MGM/MC	M			3	3
1992	392	5417	CSC	BIFACE	CD	-	CD			3	3
1992	392	5418	CSC	FLKTL	I	MH	MH			3	3
1992	455	542	EXC	BIFACE	I	TQ	TQ			3	3
1992	392	5420	CSC	FLKTL	CD	-	CD			3	3
1992	392	5421	CSC	BIFACE	CD	-	CD			3	3
1992	392	5423	CSC	BIFACE	-	-	-			3	3
1992	392	5424	CSC	BIFACE	-	-	-			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
1992	392	5425	CSC	DRILL	CD	-	CD			3	3
1992	392	5427	SUR	PRJPT	CD	-	CD	9.7		3	3
1992	392	5428	SUR	PRJPT	CD	-	CD	DH		3	3
1992	392	5429	SUR	PRJPT	TQ	-	TQ	7.5		3	3
1992	455	543	EXC	BIFACE	CD	-	CD			3	3
1992	392	5430	SUR	PRJPT	I	MGM/MC	M	9.9		3	3
1992	392	5431	SUR	PRJPT	I	BH	BH	5.5	14.0	3	3
1992	392	5432	SUR	PRJPT	CD	-	CD			3	3
1992	392	5434	SUR	BIFACE	I	CD	CD			3	3
1992	392	5437	EXC	BIFACE	I	CD/SV	I			3	3
1992	392	5438	EXC	BIFACE	TQ	-	TQ			3	3
1992	392	5439	EXC	BIFACE	TQ	-	TQ			3	3
1992	455	544	EXC	BIFACE	CD	-	CD			3	3
1992	392	5440	EXC	BIFACE	TQ	-	TQ			3	3
1992	392	5441	EXC	FRMFLKTL	I	TQ/PG	I	1.2		3	3
1992	392	5442	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5442	EXC	DBTG	TQ	-	TQ	4.3		3	3
1992	392	5442	EXC	DBTG	TQ	-	TQ	5.0		3	3
1992	392	5442	EXC	DBTG	TQ	-	TQ	4.6		3	3
1992	455	545	EXC	BIFACE	TQ	-	TQ			3	3
1992	392	5452	EXC	BIFACE	CD	-	CD			3	3
1992	392	5453	EXC	FRMFLKTL	CD	-	CD	2.8		3	3
1992	392	5454	EXC	FLKTL	CD	-	CD			3	3
1992	392	5455	EXC	FLKTL	TQ	-	TQ			3	3
1992	392	5456	EXC	FLKTL	TQ	-	TQ			3	3
1992	392	5457	EXC	FLKTL	CD	-	CD			3	3
1992	455	546	EXC	FLKTL	TQ	-	TQ			3	3
1992	392	5466	EXC	BIFACE	I	MGM	MG			3	3
1992	392	5469	EXC	FLKTL	TQ	-	TQ			3	3
1992	455	547	EXC	BIFACE	CD	-	CD			3	3
1992	392	5470	EXC	FLKTL	I	MGM	MG			3	3
1992	392	5471	EXC	FLKTL	TQ	-	TQ			3	3
1992	455	548	EXC	FLKTL	I	MGM/MC	M			3	3
1992	392	5483	EXC	BIFACE	I	MH	MH			3	3
1992	392	5484	EXC	FLKTL	I	CD	CD			3	3
1992	455	549	EXC	BIFACE	CD	-	CD	3.4		3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
1992	392	5493	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5493	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5493	EXC	DBTG	CD	-	CD			3	3
1992	392	5493	EXC	DBTG	CD	-	CD			3	3
1992	392	5493	EXC	DBTG	FS	-	FS			3	3
1992	392	5493	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5493	EXC	DBTG	CD	-	CD			3	3
1992	392	5493	EXC	DBTG	I	-	I			3	3
1992	392	5493	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5493	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5493	EXC	DBTG	CD	-	CD			3	3
1992	392	5493	EXC	DBTG	I	-	I			3	3
1992	392	5493	EXC	DBTG	I	-	I			3	3
1992	392	5493	EXC	DBTG	I	-	I			3	3
1992	392	5493	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5493	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5493	EXC	DBTG	I	-	I			3	3
1992	392	5493	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5493	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5497	EXC	FRMFLKTL	CD	-	CD	3.6		3	3
1992	392	5498	EXC	FLKTL	TQ	-	TQ			3	3
1992	392	5499	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5499	EXC	DBTG	CD	-	CD			3	3
1992	392	5499	EXC	DBTG	CD	-	CD			3	3
1992	392	5499	EXC	DBTG	I	-	I			3	3
1992	392	5499	EXC	DBTG	I	-	I			3	3
1992	392	5499	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5499	EXC	DBTG	CD	-	CD			3	3
1992	392	5499	EXC	DBTG	I	-	I			3	3
1992	392	5499	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5499	EXC	DBTG	I	-	I			3	3
1992	392	5499	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5499	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5499	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5499	EXC	DBTG	I	-	I			3	3
1992	392	5499	EXC	DBTG	I	-	I			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
1992	392	5499	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5499	EXC	DBTG	I	-	I			3	3
1992	455	550	EXC	BIFACE	CD	-	CD			3	3
1992	392	5505	EXC	FLKTL	CD	-	CD			3	3
1992	392	5506	EXC	DBTG	TQ	-	TQ	3.0		3	3
1992	392	5506	EXC	DBTG	TQ	-	TQ	3.7		3	3
1992	392	5506	EXC	DBTG	TQ	-	TQ	7.1		3	3
1992	392	5506	EXC	DBTG	TQ	-	TQ	7.2		3	3
1992	455	551	EXC	BIFACE	CD	-	CD			3	3
1992	455	551	EXC	BIFACE	TQ	-	TQ			3	3
1992	392	5519	EXC	BIFACE	CD	-	CD			3	3
1992	455	552	EXC	BIFACE	TQ	-	TQ			3	3
1992	392	5520	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5520	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5520	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5520	EXC	DBTG	CD	-	CD			3	3
1992	392	5520	EXC	DBTG	I	-	I			3	3
1992	392	5520	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5520	EXC	DBTG	CD	-	CD			3	3
1992	392	5520	EXC	DBTG	CD	-	CD			3	3
1992	392	5520	EXC	DBTG	I	-	I			3	3
1992	392	5520	EXC	DBTG	I	-	I			3	3
1992	392	5520	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5520	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5520	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5520	EXC	DBTG	I	-	I			3	3
1992	392	5520	EXC	DBTG	I	-	I			3	3
1992	392	5520	EXC	DBTG	I	-	I			3	3
1992	392	5520	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5525	EXC	PRJPT	I	TQ	TQ	9.2		3	3
1992	392	5526	EXC	FLKTL	TQ	-	TQ			3	3
1992	455	553	EXC	BIFACE	TQ	-	TQ			3	3
1992	455	554	EXC	BIFACE	TQ	-	TQ	8.9		3	3
1992	392	5540	EXC	FLKTL	TQ	-	TQ			3	3
1992	392	5541	EXC	FLKTL	TQ	-	TQ			3	3
1992	392	5542	EXC	DBTG	TQ	-	TQ			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
1992	392	5542	EXC	DBTG	CD	-	CD			3	3
1992	392	5542	EXC	DBTG	CD	-	CD			3	3
1992	392	5542	EXC	DBTG	CD	-	CD			3	3
1992	392	5542	EXC	DBTG	I	-	I			3	3
1992	392	5542	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5542	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5542	EXC	DBTG	CD	-	CD			3	3
1992	392	5542	EXC	DBTG	I	-	I			3	3
1992	392	5542	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5542	EXC	DBTG	I	-	I			3	3
1992	392	5542	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5542	EXC	DBTG	I	-	I			3	3
1992	392	5542	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5542	EXC	DBTG	I	-	I			3	3
1992	455	555	EXC	BIFACE	I	MH/TQ	I			3	3
1992	392	5551	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5551	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5551	EXC	DBTG	FS	-	FS			3	3
1992	392	5551	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5551	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5551	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5551	EXC	DBTG	I	-	I			3	3
1992	392	5551	EXC	DBTG	I	-	I			3	3
1992	392	5551	EXC	DBTG	I	-	I			3	3
1992	392	5554	EXC	PRJPT	I	-	I			3	3
1992	392	5555	EXC	FLKTL	CD	-	CD			3	3
1992	392	5556	EXC	CORE	I	SV	SV	8.5		3	3
1992	392	5557	EXC	FLKTL	TQ	-	TQ			3	3
1992	392	5558	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5558	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5558	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5558	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5558	EXC	DBTG	CD	-	CD			3	3
1992	392	5558	EXC	DBTG	CD	-	CD			3	3
1992	392	5558	EXC	DBTG	CD	-	CD			3	3
1992	392	5558	EXC	DBTG	I	-	I			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
1992	392	5558	EXC	DBTG	I	-	I			3	3
1992	392	5558	EXC	DBTG	I	-	I			3	3
1992	392	5558	EXC	DBTG	CD	-	CD			3	3
1992	392	5558	EXC	DBTG	I	-	I			3	3
1992	392	5558	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5558	EXC	DBTG	CD	-	CD			3	3
1992	392	5558	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5558	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5558	EXC	DBTG	I	-	I			3	3
1992	392	5558	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5558	EXC	DBTG	CD	-	CD			3	3
1992	392	5558	EXC	DBTG	I	-	I			3	3
1992	392	5558	EXC	DBTG	I	-	I			3	3
1992	455	556	EXC	BIFACE	I	TQ/MH	I			3	3
1992	392	5560	EXC	PRJPT	TQ	-	TQ	DH		3	3
1992	392	5565	EXC	FLKTL	TQ	-	TQ			3	3
1992	392	5569	EXC	BIFACE	TQ	-	TQ			3	3
1992	455	557	EXC	DRILL	CD	-	CD			3	3
1992	392	5570	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5570	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5570	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5570	EXC	DBTG	CD	-	CD			3	3
1992	392	5570	EXC	DBTG	CD	-	CD			3	3
1992	392	5570	EXC	DBTG	I	-	I			3	3
1992	392	5570	EXC	DBTG	I	-	I			3	3
1992	392	5570	EXC	DBTG	I	-	I			3	3
1992	392	5570	EXC	DBTG	I	-	I			3	3
1992	392	5570	EXC	DBTG	I	-	I			3	3
1992	392	5570	EXC	DBTG	CD	-	CD			3	3
1992	392	5570	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5570	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5570	EXC	DBTG	CD	-	CD			3	3
1992	392	5570	EXC	DBTG	I	-	I			3	3
1992	392	5573	EXC	FLKTL	I	BH	BH			3	3
1992	392	5576	EXC	PRJPT	CD	-	CD	7.8		3	3
1992	392	5579	EXC	BIFACE	I	MGM	MG			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
1992	392	5585	EXC	PRJPT	I	BH	BH			3	3
1992	392	5586	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5586	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5586	EXC	DBTG	I	-	I			3	3
1992	392	5586	EXC	DBTG	I	-	I			3	3
1992	392	5586	EXC	DBTG	CD	-	CD			3	3
1992	392	5586	EXC	DBTG	CD	-	CD			3	3
1992	392	5586	EXC	DBTG	CD	-	CD			3	3
1992	392	5586	EXC	DBTG	CD	-	CD			3	3
1992	392	5586	EXC	DBTG	CD	-	CD			3	3
1992	392	5586	EXC	DBTG	I	-	I			3	3
1992	392	5586	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5586	EXC	DBTG	I	-	I			3	3
1992	392	5586	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5586	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5586	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5586	EXC	DBTG	I	-	I			3	3
1992	392	5586	EXC	DBTG	I	-	I			3	3
1992	455	559	EXC	FRMFLKTL	CD	-	CD	9.0		3	3
1992	392	5593	EXC	BIFACE	-	-	-			3	3
1992	392	5598	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5598	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5598	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5598	EXC	DBTG	CD	-	CD			3	3
1992	392	5598	EXC	DBTG	CD	-	CD			3	3
1992	392	5598	EXC	DBTG	CD	-	CD			3	3
1992	392	5598	EXC	DBTG	CD	-	CD			3	3
1992	392	5598	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5598	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5598	EXC	DBTG	I	-	I			3	3
1992	392	5598	EXC	DBTG	I	-	I			3	3
1992	392	5598	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5598	EXC	DBTG	CD	-	CD			3	3
1992	392	5598	EXC	DBTG	I	-	I			3	3
1992	392	5598	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5598	EXC	DBTG	I	-	I			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
1992	392	5598	EXC	DBTG	I	-	I			3	3
1992	455	560	EXC	FRMFLKTL	I	MGM	MG	9.1		3	3
1992	392	5604	EXC	BIFACE	I	MH	MH			3	3
1992	392	5605	EXC	BIFACE	I	MH	MH			3	3
1992	392	5606	EXC	BIFACE	I	-	-			3	3
1992	392	5608	EXC	FLKTL	TQ	-	TQ			3	3
1992	455	561	EXC	FLKTL	I	SV	SV			3	3
1992	392	5614	EXC	PRJPT	I	BH	BH			3	3
1992	392	5615	EXC	BIFACE	TQ	-	TQ			3	3
1992	455	562	EXC	FRMFLKTL	TQ	-	TQ	5.8		3	3
1992	392	5622	EXC	BIFACE	CD	-	CD			3	3
1992	392	5623	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5623	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5623	EXC	DBTG	CD	-	CD			3	3
1992	392	5623	EXC	DBTG	CD	-	CD			3	3
1992	392	5623	EXC	DBTG	I	-	I			3	3
1992	392	5623	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5623	EXC	DBTG	CD	-	CD			3	3
1992	392	5623	EXC	DBTG	I	-	I			3	3
1992	392	5623	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5623	EXC	DBTG	I	-	I			3	3
1992	392	5623	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5623	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5623	EXC	DBTG	I	-	I			3	3
1992	392	5623	EXC	DBTG	I	-	I			3	3
1992	392	5628	EXC	PTBLNK	I	MH	MH	8.0		3	3
1992	455	563	EXC	FLKTL	TQ	-	TQ			3	3
1992	392	5632	EXC	FLKTL	TQ	-	TQ			3	3
1992	392	5633	EXC	FLKTL	TQ	-	TQ			3	3
1992	392	5638	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5638	EXC	DBTG	CD	-	CD			3	3
1992	392	5638	EXC	DBTG	I	-	I			3	3
1992	392	5638	EXC	DBTG	I	-	I			3	3
1992	392	5638	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5638	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5638	EXC	DBTG	CD	-	CD			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
1992	392	5638	EXC	DBTG	I	-	I			3	3
1992	392	5638	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5638	EXC	DBTG	I	-	I			3	3
1992	392	5638	EXC	DBTG	I	-	I			3	3
1992	392	5638	EXC	DBTG	TQ	-	TQ			3	3
1992	455	564	EXC	FLKTL	CD	-	CD			3	3
1992	392	5647	EXC	BIFACE	TQ	-	TQ			3	3
1992	392	5648	EXC	DBTG	TQ	-	TQ	4.8		3	3
1992	392	5648	EXC	DBTG	TQ	-	TQ	4.0		3	3
1992	392	5648	EXC	DBTG	TQ	-	TQ	9.5		3	3
1992	392	5648	EXC	DBTG	TQ	-	TQ	9.3		3	3
1992	455	565	EXC	FLKTL	I	SV	SV			3	3
1992	392	5651	EXC	BIFACE	I	MGM/MH	I			3	3
1992	392	5652	EXC	FLKTL	TQ	-	TQ			3	3
1992	392	5653	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5653	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5653	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5653	EXC	DBTG	CD	-	CD			3	3
1992	392	5653	EXC	DBTG	CD	-	CD			3	3
1992	392	5653	EXC	DBTG	CD	-	CD			3	3
1992	392	5653	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5653	EXC	DBTG	CD	-	CD			3	3
1992	392	5653	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5653	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5653	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5653	EXC	DBTG	CD	-	CD			3	3
1992	392	5653	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5653	EXC	DBTG	I	-	I			3	3
1992	392	5653	EXC	DBTG	CD	-	CD			3	3
1992	392	5653AC	EXC	DBTG	I	TQ	TQ			3	3
1992	392	5653AR	EXC	DBTG	I	CD	CD			3	3
1992	392	5653BC	EXC	DBTG	I	TQ	TQ			3	3
1992	392	5653BR	EXC	DBTG	I	CD	CD			3	3
1992	392	5653CC	EXC	DBTG	I	CD	CD			3	3
1992	392	5653CR	EXC	DBTG	I	M	M			3	3
1992	392	5653DC	EXC	DBTG	I	BH	BH			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
1992	392	5653DR	EXC	DBTG	I	TQ	TQ			3	3
1992	392	5653EC	EXC	DBTG	I	CD	CD			3	3
1992	392	5653ER	EXC	DBTG	I	TQ	TQ			3	3
1992	392	5653FC	EXC	DBTG	I	M	M			3	3
1992	392	5655	EXC	PRJPT	I	-	I			3	3
1992	392	5656	EXC	CORE	TQ	MGM	MG	8.6		3	3
1992	392	5657	EXC	FLKTL	TQ	-	TQ			3	3
1992	392	5658	EXC	FLKTL	CD	-	CD			3	3
1992	455	566	EXC	FLKTL	I	MH	MH			3	3
1992	392	5663	EXC	BIFACE	TQ	-	TQ			3	3
1992	392	5664	EXC	FLKTL	I	BH/PG	I			3	3
1992	392	5667	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5667	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5667	EXC	DBTG	CD	-	CD			3	3
1992	392	5667	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5667	EXC	DBTG	CD	-	CD			3	3
1992	392	5667L	EXC	DBTG	I	TQ	TQ			3	3
1992	392	5667M	EXC	DBTG	I	FS	FS			3	3
1992	392	5667R	EXC	DBTG	I	TQ	TQ			3	3
1992	392	5667S	EXC	DBTG	I	CD	CD			3	3
1992	392	5669	EXC	DBTG	TQ	-	TQ	7.5		3	3
1992	392	5669AW	EXC	DBTG	TQ	TQ	TQ	2.1		3	3
1992	392	5669B	EXC	DBTG	TQ	TQ	TQ	11.1		3	3
1992	392	5669CX	EXC	DBTG	TQ	TQ	TQ	7.3		3	3
1992	455	567	EXC	FLKTL	TQ	-	TQ			3	3
1992	455	568	EXC	FRMFLKTL	TQ	-	TQ	6.0		3	3
1992	392	5681	EXC	BIFACE	-	-	-			3	3
1992	392	5683	EXC	FLKTL	-	-	-			3	3
1992	392	5684	EXC	FLKTL	-	-	-			3	3
1992	392	5685	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5685	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5685	EXC	DBTG	CD	-	CD			3	3
1992	392	5685	EXC	DBTG	I	-	I			3	3
1992	392	5685	EXC	DBTG	I	-	I			3	3
1992	392	5685	EXC	DBTG	CD	-	CD			3	3
1992	392	5685	EXC	DBTG	CD	-	CD			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
1992	392	5685	EXC	DBTG	CD	-	CD			3	3
1992	392	5685	EXC	DBTG	CD	-	CD			3	3
1992	392	5685	EXC	DBTG	I	-	I			3	3
1992	392	5685	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5685	EXC	DBTG	CD	-	CD			3	3
1992	392	5685	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5685	EXC	DBTG	I	-	I			3	3
1992	392	5685	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5685	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5685	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5685	EXC	DBTG	I	-	I			3	3
1992	392	5685	EXC	DBTG	I	-	I			3	3
1992	392	5685	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5685	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5685	EXC	DBTG	I	-	I			3	3
1992	455	569	EXC	FLKTL	TQ	-	TQ			3	3
1992	392	5693	EXC	PRJPT	TQ	-	TQ			3	3
1992	392	5694	EXC	FLKTL	-	-	-			3	3
1992	455	570	EXC	FLKTL	TQ	-	TQ			3	3
1992	392	5702	EXC	BIFACE	-	-	-			3	3
1992	392	5703	EXC	BIFACE	-	-	-			3	3
1992	392	5704	EXC	FLKTL	-	-	-			3	3
1992	392	5705	EXC	FLKTL	-	-	-			3	3
1992	455	571	EXC	FLKTL	TQ	-	TQ			3	3
1992	392	5714	EXC	FLKTL	-	-	-			3	3
1992	392	5715	EXC	FLKTL	-	-	-			3	3
1992	392	5716	EXC	FLKTL	-	-	-			3	3
1992	392	5717	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5717	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5717	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5717	EXC	DBTG	CD	-	CD			3	3
1992	392	5717	EXC	DBTG	I	-	I			3	3
1992	392	5717	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5717	EXC	DBTG	CD	-	CD			3	3
1992	392	5717	EXC	DBTG	CD	-	CD			3	3
1992	392	5717	EXC	DBTG	I	-	I			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
1992	392	5717	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5717	EXC	DBTG	I	-	I			3	3
1992	392	5717	EXC	DBTG	I	-	I			3	3
1992	392	5717	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5717	EXC	DBTG	I	-	I			3	3
1992	392	5717	EXC	DBTG	I	-	I			3	3
1992	392	5717	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5717	EXC	DBTG	TQ	-	TQ			3	3
1992	455	572	EXC	FLKTL	TQ	-	TQ			3	3
1992	392	5725	EXC	BIFACE	-	-	-			3	3
1992	392	5726	EXC	BIFACE	-	-	-			3	3
1992	392	5731	EXC	FLKTL	-	-	-			3	3
1992	392	5732	EXC	FLKTL	-	-	-			3	3
1992	392	5743	EXC	PRJPT	I	-	I			3	3
1992	392	5744	EXC	BIFACE	TQ	-	TQ			3	3
1992	392	5745	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5745	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5745	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5745	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5745	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5745	EXC	DBTG	CD	-	CD			3	3
1992	392	5745	EXC	DBTG	CD	-	CD			3	3
1992	392	5745	EXC	DBTG	CD	-	CD			3	3
1992	392	5745	EXC	DBTG	I	-	I			3	3
1992	392	5745	EXC	DBTG	I	-	I			3	3
1992	392	5745	EXC	DBTG	I	-	I			3	3
1992	392	5745	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5745	EXC	DBTG	CD	-	CD			3	3
1992	392	5745	EXC	DBTG	CD	-	CD			3	3
1992	392	5745	EXC	DBTG	CD	-	CD			3	3
1992	392	5745	EXC	DBTG	I	-	I			3	3
1992	392	5745	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5745	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5745	EXC	DBTG	I	-	I			3	3
1992	392	5745	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5745	EXC	DBTG	I	-	I			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
1992	392	5745	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5745	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5745	EXC	DBTG	I	-	I			3	3
1992	455	575	EXC	FLKTL	CD	-	CD			3	3
1992	392	5751	EXC	FLKTL	TQ	-	TQ			3	3
1992	392	5752	EXC	FLKTL	TQ	-	TQ			3	3
1992	392	5757	EXC	BIFACE	TQ	-	TQ			3	3
1992	392	5758	EXC	BIFACE	TQ	-	TQ			3	3
1992	392	5759	EXC	DRILL	TQ	-	TQ			3	3
1992	455	576	EXC	FLKTL	I	MGM	MG			3	3
1992	392	5761	EXC	FLKTL	CD	-	CD			3	3
1992	392	5768	EXC	FLKTL	CD	-	CD			3	3
1992	392	5769	EXC	FLKTL	TQ	-	TQ			3	3
1992	455	577	EXC	FLKTL	I	SV/CD	I			3	3
1992	392	5772	EXC	BIFACE	I	PG	PG			3	3
1992	392	5773	EXC	FLKTL	TQ	-	TQ			3	3
1992	392	5777	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5777	EXC	DBTG	CD	-	CD			3	3
1992	392	5777	EXC	DBTG	CD	-	CD			3	3
1992	392	5777	EXC	DBTG	CD	-	CD			3	3
1992	392	5777	EXC	DBTG	CD	-	CD			3	3
1992	392	5777	EXC	DBTG	I	-	I			3	3
1992	392	5777	EXC	DBTG	I	-	I			3	3
1992	392	5777	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5777	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5777	EXC	DBTG	I	-	I			3	3
1992	392	5777	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5777	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5777	EXC	DBTG	I	-	I			3	3
1992	392	5777	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5777	EXC	DBTG	I	-	I			3	3
1992	392	5783	EXC	DBTG	TQ	-	TQ			3	3
1992	392	5783	EXC	DBTG	I	-	I			3	3
1992	392	5801	CSC	FLKTL	-	-	-			3	3
1992	392	5802	CSC	FLKTL	-	-	-			3	3
1992	392	5804	CSC	FLKTL	TQ	-	TQ			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
1992	392	5805	CSC	FLKTL	CD	-	CD			3	3
1992	392	5807	SUR	PRJPT	CD	-	CD			3	3
1992	392	5808	SUR	PRJPT	TQ	-	TQ	11.5		3	3
1992	392	5809	SUR	PRJPT	I	-	I			3	3
1992	455	581	EXC	BIFACE	TQ	-	TQ			3	3
1992	392	5810	SUR	PRJPT	I	-	I			3	3
1992	392	5811	SUR	PRJPT	TQ	-	TQ	9.5		3	3
1992	392	5812	SUR	PRJPT	TQ	-	TQ	9.0		3	3
1992	392	5813	SUR	PRJPT	CD	-	CD	10.1		3	3
1992	392	5814	SUR	FRMFLKTL	CD	-	CD	9.6		3	3
1992	392	5815	SUR	FLKTL	CD	-	CD			3	3
1992	392	5816	SUR	PRJPT	CD	-	CD	10.7		3	3
1992	392	5817	SUR	FRMFLKTL	TQ	-	TQ	8.9		3	3
1992	392	5819	SUR	PRJPT	TQ	-	TQ	8.9		3	3
1992	455	582	SUR	PRJPT	TQ	-	TQ	7.1	5.9	3	3
1992	ENF	6	SUR	FRMFLKTL	TQ	-	TQ	6.6		3	3
1992	ENF	7	SUR	BIFACE	I	MC	MC			3	3
1992	455	73	EXC	BIFACE	TQ	-	TQ			3	3
1992	ENF	8	SUR	FLKTL	CD	-	CD			3	3
1992	455	80	EXC	BIFACE	I	MH	MH			3	3
1992	455	82	EXC	BIFACE	CD	-	CD			3	3
1992	455	83	EXC	BIFACE	TQ	-	TQ			3	3
1992	455	84	EXC	BIFACE	CD	-	CD			3	3
1992	455	85	EXC	PRJPT	I	MH	MH			3	3
1992	ENF	9	SUR	FLKTL	TQ	-	TQ			3	3
1U-20	ENF	1	SUR	BIFACE	I	MGM	MG	3.1		2	3
1U-20	ENF	2	SUR	BIFACE	CD	-	CD			2	3
1U-20	ENF	3	SUR	FRMFLKTL	I	CD	CD	3.3		2	3
1U-20	ENF	4	SUR	FLKTL	TQ	-	TQ			2	3
1U-20	ENF	5	SUR	FLKTL	I	CD	CD			2	3
1U-20	ENF	6	SUR	FLKTL	TQ	-	TQ			2	3
1U-20	ENF	7	SUR	FLKTL	I	MGM	MG			2	3
1W-19	ENF	1	SUR	BIFACE	TQ	-	TQ	4.1		4	3
1W-19	ENF	12	SUR	PRJPT	CD	-	CD	5.7		4	3
1W-19	ENF	13	SUR	FLKTL	I	-	I			4	3
1W-19	ENF	14	SUR	FLKTL	I	-	I			4	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
1W-19	ENF	15	SUR	FLKTL	CD	-	CD			4	3
1W-19	ENF	16	SUR	FLKTL	I	-	I			4	3
1W-19	ENF	17	SUR	FLKTL	CD	-	CD			4	3
1W-19	ENF	2	SUR	BIFACE	TQ	-	TQ			4	3
1W-19	ENF	3	SUR	FLKTL	I	-	I			4	3
1W-19	ENF	4	SUR	FLKTL	I	-	I			4	3
1W-19	ENF	5	SUR	FLKTL	CD	-	CD			4	3
1W-19	ENF	6	SUR	FLKTL	I	-	I			4	3
1W-19	ENF	7	SUR	FLKTL	I	-	I			4	3
1W-3	ENF	1	SUR	PRJPT	TQ	-	TQ	6.6		2	3
1W-3	ENF	17	SUR	BIFACE	CD	MGM	MG	9.0		2	3
1W-3	ENF	18	SUR	BIFACE	I	TQ	TQ			2	3
1W-3	ENF	19	SUR	BIFACE	CD	CD	CD	5.0		2	3
1W-3	ENF	2	SUR	BIFACE	TQ	TQ	TQ	1.8		2	3
1W-3	ENF	20	SUR	BIFACE	TQ	TQ	TQ	7.1		2	3
1W-3	ENF	21	SUR	BIFACE	I	CD	CD			2	3
1W-3	ENF	22	SUR	BIFACE	CD	-	CD			2	3
1W-3	ENF	23	SUR	BIFACE	I	CD/SV	I			2	3
1W-3	ENF	24	SUR	FLKTL	I	MGM	MG			2	3
1W-3	ENF	25	SUR	FLKTL	TQ	-	TQ			2	3
1W-3	ENF	26	SUR	FLKTL	I	TQ	TQ			2	3
1W-3	ENF	27	SUR	FLKTL	TQ	-	TQ			2	3
1W-3	ENF	28	SUR	FLKTL	I	CD	CD			2	3
1W-3	ENF	29	SUR	FLKTL	TQ	-	TQ			2	3
1W-3	ENF	3	SUR	FLKTL	TQ	-	TQ			2	3
1W-3	ENF	30	SUR	FLKTL	I	CD	CD			2	3
1W-3	ENF	31	SUR	FLKTL	I	MGM	MG			2	3
1W-3	ENF	37	SUR	BIFACE	CD	-	CD			2	3
1W-3	ENF	38	SUR	FLKTL	CD	-	CD			2	3
1W-3	ENF	39	SUR	FLKTL	I	-	I			2	3
1W-3	ENF	40	SUR	FLKTL	I	-	I			2	3
1W-3	ENF	41	SUR	FLKTL	I	-	I			2	3
1W-3	ENF	42	SUR	FLKTL	I	-	I			2	3
1W-3	ENF	43	SUR	FLKTL	I	-	I			2	3
1W-3	ENF	44	SUR	FLKTL	TQ	-	TQ			2	3
1W-3	ENF	45	SUR	FLKTL	TQ	-	TQ			2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
1W-3	ENF	46	SUR	FLKTL	CD	-	CD			2	3
1W-3	ENF	47	SUR	FLKTL	I	-	I			2	3
1W-3	ENF	48	SUR	FLKTL	I	-	I			2	3
1W-3	ENF	49	SUR	FLKTL	I	-	I			2	3
1W-3	ENF	50	SUR	FLKTL	I	-	I			2	3
1W-3	ENF	51A	SUR	DBTG	I	SV/CD	I			2	3
1W-3	ENF	51B	SUR	DBTG	I	MGM/MC	M	5.2		2	3
1W-3	ENF	51C	SUR	DBTG	I	MGM	MG	3.7		2	3
1W-3	ENF	51D	SUR	DBTG	I	MGM	MG	5.4		2	3
1W-3	ENF	51E	SUR	DBTG	I	CD	CD	5.2		2	3
1W-3	ENF	51F	SUR	DBTG	I	CD	CD			2	3
1W-3	ENF	51G	SUR	DBTG	I	MGM	MG			2	3
1W-3	ENF	51H	SUR	DBTG	I	MGM	MG	5.5		2	3
1W-3	ENF	51I	SUR	DBTG	I	MGM	MG			2	3
1W-3	ENF	51J	SUR	DBTG	TQ	-	TQ	9.0		2	3
1W-3	ENF	51K	SUR	DBTG	CD	-	CD	5.2		2	3
1W-3	ENF	51L	SUR	DBTG	CD	-	CD			2	3
1W-3	ENF	51M	SUR	DBTG	TQ	-	TQ	5.3		2	3
1W-3	ENF	51N	SUR	DBTG	CD	-	CD			2	3
1W-3	ENF	51O	SUR	DBTG	CD	-	CD			2	3
1Z-17	ENF	3	SUR	BIFACE	CD	-	CD	8.8		2	3
1Z-17	ENF	4	SUR	BIFACE	TQ	-	TQ	5.4		2	3
1Z-17	ENF	5	SUR	BIFACE	TQ	-	TQ	3.7		2	3
1Z-17	ENF	6	SUR	PTBLNK	I	TQ	TQ	3.3	7.4	2	3
1Z-17	ENF	7	SUR	FLKTL	TQ	-	TQ			2	3
20-A	474	16	SUR	PRJPT	I	CD	CD	7.9		4	3
20-A	474	17	SUR	PRJPT	I	MGM	MG			4	3
20-A	474	24	SUR	PRJPT	CD	-	CD	4.9		4	3
20-A	474	35	SUR	PRJPT	TQ	-	TQ	4.0		4	3
20-A	474	36	SUR	PRJPT	TQ	-	TQ	5.3		4	3
20-A	474	71A	CSC	DBTG	I	CD	CD	2.8		4	3
20-A	474	71B	CSC	DBTG	I	MGM	MG	4.8		4	3
20-A	474	71C	CSC	DBTG	I	CD	CD			4	3
20-A	474	71D	CSC	DBTG	I	CD	CD	5.0		4	3
20-A	474	71E	CSC	DBTG	I	CD	CD	5.0		4	3
20-A	474	71F	CSC	DBTG	I	CD	CD	5.0		4	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
20-A	474	71G	CSC	DBTG	I	CD	CD	3.9		4	3
20-A	474	71H	CSC	DBTG	I	CD	CD			4	3
20-A	474	71I	CSC	DBTG	I	CD	CD			4	3
20-A	474	71J	CSC	DBTG	CD	-	CD	3.1		4	3
20-A	474	71K	CSC	DBTG	CD	-	CD	NMB		4	3
20-A	474	71L	CSC	DBTG	CD	-	CD			4	3
20-A	474	71M	CSC	DBTG	CD	-	CD			4	3
20-A	474	71N	CSC	DBTG	CD	-	CD			4	3
20-A	474	71O	CSC	DBTG	CD	-	CD			4	3
20-A	474	72	CSC	FLKTL	CD	-	CD			4	3
20-A	474	73A	CSC	DBTG	I	CD	CD			4	3
20-A	474	73B	CSC	DBTG	I	CD	CD			4	3
20-A	474	73C	CSC	DBTG	I	CD	CD			4	3
20-A	474	73D	CSC	DBTG	I	MGM/MC	M			4	3
20-A	474	73E	CSC	DBTG	I	CD	CD			4	3
20-A	474	73F	CSC	DBTG	I	MC	MC			4	3
20-A	474	73G	CSC	DBTG	I	CD	CD			4	3
20-A	474	73H	CSC	DBTG	I	MC/MGM	M			4	3
20-A	474	73I	CSC	DBTG	I	CD	CD			4	3
20-A	474	73J	CSC	DBTG	I	CD	CD			4	3
20-A	474	73K	CSC	DBTG	I	CD	CD			4	3
20-A	474	73L	CSC	DBTG	CD	-	CD			4	3
20-A	474	73M	CSC	DBTG	CD	-	CD			4	3
20-A	474	73N	CSC	DBTG	CD	-	CD			4	3
20-A	474	73O	CSC	DBTG	CD	-	CD			4	3
20-A	474	74A	EXC	DBTG	-	-	I	4.6		4	3
20-A	474	74B	EXC	DBTG	-	-	I	4.6		4	3
20-A	474	74C	EXC	DBTG	-	-	I	4.7		4	3
20-A	474	74D	EXC	DBTG	-	-	I	5.4		4	3
20-A	474	74E	EXC	DBTG	-	-	I	5.0		4	3
20-A	474	75	EXC	FLKTL	CD	-	CD			4	3
20-A	474	76A	EXC	DBTG	-	-	I	3.7		4	3
20-A	474	76B	EXC	DBTG	-	-	I	4.6		4	3
20-A	474	76C	EXC	DBTG	-	-	I	4.7		4	3
20-A	474	76D	EXC	DBTG	-	-	I	5.3		4	3
20-A	474	76E	EXC	DBTG	-	-	I	2.8		4	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
20C-1	455	1002A	CSC	DBTG	I	TQ	TQ			3	1
20C-1	455	1002B	CSC	DBTG	I	CD	CD			3	1
20C-1	455	1002C	CSC	DBTG	I	CD	CD			3	1
20C-1	455	1002D	CSC	DBTG	I	CD	CD			3	1
20C-1	455	1002E	CSC	DBTG	I	SV	SV			3	1
20C-1	455	1002F	CSC	DBTG	I	CD	CD			3	1
20C-1	455	1002G	CSC	DBTG	TQ	-	TQ			3	1
20C-1	455	1002H	CSC	DBTG	CD	-	CD			3	1
20C-1	455	1002I	CSC	DBTG	CD	-	CD			3	1
20C-1	455	1002J	CSC	DBTG	CD	-	CD			3	1
20C-1	455	1002K	CSC	DBTG	TQ	-	TQ			3	1
20C-1	455	1002L	CSC	DBTG	TQ	-	TQ			3	1
20C-1	455	1002M	CSC	DBTG	TQ	-	TQ			3	1
20C-1	455	1002N	CSC	DBTG	TQ	-	TQ			3	1
20C-1	455	1002O	CSC	DBTG	TQ	-	TQ			3	1
20C-1	455	1002P	CSC	DBTG	TQ	-	TQ	10.2		3	1
20C-1	455	1002Q	CSC	DBTG	TQ	-	TQ	13.0		3	1
20C-1	455	1002R	CSC	DBTG	-	-	I	8.7		3	1
20C-1	455	1002S	CSC	DBTG	-	-	I	7.6		3	1
20C-1	455	1002T	CSC	DBTG	-	-	I	9.8		3	1
20C-1	455	1002U	CSC	DBTG	-	-	I	9.7		3	1
20C-1	455	1002V	CSC	DBTG	-	-	I	6.6		3	1
20C-1	467	811A	CSC	DBTG	I	CD	CD	13.0		3	1
20C-1	467	813A	CSC	DBTG	I	CD	CD	10.1		3	1
20C-1	467	813B	CSC	DBTG	I	TQ	TQ	7.3		3	1
20C-1	467	813C	CSC	DBTG	TQ	-	TQ	13.0		3	1
20C-1	467	813D	CSC	DBTG	CD	-	CD	7.2		3	1
20C-1	467	813E	CSC	DBTG	TQ	-	TQ	9.8		3	1
20C-1	467	813F	CSC	DBTG	TQ	-	TQ	9.8		3	1
20C-1	467	814A	CSC	DBTG	I	CD	CD			3	1
20C-1	467	814B	CSC	DBTG	I	FS	FS	11.2		3	1
20C-1	467	815A	CSC	DBTG	I	CD	CD			3	1
20C-1	467	815B	CSC	DBTG	TQ	-	TQ			3	1
20C-1	467	815C	CSC	DBTG	TQ	-	TQ	12.5		3	1
20C-1	467	815D	CSC	DBTG	FS	-	FS			3	1
20C-1	467	816A	CSC	DBTG	CD	-	CD			3	1

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
20C-1	467	816B	CSC	DBTG	TQ	-	TQ			3	1
20C-1	467	819A	CSC	DBTG	TQ	-	TQ			3	1
20C-1	467	820A	CSC	DBTG	TQ	-	TQ	11.3		3	1
20C-1	467	828	CSC	BIFACE	I	MH	MH			3	1
20C-1	455	893	SUR	FRMFLKTL	I	MGM	MG	10.1		3	1
20C-1	455	895	SUR	FRMFLKTL	I	MGM	MG	10.2		3	1
20C-1	455	972	CSC	FLKTL	TQ	-	TQ			3	1
20C-1	455	973	CSC	FLKTL	TQ	-	TQ			3	1
20C-1	455	974	SUR	FLKTL	I	SV	SV			3	1
20C-1	455	975	SUR	FLKTL	I	SV	SV			3	1
20C-1	455	976	SUR	BIFACE	CD	-	CD			3	1
2189	392	114	CSC	BIFACE	I	MGM	MG			2	3
2189	392	115	CSC	BIFACE	I	MH	MH			2	3
2189	392	116	CSC	BIFACE	TQ	-	TQ			2	3
2189	392	117	CSC	FRMFLKTL	TQ	-	TQ	7.2		2	3
2189	392	118	CSC	FRMFLKTL	TQ	-	TQ	7.9		2	3
2189	392	119	CSC	CORE	I	QI/MH	I	9.5		2	3
2189	392	12	CSC	PRJPT	TQ	-	TQ			2	3
2189	392	120	CSC	CORE	TQ	-	TQ	6.1		2	3
2189	392	121	CSC	FLKTL	TQ	-	TQ			2	3
2189	392	122	CSC	PTBLNK	TQ	-	TQ	5.4		2	3
2189	392	123	CSC	FLKTL	TQ	-	TQ			2	3
2189	392	124	CSC	FLKTL	TQ	-	TQ			2	3
2189	392	125	CSC	FLKTL	TQ	-	TQ			2	3
2189	392	13	CSC	FLKTL	TQ	-	TQ			2	3
2189	392	14	CSC	FLKTL	TQ	-	TQ			2	3
2189	392	142	CSC	PRJPT	FS	-	FS	2.7		2	3
2189	392	143	CSC	BIFACE	I	TQ	TQ			2	3
2189	392	144	CSC	BIFACE	I	MH	MH			2	3
2189	392	155	CSC	PRJPT	I	-	I			2	3
2189	392	156	CSC	PRJPT	I	TQ	TQ	1.3	3.1	2	3
2189	392	157	CSC	BIFACE	-	-	-			2	3
2189	392	158	CSC	BIFACE	-	-	-			2	3
2189	392	159	CSC	BIFACE	-	-	-			2	3
2189	392	160	CSC	CORE	I	QI	QI	3.8		2	3
2189	392	161	CSC	FLKTL	-	-	-			2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2189	392	162	CSC	FLKTL	-	-	-			2	3
2189	392	163	CSC	FLKTL	-	-	-			2	3
2189	392	170	CSC	PRJPT	TQ	TQ	TQ	6.1		2	3
2189	392	175	CSC	FRMFLKTL	TQ	-	TQ	DH		2	3
2189	392	176	CSC	FLKTL	-	-	-			2	3
2189	392	191	CSC	FLKTL	-	-	-			2	3
2189	392	197	CSC	FLKTL	I	MH	MH			2	3
2189	392	198	CSC	FLKTL	TQ	-	TQ			2	3
2189	392	20	CSC	PRJPT	I	TQ	TQ			2	3
2189	392	209	CSC	BIFACE	-	-	-			2	3
2189	392	21	CSC	BIFACE	I	MH	MH			2	3
2189	392	210	CSC	BIFACE	-	-	-			2	3
2189	392	214	CSC	BIFACE	-	-	-			2	3
2189	392	217	CSC	FLKTL	-	-	-			2	3
2189	392	22	CSC	BIFACE	TQ	-	TQ			2	3
2189	392	23	CSC	BIFACE	TQ	-	TQ			2	3
2189	392	24	CSC	BIFACE	TQ	-	TQ			2	3
2189	392	25	CSC	FLKTL	TQ	-	TQ			2	3
2189	392	277	CSC	BIFACE	-	-	-			2	3
2189	392	285	CSC	PRJPT	TQ	-	TQ			2	3
2189	392	2976	EXC	DRILL	TQ	-	TQ			2	3
2189	392	2977	EXC	FLKTL	TQ	-	TQ			2	3
2189	392	2978	EXC	FLKTL	I	TQ	TQ			2	3
2189	392	2979	EXC	FLKTL	TQ	-	TQ			2	3
2189	392	2980	EXC	FLKTL	CD	-	CD			2	3
2189	392	2983	EXC	DBTG	TQ	-	TQ	7.1		2	3
2189	392	2983	EXC	DBTG	TQ	-	TQ	6.5		2	3
2189	392	2983	EXC	DBTG	TQ	-	TQ	2.8		2	3
2189	392	2983	EXC	DBTG	TQ	-	TQ			2	3
2189	392	2992	EXC	PTBLNK	TQ	-	TQ	1.5	DH	2	3
2189	392	3007	EXC	PTBLNK	I	MH	MH	2.1	10.7	2	3
2189	392	3008	EXC	BIFACE	I	MH	MH			2	3
2189	392	3009	EXC	FRMFLKTL	TQ	-	TQ	5.4		2	3
2189	392	3010	EXC	DBTG	FS	-	FS			2	3
2189	392	3010	EXC	DBTG	TQ	-	TQ			2	3
2189	392	3010	EXC	DBTG	CD	-	CD			2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2189	392	3010	EXC	DBTG	I	-	I			2	3
2189	392	3010	EXC	DBTG	TQ	-	TQ			2	3
2189	392	3010	EXC	DBTG	TQ	-	TQ			2	3
2189	392	3010	EXC	DBTG	TQ	-	TQ			2	3
2189	392	3010	EXC	DBTG	TQ	-	TQ			2	3
2189	392	3010	EXC	DBTG	TQ	-	TQ			2	3
2189	392	3010	EXC	DBTG	I	-	I			2	3
2189	392	3010L	EXC	DBTG	I	TQ	TQ			2	3
2189	392	3010M	EXC	DBTG	I	TQ	TQ			2	3
2189	392	3010S	EXC	DBTG	I	TQ	TQ			2	3
2189	392	3010X	EXC	DBTG	I	TQ	TQ			2	3
2189	392	3029	EXC	BIFACE	I	MGM	MG			2	3
2189	392	3030	EXC	FLKTL	I	TQ	TQ			2	3
2189	392	3037	EXC	PRJPT	FS	-	FS			2	3
2189	392	3038	EXC	BIFACE	CD	-	CD			2	3
2189	392	3039	EXC	BIFACE	TQ	-	TQ			2	3
2189	392	3040	EXC	BIFACE	I	MH	MH			2	3
2189	392	3041	EXC	DRILL	TQ	-	TQ			2	3
2189	392	3042	EXC	FLKTL	I	TQ	TQ			2	3
2189	392	3043	EXC	FLKTL	I	TQ	TQ			2	3
2189	392	3044	EXC	FLKTL	TQ	-	TQ			2	3
2189	392	3045	EXC	FLKTL	TQ	-	TQ			2	3
2189	392	3046	EXC	FLKTL	TQ	-	TQ			2	3
2189	392	3049	EXC	DBTG	TQ	-	TQ			2	3
2189	392	3049	EXC	DBTG	TQ	-	TQ			2	3
2189	392	3049	EXC	DBTG	CD	-	CD			2	3
2189	392	3049	EXC	DBTG	CD	-	CD			2	3
2189	392	3049	EXC	DBTG	FS	-	FS			2	3
2189	392	3049	EXC	DBTG	CD	-	CD			2	3
2189	392	3049	EXC	DBTG	CD	-	CD			2	3
2189	392	3049	EXC	DBTG	FS	-	FS			2	3
2189	392	3049	EXC	DBTG	I	-	I			2	3
2189	392	3049	EXC	DBTG	TQ	-	TQ			2	3
2189	392	3049	EXC	DBTG	I	-	I			2	3
2189	392	3049	EXC	DBTG	I	-	I			2	3
2189	392	3049	EXC	DBTG	TQ	-	TQ			2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2189	392	3049	EXC	DBTG	TQ	-	TQ			2	3
2189	392	3049	EXC	DBTG	TQ	-	TQ			2	3
2189	392	3049A	EXC	DBTG	I	CD	CD			2	3
2189	392	3049B	EXC	DBTG	I	CD	CD			2	3
2189	392	3049C	EXC	DBTG	I	M	M			2	3
2189	392	3049D	EXC	DBTG	I	M	M			2	3
2189	392	3049E	EXC	DBTG	I	CD	CD			2	3
2189	392	3049F	EXC	DBTG	I	CD	CD			2	3
2189	392	3049G	EXC	DBTG	I	TQ	TQ			2	3
2189	392	3049LR	EXC	DBTG	I	TQ	TQ			2	3
2189	392	3049MR	EXC	DBTG	I	M	M			2	3
2189	392	3049SR	EXC	DBTG	I	TQ	TQ			2	3
2189	392	3049XR	EXC	DBTG	I	M	M			2	3
2189	392	3095	SUR	PRJPT	TQ	I	I	4.3		2	3
2189	392	3096	SUR	PRJPT	CD	-	CD			2	3
2189	392	3097	SUR	PRJPT	TQ	-	TQ			2	3
2189	392	3098	SUR	PRJPT	TQ	TQ	TQ	6.6		2	3
2189	392	3099	SUR	PRJPT	TQ	TQ	TQ	2.7		2	3
2189	392	3100	SUR	PRJPT	CD	-	CD	7.2		2	3
2189	392	3101	SUR	PRJPT	TQ	-	TQ	7.1	8.2	2	3
2189	392	3104	SUR	BIFACE	-	-	-			2	3
2189	392	3106	SUR	FLKTL	-	-	-			2	3
2189	392	3108	SUR	BIFACE	-	-	-			2	3
2189	392	3109	SUR	FLKTL	-	-	-			2	3
2189	392	3110	SUR	BIFACE	-	-	-			2	3
2189	392	3111	SUR	PRJPT	I	TQ	TQ	3.3		2	3
2189	392	3112	SUR	BIFACE	-	-	-			2	3
2189	392	3113	SUR	PRJPT	TQ	-	TQ			2	3
2189	392	3114	SUR	BIFACE	-	-	-			2	3
2189	392	3115	SUR	BIFACE	-	-	-			2	3
2189	392	3116	SUR	FRMFLKTL	TQ	-	TQ	7.1		2	3
2189	392	3117	SUR	BIFACE	-	-	-			2	3
2189	392	3118	SUR	BIFACE	-	-	-			2	3
2189	392	3119	SUR	DRILL	I	-	I			2	3
2189	392	3121	SUR	BIFACE	-	-	-			2	3
2189	392	3123	SUR	FLKTL	-	-	-			2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2189	392	3125	SUR	BIFACE	-	-	-			2	3
2189	392	3126	SUR	FLKTL	-	-	-			2	3
2189	392	3128	SUR	PTBLNK	-	-	-	NA		2	3
2189	392	3130	SUR	FLKTL	-	-	-			2	3
2189	392	3132	SUR	BIFACE	-	-	-			2	3
2189	392	3135	SUR	FLKTL	-	-	-			2	3
2189	392	3136	SUR	FLKTL	-	-	-			2	3
2189	392	3138	SUR	FLKTL	-	-	-			2	3
2189	392	3140	SUR	BIFACE	-	-	-			2	3
2189	392	3142	SUR	BIFACE	-	-	-			2	3
2189	392	3144	SUR	FLKTL	-	-	-			2	3
2189	392	3148	SUR	FLKTL	-	-	-			2	3
2189	392	315	EXC	DBTG	TQ	-	TQ			2	3
2189	392	315	EXC	DBTG	TQ	-	TQ			2	3
2189	392	315	EXC	DBTG	CD	-	CD			2	3
2189	392	315	EXC	DBTG	CD	-	CD			2	3
2189	392	315	EXC	DBTG	FS	-	FS			2	3
2189	392	315	EXC	DBTG	I	-	I			2	3
2189	392	315	EXC	DBTG	I	-	I			2	3
2189	392	315	EXC	DBTG	TQ	-	TQ			2	3
2189	392	315	EXC	DBTG	CD	-	CD			2	3
2189	392	315	EXC	DBTG	TQ	-	TQ			2	3
2189	392	315	EXC	DBTG	I	-	I			2	3
2189	392	315	EXC	DBTG	I	-	I			2	3
2189	392	315	EXC	DBTG	TQ	-	TQ			2	3
2189	392	315	EXC	DBTG	TQ	-	TQ			2	3
2189	392	315	EXC	DBTG	I	-	I			2	3
2189	392	315	EXC	DBTG	TQ	-	TQ			2	3
2189	392	315	EXC	DBTG	I	-	I			2	3
2189	392	315	EXC	DBTG	I	-	I			2	3
2189	392	3150	SUR	FLKTL	-	-	-			2	3
2189	392	3154	SUR	BIFACE	-	-	-			2	3
2189	392	3155	SUR	BIFACE	-	-	-			2	3
2189	392	3157	SUR	BIFACE	-	-	-			2	3
2189	392	3159	SUR	FLKTL	-	-	-			2	3
2189	392	3161	SUR	FLKTL	-	-	-			2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2189	392	3165	SUR	FLKTL	-	-	-			2	3
2189	392	3167	SUR	FLKTL	-	-	-			2	3
2189	392	3170	SUR	FLKTL	-	-	-			2	3
2189	392	3172	SUR	FLKTL	-	-	-			2	3
2189	392	3174	SUR	FLKTL	-	-	-			2	3
2189	392	3176	SUR	BIFACE	-	-	-			2	3
2189	392	3178	SUR	BIFACE	-	-	-			2	3
2189	392	3180	SUR	BIFACE	-	-	-			2	3
2189	392	3182	SUR	FLKTL	-	-	-			2	3
2189	392	3184	SUR	FLKTL	-	-	-			2	3
2189	392	3186	SUR	FRMFLKTL	I	MH	MH	6.8		2	3
2189	392	3188	SUR	FLKTL	-	-	-			2	3
2189	392	3189	SUR	FLKTL	-	-	-			2	3
2189	392	319	EXC	BIFACE	TQ	-	TQ			2	3
2189	392	3191	SUR	FLKTL	-	-	-			2	3
2189	392	3192	SUR	FLKTL	-	-	-			2	3
2189	392	3194	SUR	FLKTL	-	-	-			2	3
2189	392	3196	SUR	FLKTL	-	-	-			2	3
2189	392	3210	SUR	PTBLNK	-	-	-	NA		2	3
2189	392	3211	SUR	PRJPT	TQ	TQ	TQ	6.3		2	3
2189	392	3212	SUR	PRJPT	CD	-	CD	DH		2	3
2189	392	3213	SUR	PRJPT	TQ	-	TQ	3.9		2	3
2189	392	3214	SUR	PRJPT	TQ	-	TQ			2	3
2189	392	3215	SUR	BIFACE	-	-	-			2	3
2189	392	3216	SUR	BIFACE	-	-	-			2	3
2189	392	3217	SUR	BIFACE	-	-	-			2	3
2189	392	3218	SUR	BIFACE	-	-	-			2	3
2189	392	3219	SUR	BIFACE	-	-	-			2	3
2189	392	3220	SUR	BIFACE	-	-	-			2	3
2189	392	3221	SUR	BIFACE	-	-	-			2	3
2189	392	3222	SUR	PTBLNK	-	-	-	NA		2	3
2189	392	3223	SUR	FRMFLKTL	TQ	-	TQ	5.9		2	3
2189	392	3224	SUR	FRMFLKTL	I	TQ	TQ	7.8		2	3
2189	392	3225	SUR	FRMFLKTL	TQ	-	TQ	5.9		2	3
2189	392	3226	SUR	FLKTL	-	-	-			2	3
2189	392	3227	SUR	FLKTL	-	-	-			2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2189	392	3228	SUR	FLKTL	-	-	-			2	3
2189	392	3229	SUR	FLKTL	-	-	-			2	3
2189	392	3230	SUR	FLKTL	-	-	-			2	3
2189	392	3231	SUR	FLKTL	-	-	-			2	3
2189	392	3232	SUR	FLKTL	-	-	-			2	3
2189	392	3233	SUR	FLKTL	-	-	-			2	3
2189	392	3234	SUR	FLKTL	-	-	-			2	3
2189	392	3235	SUR	CORE	I	TQ	TQ	6.5		2	3
2189	392	3236	SUR	CORE	I	TQ	TQ	8.3		2	3
2189	392	324	EXC	DBTG	TQ	-	TQ			2	3
2189	392	324	EXC	DBTG	TQ	-	TQ			2	3
2189	392	324	EXC	DBTG	FS	-	FS			2	3
2189	392	324	EXC	DBTG	I	-	I			2	3
2189	392	324	EXC	DBTG	I	-	I			2	3
2189	392	324	EXC	DBTG	TQ	-	TQ			2	3
2189	392	324	EXC	DBTG	TQ	-	TQ			2	3
2189	392	324	EXC	DBTG	I	-	I			2	3
2189	392	324	EXC	DBTG	I	-	I			2	3
2189	392	324	EXC	DBTG	TQ	-	TQ			2	3
2189	392	324	EXC	DBTG	I	-	I			2	3
2189	392	324	EXC	DBTG	TQ	-	TQ			2	3
2189	392	324	EXC	DBTG	I	-	I			2	3
2189	392	324	EXC	DBTG	I	-	I			2	3
2189	392	3244	SUR	FRMFLKTL	CD	-	CD	3.1		2	3
2189	392	3248	SUR	BIFACE	-	-	-			2	3
2189	392	3249	SUR	BIFACE	-	-	-			2	3
2189	392	3250	SUR	BIFACE	-	-	-			2	3
2189	392	3251	SUR	BIFACE	-	-	-			2	3
2189	392	3252	SUR	BIFACE	-	-	-			2	3
2189	392	3253	SUR	BIFACE	-	-	-			2	3
2189	392	3254	SUR	BIFACE	-	-	-			2	3
2189	392	3255	SUR	BIFACE	-	-	-			2	3
2189	392	3256	SUR	BIFACE	-	-	-			2	3
2189	392	3257	SUR	PRJPT	I	-	I			2	3
2189	392	3258	SUR	BIFACE	-	-	-			2	3
2189	392	3259	SUR	BIFACE	-	-	-			2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2189	392	326	EXC	BIFACE	TQ	-	TQ			2	3
2189	392	3260	SUR	BIFACE	-	-	-			2	3
2189	392	3261	SUR	BIFACE	-	-	-			2	3
2189	392	3262	SUR	PRJPT	I	MGM/MC	M			2	3
2189	392	3263	SUR	PRJPT	TQ	TQ	TQ	5.9		2	3
2189	392	3264	SUR	PRJPT	TQ	-	TQ	5.3		2	3
2189	392	3368	EXC	BIFACE	I	CD	CD			2	3
2189	392	3370	EXC	FLKTL	I	MGM	MG			2	3
2189	392	339	EXC	PRJPT	TQ	-	TQ	6.6		2	3
2189	392	340	EXC	BIFACE	CD	-	CD			2	3
2189	392	341	EXC	DBTG	TQ	-	TQ			2	3
2189	392	341	EXC	DBTG	TQ	-	TQ			2	3
2189	392	341	EXC	DBTG	TQ	-	TQ			2	3
2189	392	341	EXC	DBTG	CD	-	CD			2	3
2189	392	341	EXC	DBTG	TQ	-	TQ			2	3
2189	392	341	EXC	DBTG	TQ	-	TQ			2	3
2189	392	341	EXC	DBTG	I	-	I			2	3
2189	392	341	EXC	DBTG	I	-	I			2	3
2189	392	341	EXC	DBTG	I	-	I			2	3
2189	392	341	EXC	DBTG	I	-	I			2	3
2189	392	341	EXC	DBTG	TQ	-	TQ			2	3
2189	392	341	EXC	DBTG	TQ	-	TQ			2	3
2189	392	341	EXC	DBTG	I	-	I			2	3
2189	392	341	EXC	DBTG	I	-	I			2	3
2189	392	341	EXC	DBTG	TQ	-	TQ			2	3
2189	392	341	EXC	DBTG	TQ	-	TQ			2	3
2189	392	347	EXC	FLKTL	TQ	-	TQ			2	3
2189	392	348	EXC	DBTG	TQ	-	TQ	7.1		2	3
2189	392	348	EXC	DBTG	TQ	-	TQ	6.3		2	3
2189	392	348	EXC	DBTG	TQ	-	TQ	6.4		2	3
2189	392	348	EXC	DBTG	TQ	-	TQ	8.1		2	3
2189	392	358	EXC	DBTG	TQ	-	TQ			2	3
2189	392	358	EXC	DBTG	I	-	I			2	3
2189	392	358	EXC	DBTG	TQ	-	TQ			2	3
2189	392	358	EXC	DBTG	CD	-	CD			2	3
2189	392	358	EXC	DBTG	I	-	I			2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2189	392	358	EXC	DBTG	TQ	-	TQ			2	3
2189	392	358	EXC	DBTG	TQ	-	TQ			2	3
2189	392	358	EXC	DBTG	TQ	-	TQ			2	3
2189	392	358	EXC	DBTG	I	-	I			2	3
2189	392	358	EXC	DBTG	I	-	I			2	3
2189	392	358	EXC	DBTG	TQ	-	TQ			2	3
2189	392	358AL	EXC	DBTG	I	TQ	TQ			2	3
2189	392	358BM	EXC	DBTG	I	TQ	TQ			2	3
2189	392	358CS	EXC	DBTG	I	M	M			2	3
2189	392	358DS	EXC	DBTG	I	TQ	TQ			2	3
2189	392	358ES	EXC	DBTG	I	M	M			2	3
2189	392	358F	EXC	DBTG	I	I	I			2	3
2189	392	358G	EXC	DBTG	I	I	I			2	3
2189	392	358H	EXC	DBTG	I	TQ	TQ			2	3
2189	392	358I	EXC	DBTG	I	TQ	TQ			2	3
2189	392	358J	EXC	DBTG	I	TQ	TQ			2	3
2189	392	358K	EXC	DBTG	I	TQ	TQ			2	3
2189	392	358L	EXC	DBTG	I	TQ	TQ			2	3
2189	392	358M	EXC	DBTG	I	TQ	TQ			2	3
2189	392	358N	EXC	DBTG	I	TQ	TQ			2	3
2189	392	358O	EXC	DBTG	I	TQ	TQ			2	3
2189	392	36	CSC	FRMFLKTL	TQ	-	TQ	8.4		2	3
2189	392	362	EXC	BIFACE	TQ	-	TQ			2	3
2189	392	366	EXC	BIFACE	TQ	-	TQ			2	3
2189	392	367	EXC	FLKTL	TQ	-	TQ			2	3
2189	392	369	EXC	DBTG	TQ	-	TQ	6.2		2	3
2189	392	369	EXC	DBTG	TQ	-	TQ	6.2		2	3
2189	392	369	EXC	DBTG	TQ	-	TQ	6.0		2	3
2189	392	371	EXC	DBTG	TQ	-	TQ	6.1		2	3
2189	392	376	EXC	FLKTL	I	TQ	TQ			2	3
2189	392	377	EXC	CORE	CD	-	CD	5.8		2	3
2189	392	378	EXC	DBTG	FS	-	FS			2	3
2189	392	378	EXC	DBTG	I	-	I			2	3
2189	392	378	EXC	DBTG	I	-	I			2	3
2189	392	378	EXC	DBTG	TQ	-	TQ			2	3
2189	392	378	EXC	DBTG	FS	-	FS			2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2189	392	378	EXC	DBTG	I	-	I			2	3
2189	392	378	EXC	DBTG	TQ	-	TQ			2	3
2189	392	378	EXC	DBTG	TQ	-	TQ			2	3
2189	392	378	EXC	DBTG	TQ	-	TQ			2	3
2189	392	378	EXC	DBTG	TQ	-	TQ			2	3
2189	392	378	EXC	DBTG	I	-	I			2	3
2189	392	378	EXC	DBTG	I	-	I			2	3
2189	392	378	EXC	DBTG	I	-	I			2	3
2189	392	378	EXC	DBTG	TQ	-	TQ			2	3
2189	392	378	EXC	DBTG	TQ	-	TQ			2	3
2189	392	378	EXC	DBTG	TQ	-	TQ			2	3
2189	392	378	EXC	DBTG	TQ	-	TQ			2	3
2189	392	383	EXC	DBTG	TQ	-	TQ	5.7		2	3
2189	392	383	EXC	DBTG	TQ	-	TQ	7.5		2	3
2189	392	383	EXC	DBTG	TQ	-	TQ	5.3		2	3
2189	392	383	EXC	DBTG	TQ	-	TQ	5.5		2	3
2189	392	386	EXC	BIFACE	TQ	-	TQ			2	3
2189	392	39	CSC	FLKTL	-	-	-			2	3
2189	392	394	EXC	BIFACE	TQ	-	TQ			2	3
2189	392	395	EXC	FRMFLKTL	TQ	-	TQ	7.1		2	3
2189	392	4	CSC	FRMFLKTL	CD	-	CD	7.3		2	3
2189	392	400	EXC	DBTG	TQ	-	TQ			2	3
2189	392	400	EXC	DBTG	TQ	-	TQ			2	3
2189	392	400	EXC	DBTG	CD	-	CD			2	3
2189	392	400	EXC	DBTG	CD	-	CD			2	3
2189	392	400	EXC	DBTG	I	-	I			2	3
2189	392	400	EXC	DBTG	TQ	-	TQ			2	3
2189	392	400	EXC	DBTG	TQ	-	TQ			2	3
2189	392	400	EXC	DBTG	I	-	I			2	3
2189	392	400	EXC	DBTG	I	-	I			2	3
2189	392	400	EXC	DBTG	TQ	-	TQ			2	3
2189	392	400	EXC	DBTG	TQ	-	TQ			2	3
2189	392	400	EXC	DBTG	I	-	I			2	3
2189	392	400	EXC	DBTG	I	-	I			2	3
2189	392	400	EXC	DBTG	I	-	I			2	3
2189	392	400	EXC	DBTG	TQ	-	TQ			2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2189	392	400	EXC	DBTG	TQ	-	TQ			2	3
2189	392	400	EXC	DBTG	TQ	-	TQ			2	3
2189	392	407L	EXC	DBTG	TQ	I	I	7.8		2	3
2189	392	407M	EXC	DBTG	TQ	TQ	TQ	7.3		2	3
2189	392	407S	EXC	DBTG	TQ	TQ	TQ	6.0		2	3
2189	392	41	CSC	PRJPT	TQ	-	TQ			2	3
2189	392	417	EXC	BIFACE	TQ	-	TQ			2	3
2189	392	418	EXC	BIFACE	TQ	-	TQ			2	3
2189	392	419	EXC	BIFACE	I	MGM	MG			2	3
2189	392	420	EXC	BIFACE	I	MGM	MG			2	3
2189	392	421	EXC	BIFACE	TQ	-	TQ			2	3
2189	392	422	EXC	PRJPT	FS	-	FS			2	3
2189	392	424	EXC	FLKTL	TQ	-	TQ			2	3
2189	392	425	EXC	DBTG	TQ	-	TQ			2	3
2189	392	425	EXC	DBTG	CD	-	CD			2	3
2189	392	425	EXC	DBTG	CD	-	CD			2	3
2189	392	425	EXC	DBTG	FS	-	FS			2	3
2189	392	425	EXC	DBTG	I	-	I			2	3
2189	392	425	EXC	DBTG	TQ	-	TQ			2	3
2189	392	425	EXC	DBTG	TQ	-	TQ			2	3
2189	392	425	EXC	DBTG	I	-	I			2	3
2189	392	425	EXC	DBTG	I	-	I			2	3
2189	392	425	EXC	DBTG	TQ	-	TQ			2	3
2189	392	425	EXC	DBTG	I	-	I			2	3
2189	392	425	EXC	DBTG	I	-	I			2	3
2189	392	425	EXC	DBTG	TQ	-	TQ			2	3
2189	392	425	EXC	DBTG	I	-	I			2	3
2189	392	425	EXC	DBTG	TQ	-	TQ			2	3
2189	392	425	EXC	DBTG	TQ	-	TQ			2	3
2189	392	425	EXC	DBTG	TQ	-	TQ			2	3
2189	392	425	EXC	DBTG	TQ	-	TQ			2	3
2189	392	43	CSC	BIFACE	-	-	-			2	3
2189	392	439	EXC	BIFACE	TQ	-	TQ			2	3
2189	392	44	CSC	BIFACE	-	-	-			2	3
2189	392	440	EXC	BIFACE	TQ	-	TQ			2	3
2189	392	441	EXC	BIFACE	I	SV	SV			2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2189	392	442	EXC	BIFACE	CD	-	CD			2	3
2189	392	45	CSC	FLKTL	-	-	-			2	3
2189	392	452	EXC	BIFACE	CD	-	CD			2	3
2189	392	453	EXC	BIFACE	TQ	-	TQ			2	3
2189	392	454	EXC	CORE	TQ	-	TQ	6.8		2	3
2189	392	464	EXC	FLKTL	TQ	-	TQ			2	3
2189	392	465	EXC	FLKTL	TQ	-	TQ			2	3
2189	392	466	EXC	DBTG	TQ	-	TQ			2	3
2189	392	466	EXC	DBTG	TQ	-	TQ			2	3
2189	392	466	EXC	DBTG	TQ	-	TQ			2	3
2189	392	466	EXC	DBTG	I	-	I			2	3
2189	392	466	EXC	DBTG	I	-	I			2	3
2189	392	466	EXC	DBTG	I	-	I			2	3
2189	392	466	EXC	DBTG	TQ	-	TQ			2	3
2189	392	466	EXC	DBTG	CD	-	CD			2	3
2189	392	466	EXC	DBTG	I	-	I			2	3
2189	392	466	EXC	DBTG	TQ	-	TQ			2	3
2189	392	466	EXC	DBTG	CD	-	CD			2	3
2189	392	466	EXC	DBTG	TQ	-	TQ			2	3
2189	392	466	EXC	DBTG	I	-	I			2	3
2189	392	466	EXC	DBTG	I	-	I			2	3
2189	392	466	EXC	DBTG	I	-	I			2	3
2189	392	466	EXC	DBTG	I	-	I			2	3
2189	392	466	EXC	DBTG	TQ	-	TQ			2	3
2189	392	466	EXC	DBTG	TQ	-	TQ			2	3
2189	392	466	EXC	DBTG	TQ	-	TQ			2	3
2189	392	466	EXC	DBTG	TQ	-	TQ			2	3
2189	392	471	EXC	FRMFLKTL	TQ	-	TQ	6.5		2	3
2189	392	472	EXC	FRMFLKTL	TQ	-	TQ	6.8		2	3
2189	392	482	EXC	BIFACE	TQ	-	TQ			2	3
2189	392	483	EXC	BIFACE	TQ	-	TQ			2	3
2189	392	484	EXC	BIFACE	TQ	-	TQ			2	3
2189	392	492	EXC	BIFACE	CD	-	CD			2	3
2189	392	493	EXC	BIFACE	I	MH	MH			2	3
2189	392	494	EXC	BIFACE	I	TQ	TQ			2	3
2189	392	495	EXC	DRILL	TQ	-	TQ			2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2189	392	5	CSC	FLKTL	-	-	-			2	3
2189	392	507	EXC	BIFACE	TQ	-	TQ			2	3
2189	392	508	EXC	FLKTL	I	TQ	TQ			2	3
2189	392	518	EXC	FRMFLKTL	I	TQ	TQ	7.6		2	3
2189	392	519	EXC	DBTG	TQ	-	TQ			2	3
2189	392	519	EXC	DBTG	TQ	-	TQ			2	3
2189	392	519	EXC	DBTG	TQ	-	TQ			2	3
2189	392	519	EXC	DBTG	I	-	I			2	3
2189	392	519	EXC	DBTG	I	-	I			2	3
2189	392	519	EXC	DBTG	I	-	I			2	3
2189	392	519	EXC	DBTG	TQ	-	TQ			2	3
2189	392	519	EXC	DBTG	I	-	I			2	3
2189	392	519	EXC	DBTG	I	-	I			2	3
2189	392	519	EXC	DBTG	I	-	I			2	3
2189	392	519	EXC	DBTG	TQ	-	TQ			2	3
2189	392	519	EXC	DBTG	TQ	-	TQ			2	3
2189	392	519	EXC	DBTG	TQ	-	TQ			2	3
2189	392	519	EXC	DBTG	I	-	I			2	3
2189	392	519	EXC	DBTG	TQ	-	TQ			2	3
2189	392	519	EXC	DBTG	TQ	-	TQ			2	3
2189	392	52	CSC	PRJPT	TQ	TQ	TQ	1.7		2	3
2189	392	529	EXC	DBTG	TQ	-	TQ	6.2		2	3
2189	392	529	EXC	DBTG	TQ	-	TQ	5.8		2	3
2189	392	529	EXC	DBTG	TQ	-	TQ	6.2		2	3
2189	392	529	EXC	DBTG	TQ	-	TQ	5.9		2	3
2189	392	534	EXC	BIFACE	-	-	-			2	3
2189	392	537	EXC	DBTG	TQ	-	TQ	1.2		2	3
2189	392	542	EXC	DBTG	TQ	-	TQ	1.3		2	3
2189	392	567	EXC	DBTG	TQ	-	TQ			2	3
2189	392	567	EXC	DBTG	TQ	-	TQ	4.9		2	3
2189	392	567	EXC	DBTG	TQ	-	TQ	3.6		2	3
2189	392	567	EXC	DBTG	TQ	-	TQ			2	3
2189	392	573	EXC	DBTG	TQ	-	TQ	4.9		2	3
2189	392	573	EXC	DBTG	TQ	-	TQ	5.4		2	3
2189	392	574	EXC	DBTG	TQ	-	TQ	5.1		2	3
2189	392	574	EXC	DBTG	TQ	-	TQ	5.9		2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2189	392	588	CSC	FRMFLKTL	I	TQ	TQ	8.4		2	3
2189	392	589	CSC	FLKTL	TQ	-	TQ			2	3
2189	392	591	CSC	FLKTL	I	MH	MH			2	3
2189	392	632	EXC	PRJPT	TQ	TQ	TQ	5.0		2	3
2189	392	633	EXC	BIFACE	TQ	-	TQ			2	3
2189	392	635	EXC	DBTG	TQ	-	TQ	8.5		2	3
2189	392	635	EXC	DBTG	TQ	-	TQ	7.0		2	3
2189	392	635	EXC	DBTG	TQ	-	TQ	7.5		2	3
2189	392	635	EXC	DBTG	TQ	-	TQ	6.3		2	3
2189	392	645	EXC	FLKTL	I	TQ	TQ			2	3
2189	392	647	EXC	DBTG	TQ	-	TQ			2	3
2189	392	647	EXC	DBTG	TQ	-	TQ			2	3
2189	392	647	EXC	DBTG	CD	-	CD			2	3
2189	392	647	EXC	DBTG	FS	-	FS			2	3
2189	392	647	EXC	DBTG	I	-	I			2	3
2189	392	647	EXC	DBTG	I	-	I			2	3
2189	392	647	EXC	DBTG	TQ	-	TQ			2	3
2189	392	647	EXC	DBTG	TQ	-	TQ			2	3
2189	392	647	EXC	DBTG	I	-	I			2	3
2189	392	647	EXC	DBTG	I	-	I			2	3
2189	392	647	EXC	DBTG	TQ	-	TQ			2	3
2189	392	647	EXC	DBTG	I	-	I			2	3
2189	392	647	EXC	DBTG	TQ	-	TQ			2	3
2189	392	647	EXC	DBTG	I	-	I			2	3
2189	392	647	EXC	DBTG	TQ	-	TQ			2	3
2189	392	647	EXC	DBTG	I	-	I			2	3
2189	392	647	EXC	DBTG	I	-	I			2	3
2189	392	647	EXC	DBTG	I	-	I			2	3
2189	392	652	EXC	CORE	TQ	-	TQ	6.5		2	3
2189	392	655	EXC	DBTG	TQ	-	TQ			2	3
2189	392	655	EXC	DBTG	TQ	-	TQ			2	3
2189	392	655	EXC	DBTG	I	-	I			2	3
2189	392	655	EXC	DBTG	I	-	I			2	3
2189	392	655	EXC	DBTG	I	-	I			2	3
2189	392	655	EXC	DBTG	TQ	-	TQ			2	3
2189	392	655	EXC	DBTG	TQ	-	TQ			2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2189	392	655	EXC	DBTG	TQ	-	TQ			2	3
2189	392	655	EXC	DBTG	TQ	-	TQ			2	3
2189	392	655	EXC	DBTG	I	-	I			2	3
2189	392	655	EXC	DBTG	I	-	I			2	3
2189	392	655	EXC	DBTG	TQ	-	TQ			2	3
2189	392	655	EXC	DBTG	TQ	-	TQ			2	3
2189	392	655	EXC	DBTG	TQ	-	TQ			2	3
2189	392	655	EXC	DBTG	I	-	I			2	3
2189	392	655	EXC	DBTG	I	-	I			2	3
2189	392	655	EXC	DBTG	I	-	I			2	3
2189	392	655	EXC	DBTG	I	-	I			2	3
2189	392	664	EXC	DBTG	TQ	-	TQ	6.6		2	3
2189	392	664	EXC	DBTG	TQ	-	TQ	6.0		2	3
2189	392	667	EXC	DBTG	TQ	-	TQ	6.1		2	3
2189	392	667	EXC	DBTG	TQ	-	TQ	7.2		2	3
2189	392	685	EXC	DBTG	TQ	-	TQ	3.2		2	3
2189	392	685	EXC	DBTG	TQ	-	TQ	7.0		2	3
2189	392	685	EXC	DBTG	TQ	-	TQ	1.9		2	3
2189	392	70	CSC	PRJPT	CD	-	CD	6.1		2	3
2189	392	701	EXC	FLKTL	-	-	-			2	3
2189	392	71	CSC	PRJPT	CD	-	CD			2	3
2189	392	714	EXC	FLKTL	-	-	-			2	3
2189	392	72	CSC	PTBLNK	TQ	-	TQ	3.8	DH	2	3
2189	392	74	CSC	PRJPT	FS	-	FS			2	3
2189	392	75	CSC	BIFACE	CD	-	CD			2	3
2189	392	76	CSC	DRILL	I	-	I			2	3
2189	392	77	CSC	BIFACE	TQ	-	TQ			2	3
2189	392	80	CSC	CORE	TQ	-	TQ	3.8		2	3
2189	392	81	CSC	CORE	I	TQ/QI	I	5.3		2	3
2189	392	82	CSC	FLKTL	TQ	-	TQ			2	3
2189	392	83	CSC	FLKTL	I	TQ/QI	I			2	3
2189	392	84	CSC	FLKTL	I	TQ	TQ			2	3
2189	392	85	CSC	FLKTL	TQ	-	TQ			2	3
2189	392	86	CSC	FLKTL	TQ	-	TQ			2	3
2189	392	98	CSC	BIFACE	-	-	-			2	3
2189	392	99	CSC	FLKTL	-	-	-			2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2190	392	1007	CSC	PRJPT	TQ	-	TQ	3.5		2	3
2190	392	1008	CSC	PRJPT	I	TQ	TQ	1.6		2	3
2190	392	1009	CSC	PRJPT	TQ	-	TQ			2	3
2190	392	1010	CSC	PRJPT	CD	-	CD			2	3
2190	392	1011	CSC	PTBLNK	I	MGM	MG	2.3		2	3
2190	392	1012	CSC	PTBLNK	TQ	-	TQ	5.2		2	3
2190	392	1013	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1014	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1015	CSC	BIFACE	I	MH	MH			2	3
2190	392	1016	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1017	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1018	CSC	BIFACE	I	QI	QI			2	3
2190	392	1019	CSC	BIFACE	I	MH	MH			2	3
2190	392	1020	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1021	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1022	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1024	CSC	BIFACE	I	MGM	MG			2	3
2190	392	1025	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1026	CSC	PTBLNK	I	SV	SV	4.7		2	3
2190	392	1027	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1028	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1029	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1030	CSC	BIFACE	I	MGM	MG			2	3
2190	392	1032	CSC	BIFACE	I	MH	MH			2	3
2190	392	1033	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1034	CSC	BIFACE	I	MGM	MG			2	3
2190	392	1035	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1036	CSC	FRMFLKTL	TQ	-	TQ	5.3		2	3
2190	392	1037	CSC	DRILL	FS	-	FS			2	3
2190	392	1038	CSC	DRILL	I	-	I			2	3
2190	392	1040	CSC	FLKTL	I	TQ	TQ			2	3
2190	392	1041	CSC	FLKTL	CD	-	CD			2	3
2190	392	1042	CSC	FLKTL	I	MGM/MH	I			2	3
2190	392	1043	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1044	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1045	CSC	FLKTL	CD	-	CD			2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2190	392	1046	CSC	FLKTL	I	TQ/QI	I			2	3
2190	392	1047	CSC	FLKTL	I	MH	MH			2	3
2190	392	1048	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1049	CSC	FLKTL	I	TQ	TQ			2	3
2190	392	1050	CSC	FLKTL	I	CD	CD			2	3
2190	392	1051	CSC	CORE	TQ	-	TQ	4.2		2	3
2190	392	1052	CSC	CORE	I	MGM/MC	M	2.4		2	3
2190	392	1053	CSC	CORE	I	MGM	MG	6.2		2	3
2190	392	1082	CSC	PRJPT	TQ	-	TQ			2	3
2190	392	1083	CSC	PRJPT	TQ	TQ	TQ	6.1		2	3
2190	392	1084	CSC	PRJPT	I	-	I			2	3
2190	392	1085	CSC	BIFACE	I	MGM/MC	M	7.4		2	3
2190	392	1086	CSC	PTBLNK	I	CD	CD	3.7		2	3
2190	392	1087	CSC	BIFACE	CD	-	CD			2	3
2190	392	1088	CSC	BIFACE	I	CD	CD			2	3
2190	392	1089	CSC	BIFACE	CD	-	CD			2	3
2190	392	1090	CSC	BIFACE	CD	-	CD			2	3
2190	392	1091	CSC	BIFACE	CD	-	CD			2	3
2190	392	1092	CSC	BIFACE	CD	-	CD			2	3
2190	392	1093	CSC	FLKTL	I	MC/MGM	M			2	3
2190	392	1094	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1095	CSC	FLKTL	I	MH	MH			2	3
2190	392	1096	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1123	CSC	PRJPT	I	MGM/MC	M	2.8		2	3
2190	392	1124	CSC	PRJPT	TQ	-	TQ			2	3
2190	392	1125	CSC	PRJPT	TQ	-	TQ	4.9		2	3
2190	392	1126	CSC	BIFACE	I	SV	SV			2	3
2190	392	1127	CSC	BIFACE	I	MH	MH			2	3
2190	392	1128	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1129	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1130	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1131	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1132	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1164	CSC	BIFACE	-	-	-			2	3
2190	392	1165	CSC	FLKTL	-	-	-			2	3
2190	392	1181	CSC	PRJPT	TQ	-	TQ			2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2190	392	1182	CSC	PRJPT	TQ	-	TQ			2	3
2190	392	1183	CSC	PRJPT	I	-	I			2	3
2190	392	1184	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1185	CSC	BIFACE	CD	-	CD			2	3
2190	392	1186	CSC	BIFACE	I	MH	MH			2	3
2190	392	1187	CSC	BIFACE	I	MGM	MG			2	3
2190	392	1188	CSC	BIFACE	I	CD	CD			2	3
2190	392	1189	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1190	CSC	FRMFLKTL	TQ	-	TQ	4.7		2	3
2190	392	1191	CSC	FRMFLKTL	I	CD	CD	10.9		2	3
2190	392	1192	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1193	CSC	FLKTL	I	MGM	MG			2	3
2190	392	1212	CSC	BIFACE	-	-	-			2	3
2190	392	1222	CSC	PRJPT	TQ	TQ	TQ	6.2		2	3
2190	392	1223	CSC	PRJPT	I	TQ	TQ	3.6		2	3
2190	392	1224	CSC	PRJPT	I	-	I			2	3
2190	392	1225	CSC	PRJPT	CD	-	CD			2	3
2190	392	1226	CSC	BIFACE	I	TQ	TQ			2	3
2190	392	1227	CSC	PRJPT	CD	-	CD			2	3
2190	392	1228	CSC	PRJPT	I	-	I			2	3
2190	392	1229	CSC	PTBLNK	I	QI	QI	3.6		2	3
2190	392	1230	CSC	PTBLNK	I	SV/CD	I	3.8		2	3
2190	392	1231	CSC	PTBLNK	I	FS	FS	3.7		2	3
2190	392	1232	CSC	BIFACE	I	MH	MH			2	3
2190	392	1233	CSC	BIFACE	I	MH	MH			2	3
2190	392	1234	CSC	BIFACE	TQ	-	TQ	8.9		2	3
2190	392	1235	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1236	CSC	BIFACE	CD	-	CD			2	3
2190	392	1237	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1238	CSC	BIFACE	I	SV/MH	I			2	3
2190	392	1239	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1240	CSC	BIFACE	I	MH	MH			2	3
2190	392	1241	CSC	BIFACE	CD	-	CD			2	3
2190	392	1242	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1243	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1244	CSC	BIFACE	TQ	-	TQ			2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2190	392	1245	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1246	CSC	BIFACE	I	FS	FS			2	3
2190	392	1247	CSC	BIFACE	I	MH/TQ	I			2	3
2190	392	1248	CSC	BIFACE	I	TQ	TQ			2	3
2190	392	1249	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1250	CSC	BIFACE	I	SV	SV			2	3
2190	392	1251	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1252	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1253	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1254	CSC	BIFACE	I	MH	MH			2	3
2190	392	1255	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1256	CSC	BIFACE	CD	-	CD			2	3
2190	392	1257	CSC	BIFACE	I	MGM/MH	I			2	3
2190	392	1258	CSC	BIFACE	CD	-	CD			2	3
2190	392	1259	CSC	BIFACE	I	CD	CD			2	3
2190	392	1260	CSC	BIFACE	CD	-	CD			2	3
2190	392	1261	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1262	CSC	BIFACE	CD	-	CD			2	3
2190	392	1263	CSC	BIFACE	I	CD	CD			2	3
2190	392	1264	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1265	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1266	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1267	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1268	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1269	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1270	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1271	CSC	FLKTL	I	MGM	MG			2	3
2190	392	1272	CSC	FLKTL	I	CD/SV	I			2	3
2190	392	1273	CSC	FLKTL	I	SV	SV			2	3
2190	392	1274	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1275	CSC	CORE	TQ	-	TQ	2.8		2	3
2190	392	1276	CSC	CORE	TQ	-	TQ	3.3		2	3
2190	392	1277	CSC	CORE	TQ	-	TQ	6.5		2	3
2190	392	1278	CSC	CORE	I	TQ	TQ	3.2		2	3
2190	392	1300	CSC	PRJPT	TQ	-	TQ			2	3
2190	392	1301	CSC	BIFACE	TQ	-	TQ			2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2190	392	1302	CSC	BIFACE	CD	-	CD			2	3
2190	392	1303	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1304	CSC	CORE	TQ	-	TQ	NVB		2	3
2190	392	1305	CSC	BIFACE	CD	-	CD			2	3
2190	392	1306	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1307	CSC	FRMFLKTL	TQ	-	TQ	8.6		2	3
2190	392	1308	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1309	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1345	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1346	CSC	BIFACE	I	CD	CD			2	3
2190	392	1347	CSC	BIFACE	I	SV	SV			2	3
2190	392	1348	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1349	CSC	BIFACE	TQ	-	TQ	5.7		2	3
2190	392	1350	CSC	BIFACE	CD	-	CD			2	3
2190	392	1351	CSC	BIFACE	CD	-	CD			2	3
2190	392	1352	CSC	BIFACE	I	SV	SV			2	3
2190	392	1353	CSC	FRMFLKTL	TQ	-	TQ	7.8		2	3
2190	392	1354	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1355	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1357	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1358	CSC	FLKTL	I	SV	SV			2	3
2190	392	1359	CSC	FLKTL	I	MGM	MG			2	3
2190	392	1360	CSC	FLKTL	CD	-	CD			2	3
2190	392	1361	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1362	CSC	CORE	TQ	-	TQ	1.5	6.3	2	3
2190	392	1363	CSC	CORE	TQ	-	TQ	3.9		2	3
2190	392	1364	CSC	CORE	CD	-	CD	4.4		2	3
2190	392	1396	CSC	BIFACE	-	-	-			2	3
2190	392	1397	CSC	BIFACE	-	-	-			2	3
2190	392	1398	CSC	BIFACE	-	-	-			2	3
2190	392	1399	CSC	BIFACE	-	-	-			2	3
2190	392	1400	CSC	FLKTL	-	-	-			2	3
2190	392	1401	CSC	BIFACE	-	-	-			2	3
2190	392	1402	CSC	BIFACE	-	-	-			2	3
2190	392	1403	CSC	FRMFLKTL	I	MGM	MG	1.8		2	3
2190	392	1404	CSC	FLKTL	-	-	-			2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2190	392	1405	CSC	FLKTL	-	-	-			2	3
2190	392	1406	CSC	FLKTL	-	-	-			2	3
2190	392	1421	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1422	CSC	BIFACE	CD	-	CD			2	3
2190	392	1423	CSC	BIFACE	CD	-	CD			2	3
2190	392	1424	CSC	FLKTL	I	MGM	MG			2	3
2190	392	1425	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1434	CSC	BIFACE	-	-	-			2	3
2190	392	1435	CSC	BIFACE	-	-	-			2	3
2190	392	1442	CSC	PRJPT	TQ	-	TQ			2	3
2190	392	1443	CSC	PRJPT	I	TQ	TQ			2	3
2190	392	1444	CSC	PRJPT	I	-	I			2	3
2190	392	1445	CSC	BIFACE	TQ	-	TQ	8.3		2	3
2190	392	1446	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1447	CSC	BIFACE	CD	-	CD			2	3
2190	392	1448	CSC	BIFACE	I	CD	CD			2	3
2190	392	1449	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1450	CSC	BIFACE	CD	-	CD			2	3
2190	392	1451	CSC	BIFACE	I	MH/TQ	I			2	3
2190	392	1452	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1453	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1454	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1455	CSC	FLKTL	I	MH	MH			2	3
2190	392	1456	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1457	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1477	CSC	BIFACE	I	MH	MH			2	3
2190	392	1479	CSC	BIFACE	I	MH	MH			2	3
2190	392	1480	CSC	BIFACE	I	SV	SV			2	3
2190	392	1481	CSC	BIFACE	I	SV	SV			2	3
2190	392	1482	CSC	BIFACE	I	SV	SV			2	3
2190	392	1484	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1485	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1486	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1487	CSC	BIFACE	I	CD	CD			2	3
2190	392	1488	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1489	CSC	BIFACE	I	MGM	MG			2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2190	392	1490	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1491	CSC	BIFACE	I	MH	MH			2	3
2190	392	1492	CSC	FLKTL	I	MGM	MG			2	3
2190	392	1493	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1494	CSC	FLKTL	I	MGM	MG			2	3
2190	392	1495	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1496	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1497	CSC	FLKTL	I	CD	CD			2	3
2190	392	1498	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1499	CSC	CORE	CD	-	CD	3.6		2	3
2190	392	1530	CSC	PRJPT	I	MGM/MC	M	2.9		2	3
2190	392	1531	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1532	CSC	BIFACE	TQ	-	TQ	3.1		2	3
2190	392	1533	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1534	CSC	CORE	I	MGM	MG	1.5		2	3
2190	392	1564	CSC	FLKTL	-	-	-			2	3
2190	392	1569	CSC	BIFACE	-	-	-			2	3
2190	392	1570	CSC	FLKTL	-	-	-			2	3
2190	392	1571	CSC	FLKTL	-	-	-			2	3
2190	392	1586	CSC	PRJPT	I	MH	MH	2.3		2	3
2190	392	1587	CSC	FLKTL	I	MGM/MC	M			2	3
2190	392	1588	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1589	CSC	FLKTL	CD	-	CD			2	3
2190	392	1597	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1598	CSC	DRILL	CD	-	CD			2	3
2190	392	1599	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1600	CSC	BIFACE	I	SV	SV			2	3
2190	392	1601	CSC	BIFACE	I	MH	MH			2	3
2190	392	1602	CSC	BIFACE	I	SV	SV			2	3
2190	392	1603	CSC	BIFACE	I	SV	SV			2	3
2190	392	1604	CSC	BIFACE	CD	-	CD			2	3
2190	392	1605	CSC	BIFACE	I	MH	MH			2	3
2190	392	1606	CSC	FLKTL	I	SV	SV			2	3
2190	392	1607	CSC	FLKTL	I	MH	MH			2	3
2190	392	1608	CSC	FLKTL	I	MGM/MC	M			2	3
2190	392	1609	CSC	PTBLNK	TQ	-	TQ	4.1		2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2190	392	1627	CSC	PTBLNK	TQ	-	TQ	3.6	6.6	2	3
2190	392	1628	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1629	CSC	FLKTL	I	SV	SV			2	3
2190	392	1630	CSC	FLKTL	I	MGM	MG			2	3
2190	392	1631	CSC	FLKTL	I	MGM	MG			2	3
2190	392	1668	CSC	PRJPT	CD	-	CD	6.8		2	3
2190	392	1669	CSC	BIFACE	-	-	-			2	3
2190	392	1670	CSC	BIFACE	-	-	-			2	3
2190	392	1671	CSC	FLKTL	-	-	-			2	3
2190	392	1672	CSC	FLKTL	-	-	-			2	3
2190	392	1673	CSC	FLKTL	-	-	-			2	3
2190	392	1696	CSC	BIFACE	-	-	-			2	3
2190	392	1697	CSC	BIFACE	-	-	-			2	3
2190	392	1698	CSC	FLKTL	-	-	-			2	3
2190	392	1707	CSC	PRJPT	CD	-	CD			2	3
2190	392	1708	CSC	BIFACE	-	-	-			2	3
2190	392	1709	CSC	BIFACE	-	-	-			2	3
2190	392	1715	CSC	PRJPT	I	CD	CD			2	3
2190	392	1716	CSC	BIFACE	I	CD	CD	3.4		2	3
2190	392	1717	CSC	PTBLNK	TQ	-	TQ	3.6		2	3
2190	392	1718	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1719	CSC	BIFACE	I	MH	MH			2	3
2190	392	1720	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1721	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1722	CSC	BIFACE	I	SV	SV			2	3
2190	392	1723	CSC	BIFACE	I	SV	SV			2	3
2190	392	1724	CSC	BIFACE	I	MGM	MG			2	3
2190	392	1725	CSC	FLKTL	I	MGM/MC	M			2	3
2190	392	1726	CSC	FLKTL	CD	-	CD			2	3
2190	392	1727	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1728	CSC	FLKTL	I	SV	SV			2	3
2190	392	1729	CSC	FLKTL	I	CD	CD			2	3
2190	392	1759	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1760	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1761	CSC	FLKTL	I	TQ	TQ			2	3
2190	392	1785	CSC	PRJPT	CD	-	CD	6.9		2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2190	392	1786	CSC	PTBLNK	TQ	-	TQ	5.4		2	3
2190	392	1787	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1788	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1794	CSC	BIFACE	I	CD/SV	I			2	3
2190	392	1795	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1796	CSC	FLKTL	I	-	-			2	3
2190	392	1797	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1798	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1799	CSC	FLKTL	I	SV	SV			2	3
2190	392	1800	CSC	FLKTL	I	TQ/MH	I			2	3
2190	392	1830	CSC	BIFACE	I	MH	MH			2	3
2190	392	1831	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1832	CSC	BIFACE	CD	-	CD			2	3
2190	392	1833	CSC	BIFACE	I	FS	FS			2	3
2190	392	1834	CSC	FRMFLKTL	I	SV	SV	5.5		2	3
2190	392	1835	CSC	FLKTL	I	SV	SV			2	3
2190	392	1836	CSC	FLKTL	I	MGM	MG			2	3
2190	392	1837	CSC	FLKTL	CD	-	CD			2	3
2190	392	1838	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1839	CSC	FLKTL	CD	-	CD			2	3
2190	392	1840	CSC	FLKTL	I	CD	CD			2	3
2190	392	1841	CSC	FLKTL	I	MGM	MG			2	3
2190	392	1867	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1868	CSC	FLKTL	I	CD	CD			2	3
2190	392	1876	CSC	PRJPT	CD	-	CD	5.7		2	3
2190	392	1877	CSC	BIFACE	-	-	-			2	3
2190	392	1878	CSC	BIFACE	-	-	-			2	3
2190	392	1883	CSC	PRJPT	TQ	TQ	TQ	5.1		2	3
2190	392	1884	CSC	PRJPT	I	TQ	TQ	3.6		2	3
2190	392	1885	CSC	BIFACE	CD	-	CD	3.2		2	3
2190	392	1886	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1887	CSC	BIFACE	I	CD	CD			2	3
2190	392	1888	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1889	CSC	CORE	I	MC/MGM	M	3.9		2	3
2190	392	1890	CSC	CORE	I	MH	MH	3.9		2	3
2190	392	1891	CSC	FLKTL	I	CD	CD			2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2190	392	1907	CSC	PRJPT	TQ	-	TQ			2	3
2190	392	1908	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1910	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1919	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1925	CSC	PRJPT	TQ	-	TQ	2.9		2	3
2190	392	1926	CSC	BIFACE	I	CD	CD			2	3
2190	392	1927	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1928	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1929	CSC	FLKTL	I	MGM	MG			2	3
2190	392	1930	CSC	FLKTL	I	SV	SV			2	3
2190	392	1960	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	1961	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1962	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1963	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1986	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	1987	CSC	CORE	TQ	-	TQ	3.2		2	3
2190	392	2003	CSC	FLKTL	-	-	-			2	3
2190	392	2004	CSC	BIFACE	-	-	-			2	3
2190	392	2024	CSC	BIFACE	-	-	-			2	3
2190	392	2025	CSC	BIFACE	-	-	-			2	3
2190	392	2026	CSC	BIFACE	-	-	-			2	3
2190	392	2027	CSC	BIFACE	-	-	-			2	3
2190	392	2028	CSC	PTBLNK	-	-	-	NA		2	3
2190	392	2029	CSC	FLKTL	-	-	-			2	3
2190	392	2030	CSC	FLKTL	-	-	-			2	3
2190	392	2063	CSC	PRJPT	I	-	I			2	3
2190	392	2064	CSC	PRJPT	TQ	-	TQ	2.0		2	3
2190	392	2065	CSC	BIFACE	-	-	-			2	3
2190	392	2067	CSC	FRMFLKTL	TQ	-	TQ	4.6		2	3
2190	392	2068	CSC	FLKTL	-	-	-			2	3
2190	392	2085	CSC	PRJPT	TQ	-	TQ			2	3
2190	392	2086	CSC	FLKTL	-	-	-			2	3
2190	392	2101	CSC	FLKTL	I	MH	MH			2	3
2190	392	2116	CSC	PRJPT	TQ	TQ	TQ	2.7		2	3
2190	392	2117	CSC	BIFACE	I	TQ	TQ			2	3
2190	392	2118	CSC	BIFACE	TQ	-	TQ			2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2190	392	2119	CSC	BIFACE	I	TQ/MH	I			2	3
2190	392	2123	CSC	DBTG	TQ	-	TQ			2	3
2190	392	2123	CSC	DBTG	TQ	-	TQ	7.4		2	3
2190	392	2123	CSC	DBTG	TQ	-	TQ	8.7		2	3
2190	392	2123	CSC	DBTG	TQ	-	TQ	2.6		2	3
2190	392	2145	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	2152	EXC	BIFACE	TQ	-	TQ			2	3
2190	392	2153	EXC	BIFACE	I	MH	MH			2	3
2190	392	2154	EXC	BIFACE	TQ	-	TQ			2	3
2190	392	2155	EXC	BIFACE	I	MGM	MG			2	3
2190	392	2156	EXC	FRMFLKTL	TQ	-	TQ	3.2		2	3
2190	392	2158	EXC	DBTG	TQ	-	TQ	5.1		2	3
2190	392	2158	EXC	DBTG	TQ	-	TQ	3.3		2	3
2190	392	2158	EXC	DBTG	TQ	-	TQ	3.7		2	3
2190	392	2158	EXC	DBTG	TQ	-	TQ	3.5		2	3
2190	392	2167	EXC	BIFACE	I	MGM	MG			2	3
2190	392	2169	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2169	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2169	EXC	DBTG	CD	-	CD			2	3
2190	392	2169	EXC	DBTG	FS	-	FS			2	3
2190	392	2169	EXC	DBTG	CD	-	CD			2	3
2190	392	2169	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2169	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2169	EXC	DBTG	CD	-	CD			2	3
2190	392	2169	EXC	DBTG	CD	-	CD			2	3
2190	392	2169	EXC	DBTG	I	-	I			2	3
2190	392	2169	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2169	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2169	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2169	EXC	DBTG	I	-	I			2	3
2190	392	2169	EXC	DBTG	I	-	I			2	3
2190	392	2169AL	EXC	DBTG	I	CD	CD			2	3
2190	392	2169BM	EXC	DBTG	I	CD	CD			2	3
2190	392	2169CS	EXC	DBTG	I	CD	CD			2	3
2190	392	2169DR	EXC	DBTG	I	TQ	TQ			2	3
2190	392	2169E	EXC	DBTG	I	CD	CD			2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2190	392	2169F	EXC	DBTG	I	CD	CD			2	3
2190	392	2169G	EXC	DBTG	I	CD	CD			2	3
2190	392	2179	EXC	BIFACE	TQ	-	TQ			2	3
2190	392	2180	EXC	BIFACE	I	MH	MH			2	3
2190	392	2181	EXC	BIFACE	I	MH	MH			2	3
2190	392	2189	EXC	BIFACE	I	TQ/QI	I			2	3
2190	392	2190	EXC	BIFACE	TQ	-	TQ			2	3
2190	392	2191	EXC	FLKTL	I	TQ	TQ			2	3
2190	392	2192	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2192	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2192	EXC	DBTG	CD	-	CD			2	3
2190	392	2192	EXC	DBTG	CD	-	CD			2	3
2190	392	2192	EXC	DBTG	I	-	I			2	3
2190	392	2192	EXC	DBTG	I	-	I			2	3
2190	392	2192	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2192	EXC	DBTG	I	-	I			2	3
2190	392	2192	EXC	DBTG	CD	-	CD			2	3
2190	392	2192	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2192	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2192	EXC	DBTG	CD	-	CD			2	3
2190	392	2192	EXC	DBTG	CD	-	CD			2	3
2190	392	2192	EXC	DBTG	I	-	I			2	3
2190	392	2192	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2192	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2192	EXC	DBTG	I	-	I			2	3
2190	392	2192	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2192	EXC	DBTG	I	-	I			2	3
2190	392	2207	EXC	DBTG	CD	-	CD			2	3
2190	392	2207	EXC	DBTG	I	-	I			2	3
2190	392	2207	EXC	DBTG	I	-	I			2	3
2190	392	2207	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2207	EXC	DBTG	CD	-	CD			2	3
2190	392	2207	EXC	DBTG	CD	-	CD			2	3
2190	392	2207	EXC	DBTG	I	-	I			2	3
2190	392	2207	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2207	EXC	DBTG	I	-	I			2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2190	392	2207	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2207	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2210	EXC	PRJPT	I	TQ	TQ	2.2		2	3
2190	392	2211	EXC	PRJPT	TQ	-	TQ			2	3
2190	392	2212	EXC	BIFACE	TQ	-	TQ			2	3
2190	392	2213	EXC	BIFACE	TQ	-	TQ			2	3
2190	392	2214	EXC	FRMFLKTL	I	MGM	MG	3.9		2	3
2190	392	2215	EXC	BIFACE	I	SV	SV			2	3
2190	392	2217	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2217	EXC	DBTG	CD	-	CD			2	3
2190	392	2217	EXC	DBTG	I	-	I			2	3
2190	392	2217	EXC	DBTG	I	-	I			2	3
2190	392	2217	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2217	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2217	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2217	EXC	DBTG	CD	-	CD			2	3
2190	392	2217	EXC	DBTG	I	-	I			2	3
2190	392	2217	EXC	DBTG	CD	-	CD			2	3
2190	392	2217	EXC	DBTG	CD	-	CD			2	3
2190	392	2217	EXC	DBTG	I	-	I			2	3
2190	392	2217	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2217	EXC	DBTG	I	-	I			2	3
2190	392	2217	EXC	DBTG	I	-	I			2	3
2190	392	2217	EXC	DBTG	I	-	I			2	3
2190	392	2217	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2217	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2217	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2229	EXC	BIFACE	TQ	-	TQ			2	3
2190	392	2230	EXC	BIFACE	I	MH	MH			2	3
2190	392	2231	EXC	BIFACE	TQ	-	TQ			2	3
2190	392	2232	EXC	FLKTL	I	MH	MH			2	3
2190	392	2244	EXC	BIFACE	I	SV/CD	I			2	3
2190	392	2246	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2246	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2246	EXC	DBTG	CD	-	CD			2	3
2190	392	2246	EXC	DBTG	CD	-	CD			2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2190	392	2246	EXC	DBTG	I	-	I			2	3
2190	392	2246	EXC	DBTG	CD	-	CD			2	3
2190	392	2246	EXC	DBTG	CD	-	CD			2	3
2190	392	2246	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2246	EXC	DBTG	CD	-	CD			2	3
2190	392	2246	EXC	DBTG	I	-	I			2	3
2190	392	2246	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2246	EXC	DBTG	CD	-	CD			2	3
2190	392	2246	EXC	DBTG	I	-	I			2	3
2190	392	2246	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2246	EXC	DBTG	I	-	I			2	3
2190	392	2246	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2246	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2246	EXC	DBTG	I	-	I			2	3
2190	392	2246	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2246	EXC	DBTG	I	-	I			2	3
2190	392	2246	EXC	DBTG	I	-	I			2	3
2190	392	2246	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2259	EXC	FLKTL	-	-	-			2	3
2190	392	2260	EXC	FLKTL	-	-	-			2	3
2190	392	2269	EXC	BIFACE	-	-	-			2	3
2190	392	2270	SS	PRJPT	I	CD	CD	3.0	7.7	2	3
2190	392	2271	SS	PRJPT	I	-	I			2	3
2190	392	2272	SS	BIFACE	-	-	-			2	3
2190	392	2273	SS	BIFACE	-	-	-			2	3
2190	392	2274	SS	BIFACE	-	-	-			2	3
2190	392	2275	SS	BIFACE	-	-	-			2	3
2190	392	2276	EXC	FLKTL	-	-	-			2	3
2190	392	2277	EXC	FLKTL	-	-	-			2	3
2190	392	2278	EXC	FLKTL	-	-	-			2	3
2190	392	2279	EXC	FLKTL	-	-	-			2	3
2190	392	2293	EXC	DBTG	TQ	-	TQ	3.8		2	3
2190	392	2293	EXC	DBTG	TQ	-	TQ	4.5		2	3
2190	392	2293	EXC	DBTG	TQ	-	TQ	2.0		2	3
2190	392	2293	EXC	DBTG	TQ	-	TQ	8.6		2	3
2190	392	2307	SS	PRJPT	I	TQ	TQ	3.8		2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2190	392	2308	SS	PRJPT	I	CD	CD	1.8		2	3
2190	392	2309	SS	PRJPT	TQ	TQ	TQ	2.6		2	3
2190	392	2310	SS	PRJPT	TQ	-	TQ			2	3
2190	392	2311	SS	PRJPT	CD	-	CD			2	3
2190	392	2312	SS	BIFACE	TQ	-	TQ			2	3
2190	392	2313	SS	BIFACE	I	SV	SV			2	3
2190	392	2315	SS	BIFACE	TQ	-	TQ			2	3
2190	392	2316	SS	BIFACE	CD	-	CD			2	3
2190	392	2317	SS	BIFACE	TQ	-	TQ			2	3
2190	392	2318	SS	BIFACE	CD	-	CD			2	3
2190	392	2319	SS	BIFACE	CD	-	CD	3.9		2	3
2190	392	2320	SS	BIFACE	I	SV	SV			2	3
2190	392	2321	SS	BIFACE	I	TQ	TQ			2	3
2190	392	2322	SS	BIFACE	I	SV	SV			2	3
2190	392	2323	SS	BIFACE	CD	-	CD			2	3
2190	392	2324	SS	BIFACE	I	CD/SV	I			2	3
2190	392	2325	SS	BIFACE	TQ	-	TQ			2	3
2190	392	2326	SS	BIFACE	I	MH	MH			2	3
2190	392	2328	EXC	FLKTL	TQ	-	TQ			2	3
2190	392	2329	EXC	FLKTL	CD	-	CD			2	3
2190	392	2330	EXC	FLKTL	TQ	-	TQ			2	3
2190	392	2331	EXC	FLKTL	I	CD	CD			2	3
2190	392	2332	EXC	FLKTL	CD	-	CD			2	3
2190	392	2333	EXC	FLKTL	CD	-	CD			2	3
2190	392	2334	EXC	CORE	TQ	-	TQ	1.5	6.0	2	3
2190	392	2340	EXC	DBTG	TQ	-	TQ	8.2		2	3
2190	392	2340	EXC	DBTG	TQ	-	TQ	2.7		2	3
2190	392	2340	EXC	DBTG	TQ	-	TQ	4.1		2	3
2190	392	2340	EXC	DBTG	TQ	-	TQ	3.8		2	3
2190	392	2352	SS	PRJPT	TQ	-	TQ	4.9		2	3
2190	392	2353	SS	PRJPT	TQ	-	TQ	7.1		2	3
2190	392	2354	SS	PRJPT	TQ	-	TQ			2	3
2190	392	2355	SS	BIFACE	-	-	-			2	3
2190	392	2356	EXC	FLKTL	-	-	-			2	3
2190	392	2357	EXC	FLKTL	-	-	-			2	3
2190	392	2358	EXC	FLKTL	-	-	-			2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2190	392	2359	EXC	FLKTL	-	-	-			2	3
2190	392	2362	EXC	DBTG	TQ	-	TQ	6.8		2	3
2190	392	2362A	EXC	DBTG	TQ	TQ	TQ	3.9		2	3
2190	392	2362B	EXC	DBTG	TQ	TQ	TQ	5.8		2	3
2190	392	2362C	EXC	DBTG	TQ	TQ	TQ	5.5		2	3
2190	392	2371	SS	BIFACE	-	-	-			2	3
2190	392	2372	SS	BIFACE	-	-	-			2	3
2190	392	2373	SS	BIFACE	-	-	-			2	3
2190	392	2374	EXC	FLKTL	-	-	-			2	3
2190	392	2375	EXC	FLKTL	-	-	-			2	3
2190	392	2376	EXC	FLKTL	-	-	-			2	3
2190	392	2377	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2377	EXC	DBTG	I	-	I			2	3
2190	392	2377	EXC	DBTG	I	-	I			2	3
2190	392	2377	EXC	DBTG	I	-	I			2	3
2190	392	2377	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2377	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2377	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2377	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2377	EXC	DBTG	I	-	I			2	3
2190	392	2377	EXC	DBTG	I	-	I			2	3
2190	392	2377	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2377	EXC	DBTG	I	-	I			2	3
2190	392	2377	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2377	EXC	DBTG	I	-	I			2	3
2190	392	2390	EXC	BIFACE	CD	-	CD			2	3
2190	392	2405	EXC	BIFACE	TQ	-	TQ			2	3
2190	392	2411	EXC	BIFACE	TQ	-	TQ			2	3
2190	392	2412	EXC	FLKTL	TQ	-	TQ			2	3
2190	392	2413	EXC	FLKTL	I	TQ	TQ			2	3
2190	392	2414	EXC	FLKTL	TQ	-	TQ			2	3
2190	392	2415	EXC	DBTG	TQ	-	TQ	7.1		2	3
2190	392	2415	EXC	DBTG	TQ	-	TQ	5.3		2	3
2190	392	2415	EXC	DBTG	TQ	-	TQ	4.0		2	3
2190	392	2415	EXC	DBTG	TQ	-	TQ	4.1		2	3
2190	392	2420	EXC	PRJPT	I	TQ	TQ	4.9		2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2190	392	2421	EXC	BIFACE	TQ	-	TQ			2	3
2190	392	2422	EXC	BIFACE	I	TQ	TQ			2	3
2190	392	2430	EXC	PRJPT	TQ	-	TQ			2	3
2190	392	2431	EXC	BIFACE	I	MH	MH			2	3
2190	392	2432	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2432	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2432	EXC	DBTG	CD	-	CD			2	3
2190	392	2432	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2432	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2432	EXC	DBTG	I	-	I			2	3
2190	392	2432	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2432	EXC	DBTG	I	-	I			2	3
2190	392	2432	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2432	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2432	EXC	DBTG	I	-	I			2	3
2190	392	2432AO	EXC	DBTG	I	CD	CD			2	3
2190	392	2432BO	EXC	DBTG	I	TQ	TQ			2	3
2190	392	2432CO	EXC	DBTG	I	TQ	TQ			2	3
2190	392	2432DO	EXC	DBTG	I	CD	CD			2	3
2190	392	2432EO	EXC	DBTG	I	TQ	TQ			2	3
2190	392	2432FO	EXC	DBTG	I	I	I			2	3
2190	392	2432GO	EXC	DBTG	I	M	M			2	3
2190	392	2432RA	EXC	DBTG	I	TQ	TQ			2	3
2190	392	2432RB	EXC	DBTG	I	TQ	TQ			2	3
2190	392	2432RC	EXC	DBTG	I	TQ	TQ			2	3
2190	392	2442	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2442	EXC	DBTG	CD	-	CD			2	3
2190	392	2442	EXC	DBTG	CD	-	CD			2	3
2190	392	2442	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2442	EXC	DBTG	I	-	I			2	3
2190	392	2442	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2442	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2442	EXC	DBTG	I	-	I			2	3
2190	392	2448	EXC	PRJPT	TQ	-	TQ			2	3
2190	392	2449	EXC	BIFACE	CD	-	CD			2	3
2190	392	2450	EXC	FLKTL	I	TQ/MH	I			2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2190	392	2452	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2452	EXC	DBTG	CD	-	CD			2	3
2190	392	2452	EXC	DBTG	CD	-	CD			2	3
2190	392	2452	EXC	DBTG	I	-	I			2	3
2190	392	2452	EXC	DBTG	I	-	I			2	3
2190	392	2452	EXC	DBTG	CD	-	CD			2	3
2190	392	2452	EXC	DBTG	CD	-	CD			2	3
2190	392	2452	EXC	DBTG	CD	-	CD			2	3
2190	392	2452	EXC	DBTG	I	-	I			2	3
2190	392	2452	EXC	DBTG	I	-	I			2	3
2190	392	2452	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2452	EXC	DBTG	I	-	I			2	3
2190	392	2452	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2452	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2452	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2452	EXC	DBTG	CD	-	CD			2	3
2190	392	2452	EXC	DBTG	CD	-	CD			2	3
2190	392	2452	EXC	DBTG	I	-	I			2	3
2190	392	2452	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2452	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2452	EXC	DBTG	I	-	I			2	3
2190	392	2452	EXC	DBTG	I	-	I			2	3
2190	392	2458	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2458	EXC	DBTG	CD	-	CD			2	3
2190	392	2458	EXC	DBTG	FS	-	FS			2	3
2190	392	2458	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2458	EXC	DBTG	CD	-	CD			2	3
2190	392	2458	EXC	DBTG	CD	-	CD			2	3
2190	392	2458	EXC	DBTG	I	-	I			2	3
2190	392	2458	EXC	DBTG	I	-	I			2	3
2190	392	2458	EXC	DBTG	I	-	I			2	3
2190	392	2458	EXC	DBTG	I	-	I			2	3
2190	392	2458	EXC	DBTG	CD	-	CD			2	3
2190	392	2458	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2458	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2458	EXC	DBTG	TQ	-	TQ			2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2190	392	2458	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2458	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2458	EXC	DBTG	I	-	I			2	3
2190	392	2458	EXC	DBTG	I	-	I			2	3
2190	392	2458	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2458	EXC	DBTG	I	-	I			2	3
2190	392	2458	EXC	DBTG	I	-	I			2	3
2190	392	2469	EXC	PRJPT	CD	-	CD			2	3
2190	392	2470	EXC	FRMFLKTL	I	QI	QI	4.0		2	3
2190	392	2471	EXC	DBTG	TQ	-	TQ	4.7		2	3
2190	392	2471	EXC	DBTG	TQ	-	TQ	3.6		2	3
2190	392	2471	EXC	DBTG	TQ	-	TQ	3.8		2	3
2190	392	2471	EXC	DBTG	TQ	-	TQ	5.3		2	3
2190	392	2475	EXC	BIFACE	TQ	-	TQ			2	3
2190	392	2476	EXC	FLKTL	I	SV	SV			2	3
2190	392	2477	EXC	FLKTL	CD	-	CD			2	3
2190	392	2485	EXC	BIFACE	TQ	-	TQ			2	3
2190	392	2486	EXC	BIFACE	I	MGM	MG			2	3
2190	392	2487	EXC	BIFACE	I	MGM	MG			2	3
2190	392	2488	EXC	FLKTL	I	MGM	MG			2	3
2190	392	2494	EXC	PRJPT	CD	-	CD	4.2		2	3
2190	392	2495	EXC	FLKTL	TQ	-	TQ			2	3
2190	392	2496	EXC	FLKTL	TQ	-	TQ			2	3
2190	392	2507	EXC	PRJPT	I	-	I			2	3
2190	392	2508	EXC	BIFACE	CD	-	CD			2	3
2190	392	2519	EXC	FLKTL	TQ	-	TQ			2	3
2190	392	2527	EXC	BIFACE	TQ	-	TQ			2	3
2190	392	2528	EXC	BIFACE	TQ	-	TQ			2	3
2190	392	2529	EXC	FLKTL	I	CD	CD			2	3
2190	392	2530	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2530	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2530	EXC	DBTG	CD	-	CD			2	3
2190	392	2530	EXC	DBTG	CD	-	CD			2	3
2190	392	2530	EXC	DBTG	CD	-	CD			2	3
2190	392	2530	EXC	DBTG	I	-	I			2	3
2190	392	2530	EXC	DBTG	TQ	-	TQ			2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2190	392	2530	EXC	DBTG	I	-	I			2	3
2190	392	2530	EXC	DBTG	CD	-	CD			2	3
2190	392	2530	EXC	DBTG	I	-	I			2	3
2190	392	2530	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2530	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2530	EXC	DBTG	I	-	I			2	3
2190	392	2530	EXC	DBTG	I	-	I			2	3
2190	392	2530	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2545	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2545	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2545	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2545	EXC	DBTG	CD	-	CD			2	3
2190	392	2545	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2545	EXC	DBTG	I	-	I			2	3
2190	392	2545	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2545	EXC	DBTG	I	-	I			2	3
2190	392	2545	EXC	DBTG	I	-	I			2	3
2190	392	2545	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2545A	EXC	DBTG	I	M	M			2	3
2190	392	2545B	EXC	DBTG	I	M	M			2	3
2190	392	2545C	EXC	DBTG	I	M	M			2	3
2190	392	2545D	EXC	DBTG	I	M	M			2	3
2190	392	2545R	EXC	DBTG	I	TQ	TQ			2	3
2190	392	2554	EXC	BIFACE	TQ	-	TQ			2	3
2190	392	2555	EXC	BIFACE	TQ	-	TQ			2	3
2190	392	2556	EXC	BIFACE	I	SV	SV			2	3
2190	392	2557	EXC	FLKTL	TQ	-	TQ			2	3
2190	392	2558	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2558	EXC	DBTG	CD	-	CD			2	3
2190	392	2558	EXC	DBTG	CD	-	CD			2	3
2190	392	2558	EXC	DBTG	I	-	I			2	3
2190	392	2558	EXC	DBTG	I	-	I			2	3
2190	392	2558	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2558	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2558	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2558	EXC	DBTG	I	-	I			2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2190	392	2558	EXC	DBTG	I	-	I			2	3
2190	392	2558	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2558	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2558	EXC	DBTG	I	-	I			2	3
2190	392	2558	EXC	DBTG	I	-	I			2	3
2190	392	2564	EXC	BIFACE	TQ	-	TQ			2	3
2190	392	2565	EXC	FLKTL	CD	-	CD			2	3
2190	392	2566	EXC	FLKTL	TQ	-	TQ			2	3
2190	392	2567	EXC	FLKTL	CD	-	CD			2	3
2190	392	2585	EXC	FLKTL	I	CD	CD			2	3
2190	392	2601	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2601	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2601	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2601	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2601	EXC	DBTG	CD	-	CD			2	3
2190	392	2601	EXC	DBTG	CD	-	CD			2	3
2190	392	2601	EXC	DBTG	CD	-	CD			2	3
2190	392	2601	EXC	DBTG	I	-	I			2	3
2190	392	2601	EXC	DBTG	I	-	I			2	3
2190	392	2601	EXC	DBTG	I	-	I			2	3
2190	392	2601	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2601	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2601	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2601	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2601	EXC	DBTG	I	-	I			2	3
2190	392	2601	EXC	DBTG	I	-	I			2	3
2190	392	2601	EXC	DBTG	I	-	I			2	3
2190	392	2601	EXC	DBTG	I	-	I			2	3
2190	392	2601	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2601	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2605	EXC	FLKTL	TQ	-	TQ			2	3
2190	392	2610	EXC	BIFACE	I	MH	MH			2	3
2190	392	2611	EXC	BIFACE	I	MH	MH			2	3
2190	392	2614	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2614	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2614	EXC	DBTG	CD	-	CD			2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2190	392	2614	EXC	DBTG	I	-	I			2	3
2190	392	2614	EXC	DBTG	I	-	I			2	3
2190	392	2614	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2614	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2614	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2614	EXC	DBTG	I	-	I			2	3
2190	392	2614	EXC	DBTG	I	-	I			2	3
2190	392	2614	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2614	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2622	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2622	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2622	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2622	EXC	DBTG	I	-	I			2	3
2190	392	2622	EXC	DBTG	I	-	I			2	3
2190	392	2622	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2631	EXC	BIFACE	-	-	-			2	3
2190	392	2632	EXC	BIFACE	-	-	-			2	3
2190	392	2633	EXC	BIFACE	-	-	-			2	3
2190	392	2634	EXC	FLKTL	-	-	-			2	3
2190	392	2635	EXC	FLKTL	-	-	-			2	3
2190	392	2636	EXC	DBTG	TQ	-	TQ	5.5		2	3
2190	392	2636	EXC	DBTG	TQ	-	TQ	3.7		2	3
2190	392	2636	EXC	DBTG	TQ	-	TQ	4.9		2	3
2190	392	2644	EXC	BIFACE	-	-	-			2	3
2190	392	2645	EXC	BIFACE	-	-	-			2	3
2190	392	2646	EXC	FLKTL	-	-	-			2	3
2190	392	2647	EXC	FLKTL	-	-	-			2	3
2190	392	2652	EXC	BIFACE	-	-	-			2	3
2190	392	2653	EXC	BIFACE	-	-	-			2	3
2190	392	2654	EXC	BIFACE	-	-	-			2	3
2190	392	2655	EXC	FLKTL	-	-	-			2	3
2190	392	2656	EXC	FLKTL	-	-	-			2	3
2190	392	2657	EXC	DBTG	TQ	-	TQ	3.7		2	3
2190	392	2657	EXC	DBTG	TQ	-	TQ	3.7		2	3
2190	392	2657	EXC	DBTG	TQ	-	TQ	4.8		2	3
2190	392	2672	EXC	BIFACE	-	-	-			2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2190	392	2673	EXC	BIFACE	-	-	-			2	3
2190	392	2674	EXC	BIFACE	-	-	-			2	3
2190	392	2675	EXC	BIFACE	-	-	-			2	3
2190	392	2676	EXC	DRILL	I	-	I			2	3
2190	392	2677	SS	FRMFLKTL	I	MH	MH	4.0		2	3
2190	392	2678	EXC	FLKTL	-	-	-			2	3
2190	392	2679	EXC	FLKTL	-	-	-			2	3
2190	392	2682	EXC	DBTG	CD	-	CD			2	3
2190	392	2682	EXC	DBTG	I	-	I			2	3
2190	392	2682	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2682	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2682	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2682	EXC	DBTG	I	-	I			2	3
2190	392	2682	EXC	DBTG	I	-	I			2	3
2190	392	2682	EXC	DBTG	CD	-	CD			2	3
2190	392	2682	EXC	DBTG	CD	-	CD			2	3
2190	392	2682	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2682	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2682	EXC	DBTG	CD	-	CD			2	3
2190	392	2682	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2682	EXC	DBTG	I	-	I			2	3
2190	392	2682	EXC	DBTG	CD	-	CD			2	3
2190	392	2682	EXC	DBTG	I	-	I			2	3
2190	392	2682	EXC	DBTG	CD	-	CD			2	3
2190	392	2682	EXC	DBTG	I	-	I			2	3
2190	392	2682	EXC	DBTG	I	-	I			2	3
2190	392	2682	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2682	EXC	DBTG	I	-	I			2	3
2190	392	2692	EXC	PRJPT	TQ	-	TQ	5.7		2	3
2190	392	2693	EXC	PRJPT	I	CD	CD	DH		2	3
2190	392	2694	EXC	PRJPT	I	-	I			2	3
2190	392	2695	EXC	BIFACE	-	-	-			2	3
2190	392	2696	EXC	BIFACE	-	-	-			2	3
2190	392	2698	EXC	BIFACE	-	-	-			2	3
2190	392	2699	EXC	FLKTL	-	-	-			2	3
2190	392	2700	EXC	FLKTL	-	-	-			2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2190	392	2701	EXC	FLKTL	-	-	-			2	3
2190	392	2702	EXC	FLKTL	-	-	-			2	3
2190	392	2703	EXC	FLKTL	-	-	-			2	3
2190	392	2724	EXC	BIFACE	-	-	-			2	3
2190	392	2725	EXC	BIFACE	-	-	-			2	3
2190	392	2726	EXC	BIFACE	-	-	-			2	3
2190	392	2728	EXC	FLKTL	-	-	-			2	3
2190	392	2729	EXC	PTBLNK	-	-	-	NA		2	3
2190	392	2730	EXC	FLKTL	-	-	-			2	3
2190	392	2731	EXC	FLKTL	-	-	-			2	3
2190	392	2732	EXC	FLKTL	-	-	-			2	3
2190	392	2733	EXC	FLKTL	-	-	-			2	3
2190	392	2739	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2739	EXC	DBTG	CD	-	CD			2	3
2190	392	2739	EXC	DBTG	CD	-	CD			2	3
2190	392	2739	EXC	DBTG	I	-	I			2	3
2190	392	2739	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2739	EXC	DBTG	CD	-	CD			2	3
2190	392	2739	EXC	DBTG	CD	-	CD			2	3
2190	392	2739	EXC	DBTG	CD	-	CD			2	3
2190	392	2739	EXC	DBTG	I	-	I			2	3
2190	392	2739	EXC	DBTG	I	-	I			2	3
2190	392	2739	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2739	EXC	DBTG	CD	-	CD			2	3
2190	392	2739	EXC	DBTG	I	-	I			2	3
2190	392	2739	EXC	DBTG	I	-	I			2	3
2190	392	2739	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2739	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2739	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2739	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2739	EXC	DBTG	I	-	I			2	3
2190	392	2739	EXC	DBTG	I	-	I			2	3
2190	392	2739	EXC	DBTG	I	-	I			2	3
2190	392	2776	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	2795	EXC	BIFACE	TQ	-	TQ			2	3
2190	392	2802	EXC	DBTG	TQ	-	TQ			2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2190	392	2802	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2802	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2802	EXC	DBTG	CD	-	CD			2	3
2190	392	2802	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2802	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2802	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2802	EXC	DBTG	CD	-	CD			2	3
2190	392	2802	EXC	DBTG	CD	-	CD			2	3
2190	392	2802	EXC	DBTG	I	-	I			2	3
2190	392	2802	EXC	DBTG	I	-	I			2	3
2190	392	2802	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2802	EXC	DBTG	CD	-	CD			2	3
2190	392	2802LC	EXC	DBTG	I	TQ	TQ			2	3
2190	392	2802LO	EXC	DBTG	I	TQ	TQ			2	3
2190	392	2802LR	EXC	DBTG	I	TQ	TQ			2	3
2190	392	2802MO	EXC	DBTG	I	TQ	TQ			2	3
2190	392	2802SC	EXC	DBTG	I	TQ	TQ			2	3
2190	392	2802SO	EXC	DBTG	I	TQ	TQ			2	3
2190	392	2802SR	EXC	DBTG	I	TQ	TQ			2	3
2190	392	2802XO	EXC	DBTG	I	TQ	TQ			2	3
2190	392	2811	EXC	PRJPT	CD	-	CD			2	3
2190	392	2812	EXC	PTBLNK	TQ	-	TQ	2.2		2	3
2190	392	2813	EXC	BIFACE	I	BH	BH			2	3
2190	392	2814	EXC	BIFACE	I	MH/SV	I			2	3
2190	392	2815	EXC	FRMFLKTL	I	MH/MGM	I	2.4		2	3
2190	392	2816	EXC	FLKTL	TQ	-	TQ			2	3
2190	392	2817	EXC	FLKTL	TQ	-	TQ			2	3
2190	392	2818	EXC	FLKTL	I	CD	CD			2	3
2190	392	2819	EXC	FLKTL	I	TQ	TQ			2	3
2190	392	2820	EXC	FLKTL	I	MGM	MG			2	3
2190	392	2821	EXC	FLKTL	I	SV	SV			2	3
2190	392	2822	EXC	FLKTL	TQ	-	TQ			2	3
2190	392	2823	EXC	PTBLNK	TQ	-	TQ	4.4		2	3
2190	392	2824	EXC	FLKTL	TQ	-	TQ			2	3
2190	392	2827	EXC	DBTG	TQ	-	TQ			2	3
2190	392	2827	EXC	DBTG	TQ	-	TQ	1.4		2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2190	392	2827	EXC	DBTG	TQ	-	TQ	4.6		2	3
2190	392	2842	CSC	FLKTL	CD	-	CD			2	3
2190	392	2853	CSC	PTBLNK	I	CD/SV	I	1.9		2	3
2190	392	2893	CSC	FLKTL	I	MGM/MC	M			2	3
2190	392	2894	CSC	FLKTL	I	MH	MH			2	3
2190	392	2895	CSC	FLKTL	I	MH	MH			2	3
2190	392	2901	CSC	PRJPT	I	-	I			2	3
2190	392	2902	CSC	DRILL	I	-	I			2	3
2190	392	2906	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	2915	CSC	PRJPT	I	BH	BH	3.4	2.2	2	3
2190	392	2916	CSC	FLKTL	I	SV/CD	I			2	3
2190	392	3265	SUR	PRJPT	I	BH	BH	3.4		2	3
2190	392	3266	SUR	BIFACE	-	-	-			2	3
2190	392	3267	SUR	BIFACE	-	-	-			2	3
2190	392	3268	SUR	BIFACE	-	-	-			2	3
2190	392	3270	SUR	BIFACE	-	-	-			2	3
2190	392	3271	SUR	BIFACE	-	-	-			2	3
2190	392	3272	SUR	BIFACE	-	-	-			2	3
2190	392	3273	SUR	PRJPT	I	TQ	TQ	2.4		2	3
2190	392	3274	SUR	PRJPT	TQ	TQ	TQ	3.8		2	3
2190	392	3275	SUR	DRILL	CD	-	CD			2	3
2190	392	3276	SUR	PRJPT	CD	-	CD	3.8		2	3
2190	392	3277	SUR	PRJPT	I	CD	CD	3.9		2	3
2190	392	3278	SUR	PRJPT	TQ	TQ	TQ	2.5		2	3
2190	392	3279	SUR	PRJPT	TQ	-	TQ	4.5		2	3
2190	392	3298	SUR	PRJPT	TQ	TQ	TQ	3.1		2	3
2190	392	3299	SUR	PRJPT	TQ	-	TQ	4.7		2	3
2190	392	3300	SUR	PRJPT	TQ	TQ	TQ	4.6		2	3
2190	392	3301	SUR	PRJPT	CD	-	CD	4.8		2	3
2190	392	3302	SUR	PRJPT	TQ	-	TQ	5.5		2	3
2190	392	3303	SUR	PRJPT	I	CD	CD	3.7		2	3
2190	392	3304	SUR	PRJPT	TQ	-	TQ	DH		2	3
2190	392	3305	SUR	PRJPT	TQ	-	TQ	DH		2	3
2190	392	3306	SUR	BIFACE	-	-	-			2	3
2190	392	3307	SUR	PRJPT	I	-	I			2	3
2190	392	3308	SUR	PRJPT	I	MGM/MC	M			2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2190	392	3309	SUR	BIFACE	-	-	-			2	3
2190	392	3310	SUR	BIFACE	-	-	-			2	3
2190	392	3311	SUR	BIFACE	-	-	-			2	3
2190	392	3312	SUR	BIFACE	-	-	-			2	3
2190	392	3313	SUR	PRJPT	TQ	-	TQ			2	3
2190	392	3314	SUR	PRJPT	CD	-	CD			2	3
2190	392	3315	SUR	PRJPT	I	-	I			2	3
2190	392	3316	SUR	PRJPT	FS	-	FS			2	3
2190	392	3317	SUR	BIFACE	-	-	-			2	3
2190	392	3320	SUR	BIFACE	-	-	-			2	3
2190	392	3321	SUR	PRJPT	I	TQ	TQ			2	3
2190	392	3322	SUR	BIFACE	-	-	-			2	3
2190	392	3323	SUR	BIFACE	-	-	-			2	3
2190	392	3324	SUR	BIFACE	-	-	-			2	3
2190	392	3325	SUR	BIFACE	-	-	-			2	3
2190	392	3326	SUR	BIFACE	-	-	-			2	3
2190	392	3327	SUR	BIFACE	-	-	-			2	3
2190	392	3328	SUR	BIFACE	-	-	-			2	3
2190	392	3329	SUR	BIFACE	-	-	-			2	3
2190	392	3330	SUR	BIFACE	-	-	-			2	3
2190	392	3331	SUR	BIFACE	-	-	-			2	3
2190	392	3332	SUR	BIFACE	-	-	-			2	3
2190	392	3333	SUR	BIFACE	-	-	-			2	3
2190	392	3334	SUR	BIFACE	-	-	-			2	3
2190	392	3335	SUR	BIFACE	-	-	-			2	3
2190	392	3336	SUR	BIFACE	-	-	-			2	3
2190	392	3337	SUR	BIFACE	-	-	-			2	3
2190	392	3338	SUR	FRMFLKTL	I	MGM	MG	5.8		2	3
2190	392	3344	SUR	PRJPT	TQ	-	TQ			2	3
2190	392	3345	SUR	BIFACE	-	-	-			2	3
2190	392	3346	SUR	BIFACE	-	-	-			2	3
2190	392	3347	SUR	BIFACE	-	-	-			2	3
2190	392	3348	SUR	BIFACE	-	-	-			2	3
2190	392	3349	SUR	FLKTL	-	-	-			2	3
2190	392	3350	SUR	FLKTL	-	-	-			2	3
2190	392	3351	SUR	FLKTL	-	-	-			2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2190	392	3352	SUR	FLKTL	-	-	-			2	3
2190	392	3353	SUR	FLKTL	-	-	-			2	3
2190	392	3354	SUR	FLKTL	-	-	-			2	3
2190	392	3355	SUR	FLKTL	-	-	-			2	3
2190	392	3356	SUR	FLKTL	-	-	-			2	3
2190	392	3357	SUR	FLKTL	-	-	-			2	3
2190	392	3358	SUR	FLKTL	-	-	-			2	3
2190	392	3359	SUR	FLKTL	-	-	-			2	3
2190	392	3371	EXC	FLKTL	I	TQ	TQ			2	3
2190	392	3372	EXC	FLKTL	CD	-	CD			2	3
2190	392	3373	EXC	FLKTL	-	-	-			2	3
2190	392	3374	EXC	FLKTL	-	-	-			2	3
2190	392	3375	EXC	FLKTL	TQ	-	TQ			2	3
2190	392	3376	EXC	FLKTL	TQ	-	TQ			2	3
2190	392	3377	EXC	FLKTL	TQ	-	TQ			2	3
2190	392	3378	EXC	FLKTL	TQ	-	TQ			2	3
2190	392	3379	EXC	FLKTL	-	-	-			2	3
2190	392	3380	EXC	FLKTL	TQ	-	TQ			2	3
2190	392	3381	CSC	BIFACE	CD	-	CD			2	3
2190	392	3382	CSC	FLKTL	I	TQ/QI	I			2	3
2190	392	3383	CSC	FLKTL	I	CD	CD			2	3
2190	392	3384	CSC	FLKTL	I	CD	CD			2	3
2190	392	3385	CSC	FLKTL	-	-	-			2	3
2190	392	3386	CSC	FLKTL	CD	-	CD			2	3
2190	392	3387	CSC	PRJPT	I	-	I			2	3
2190	392	3388	CSC	FLKTL	CD	-	CD			2	3
2190	392	3389	CSC	FLKTL	CD	-	CD			2	3
2190	392	3390	CSC	FLKTL	I	-	-			2	3
2190	392	3391	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	3392	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	3393	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	3394	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	3395	EXC	FLKTL	-	-	-			2	3
2190	392	720	CSC	PRJPT	I	TQ	TQ			2	3
2190	392	721	CSC	PRJPT	I	MGM/MC	M			2	3
2190	392	723	CSC	PRJPT	I	TQ	TQ	4.1		2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2190	392	724	CSC	PRJPT	TQ	-	TQ			2	3
2190	392	725	CSC	BIFACE	-	-	-			2	3
2190	392	726	CSC	BIFACE	-	-	-			2	3
2190	392	727	CSC	BIFACE	-	-	-			2	3
2190	392	728	CSC	BIFACE	-	-	-			2	3
2190	392	729	CSC	BIFACE	-	-	-			2	3
2190	392	730	CSC	BIFACE	-	-	-			2	3
2190	392	731	CSC	BIFACE	-	-	-			2	3
2190	392	732	CSC	BIFACE	-	-	-			2	3
2190	392	733	CSC	FRMFLKTL	I	MGM	MG	5.0		2	3
2190	392	734	CSC	BIFACE	-	-	-			2	3
2190	392	735	CSC	BIFACE	-	-	-			2	3
2190	392	736	CSC	BIFACE	-	-	-			2	3
2190	392	737	CSC	BIFACE	-	-	-			2	3
2190	392	740	CSC	BIFACE	-	-	-			2	3
2190	392	741	CSC	BIFACE	-	-	-			2	3
2190	392	742	CSC	BIFACE	-	-	-			2	3
2190	392	743	CSC	FRMFLKTL	I	SV	SV	5.3		2	3
2190	392	744	CSC	BIFACE	-	-	-			2	3
2190	392	746	CSC	FLKTL	-	-	-			2	3
2190	392	747	CSC	FLKTL	-	-	-			2	3
2190	392	748	CSC	FLKTL	-	-	-			2	3
2190	392	749	CSC	FLKTL	-	-	-			2	3
2190	392	750	CSC	FLKTL	-	-	-			2	3
2190	392	751	CSC	FLKTL	-	-	-			2	3
2190	392	752	CSC	FLKTL	-	-	-			2	3
2190	392	769	CSC	PRJPT	TQ	-	TQ			2	3
2190	392	770	CSC	PRJPT	TQ	TQ	TQ	3.8		2	3
2190	392	771	CSC	PRJPT	I	TQ	TQ	4.0		2	3
2190	392	772	CSC	PRJPT	TQ	-	TQ			2	3
2190	392	773	CSC	PRJPT	TQ	-	TQ			2	3
2190	392	774	CSC	PRJPT	TQ	-	TQ			2	3
2190	392	775	CSC	BIFACE	CD	-	CD			2	3
2190	392	776	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	777	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	778	CSC	BIFACE	TQ	-	TQ			2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2190	392	779	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	780	CSC	BIFACE	I	TQ/MH	I			2	3
2190	392	781	CSC	BIFACE	I	SV	SV			2	3
2190	392	782	CSC	DRILL	TQ	-	TQ			2	3
2190	392	783	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	784	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	785	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	786	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	787	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	788	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	806	CSC	FLKTL	I	MGM	MG			2	3
2190	392	807	CSC	FLKTL	CD	-	CD			2	3
2190	392	811	CSC	PRJPT	I	CD	CD	2.7		2	3
2190	392	812	CSC	PRJPT	FS	-	FS	3.0		2	3
2190	392	813	CSC	PRJPT	I	MGM/MC	M	4.1		2	3
2190	392	814	CSC	PRJPT	TQ	-	TQ	DH		2	3
2190	392	815	CSC	PRJPT	CD	-	CD	DH		2	3
2190	392	816	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	817	CSC	BIFACE	CD	-	CD			2	3
2190	392	818	CSC	BIFACE	I	SV/CD	I			2	3
2190	392	819	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	820	CSC	BIFACE	CD	-	CD			2	3
2190	392	821	CSC	BIFACE	I	TQ	TQ			2	3
2190	392	822	CSC	BIFACE	CD	-	CD			2	3
2190	392	823	CSC	BIFACE	I	MGM	MG			2	3
2190	392	824	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	825	CSC	FRMFLKTL	TQ	-	TQ	3.3		2	3
2190	392	826	CSC	CORE	TQ	-	TQ	8.3		2	3
2190	392	827	CSC	CORE	CD	-	CD	2.1		2	3
2190	392	828	CSC	FLKTL	I	TQ	TQ			2	3
2190	392	829	CSC	DRILL	I	-	I			2	3
2190	392	830	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	831	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	832	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	833	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	834	CSC	FLKTL	I	TQ	TQ			2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2190	392	853	CSC	PRJPT	I	-	I			2	3
2190	392	854	CSC	PRJPT	TQ	-	TQ			2	3
2190	392	855	CSC	BIFACE	I	MGM	MG			2	3
2190	392	856	CSC	BIFACE	I	MH/MGM	I			2	3
2190	392	857	CSC	BIFACE	I	SV	SV			2	3
2190	392	858	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	859	CSC	BIFACE	I	SV	SV			2	3
2190	392	860	CSC	BIFACE	I	TQ	TQ			2	3
2190	392	861	CSC	PTBLNK	TQ	-	TQ	2.4	7.7	2	3
2190	392	862	CSC	FRMFLKTL	CD	-	CD	2.4		2	3
2190	392	863	CSC	CORE	TQ	-	TQ	1.6		2	3
2190	392	864	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	865	CSC	FLKTL	I	CD	CD			2	3
2190	392	866	CSC	FLKTL	CD	-	CD			2	3
2190	392	867	CSC	FLKTL	I	SV	SV			2	3
2190	392	868	CSC	FLKTL	I	SV	SV			2	3
2190	392	898	CSC	BIFACE	I	MH	MH			2	3
2190	392	910	CSC	PRJPT	I	-	I			2	3
2190	392	911	CSC	BIFACE	-	-	-			2	3
2190	392	912	CSC	BIFACE	-	-	-			2	3
2190	392	913	CSC	BIFACE	-	-	-			2	3
2190	392	914	CSC	DRILL	I	-	I			2	3
2190	392	929	CSC	PRJPT	I	TQ	TQ	7.8		2	3
2190	392	930	CSC	PRJPT	TQ	-	TQ	4.8		2	3
2190	392	931	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	932	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	933	CSC	BIFACE	I	TQ	TQ			2	3
2190	392	934	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	936	CSC	BIFACE	CD	-	CD			2	3
2190	392	937	CSC	BIFACE	I	TQ/QI	I	3.0		2	3
2190	392	938	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	939	CSC	FRMFLKTL	I	TQ/MH	I	3.3		2	3
2190	392	940	CSC	FRMFLKTL	I	SV	SV	2.9		2	3
2190	392	941	CSC	FLKTL	CD	-	CD			2	3
2190	392	942	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	943	CSC	FLKTL	I	MGM	MG			2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2190	392	944	CSC	FLKTL	CD	-	CD			2	3
2190	392	945	CSC	FLKTL	I	SV	SV			2	3
2190	392	946	CSC	FLKTL	I	CD	CD			2	3
2190	392	947	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	978	CSC	PRJPT	CD	-	CD	3.9		2	3
2190	392	979	CSC	PRJPT	TQ	-	TQ	5.0	DH	2	3
2190	392	980	CSC	PRJPT	CD	-	CD	10.9		2	3
2190	392	981	CSC	BIFACE	I	CD	CD			2	3
2190	392	982	CSC	BIFACE	TQ	-	TQ			2	3
2190	392	983	CSC	BIFACE	CD	-	CD			2	3
2190	392	984	CSC	BIFACE	I	MGM	MG			2	3
2190	392	985	CSC	BIFACE	TQ	-	TQ	6.9		2	3
2190	392	986	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	987	CSC	FLKTL	I	SV	SV			2	3
2190	392	988	CSC	FLKTL	I	SV	SV			2	3
2190	392	989	CSC	FLKTL	TQ	-	TQ			2	3
2190	392	998	CSC	FRMFLKTL	TQ	-	TQ	7.6		2	3
22B-1	455	1005A	CSC	DBTG	I	MGM	MG			3	1
22B-1	455	1005B	CSC	DBTG	I	MGM	MG			3	1
22B-1	455	1005C	CSC	DBTG	TQ	-	TQ			3	1
22B-1	455	1005D	CSC	DBTG	TQ	-	TQ			3	1
22B-1	455	1005E	CSC	DBTG	TQ	-	TQ			3	1
22B-1	455	1005F	CSC	DBTG	TQ	-	TQ			3	1
22B-1	455	1005G	CSC	DBTG	TQ	-	TQ			3	1
22B-1	455	1005H	CSC	DBTG	CD	-	CD			3	1
22B-1	455	1005I	CSC	DBTG	TQ	-	TQ	8.9		3	1
22B-1	455	1005J	CSC	DBTG	TQ	-	TQ	8.5		3	1
22B-1	455	1051A	CSC	DBTG	I	FS	FS			3	1
22B-1	455	1051B	CSC	DBTG	I	MH	MH			3	1
22B-1	455	1051C	CSC	DBTG	I	MGM	MG			3	1
22B-1	455	1051D	CSC	DBTG	I	MH	MH			3	1
22B-1	455	1051E	CSC	DBTG	I	MGM	MG			3	1
22B-1	455	1051F	CSC	DBTG	TQ	-	TQ	11.3		3	1
22B-1	455	1051G	CSC	DBTG	TQ	-	TQ			3	1
22B-1	455	1051H	CSC	DBTG	TQ	-	TQ			3	1
22B-1	455	1051I	CSC	DBTG	CD	-	CD			3	1

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
22B-1	455	896	SUR	PRJPT	I	QI	QI	10.6		3	1
22B-1	467	900	SUR	FLKTL	I	MGM	MG			3	1
22B-1	467	901	SUR	FLKTL	CD	-	CD			3	1
22B-1	467	902	SUR	FLKTL	CD	-	CD			3	1
22B-1	467	905	SUR	FLKTL	CD	-	CD			3	1
22B-1	467	907	SUR	FLKTL	TQ	-	TQ			3	1
22B-1	467	919A	EXC	DBTG	I	CD	CD	8.6		3	1
22B-1	467	919B	EXC	DBTG	TQ	-	TQ	11.2		3	1
22B-1	467	919C	EXC	DBTG	TQ	-	TQ			3	1
22B-1	467	919D	EXC	DBTG	TQ	-	TQ	11.1		3	1
22B-1	467	919E	EXC	DBTG	CD	-	CD	10.5		3	1
22B-1	467	919F	EXC	DBTG	-	-	I	10.2		3	1
22B-1	467	919G	EXC	DBTG	-	-	I	10.1		3	1
22B-1	467	919H	EXC	DBTG	-	-	I	9.8		3	1
22B-1	467	919I	EXC	DBTG	-	-	I	9.7		3	1
22B-1	467	919J	EXC	DBTG	-	-	I	9.8		3	1
22B-1	467	921A	EXC	DBTG	I	CD	CD	8.4		3	1
22B-1	467	921B	EXC	DBTG	I	MGM/MC	M	10.1		3	1
22B-1	467	921C	EXC	DBTG	I	CD	CD			3	1
22B-1	467	921D	EXC	DBTG	TQ	-	TQ			3	1
22B-1	467	921E	EXC	DBTG	TQ	-	TQ			3	1
22B-1	455	977	CSC	FLKTL	CD	-	CD			3	1
22B-1	455	978	CSC	FRMFLKTL	I	SV/CD	I	11.7		3	1
22C-1	455	1009A	CSC	DBTG	I	MGM	MG	13.1		3	1
22C-1	455	1009B	CSC	DBTG	I	TQ	TQ			3	1
22C-1	455	1009C	CSC	DBTG	I	MGM/MC	M	10.5		3	1
22C-1	455	1009D	CSC	DBTG	I	CD	CD	12.4		3	1
22C-1	455	1009E	CSC	DBTG	I	CD	CD			3	1
22C-1	455	1009F	CSC	DBTG	I	SV/CD	I			3	1
22C-1	455	1009G	CSC	DBTG	I	MGM/MC	M	8.5		3	1
22C-1	455	1009H	CSC	DBTG	TQ	-	TQ	8.9		3	1
22C-1	455	1009I	CSC	DBTG	TQ	-	TQ	8.9		3	1
22C-1	455	1009J	CSC	DBTG	TQ	-	TQ	8.7		3	1
22C-1	455	1009K	CSC	DBTG	TQ	-	TQ			3	1
22C-1	455	1009L	CSC	DBTG	TQ	-	TQ			3	1
22C-1	455	1009M	CSC	DBTG	TQ	-	TQ	8.7		3	1

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
22C-1	455	1009N	CSC	DBTG	CD	-	CD			3	1
22C-1	455	1009O	CSC	DBTG	CD	-	CD			3	1
22C-1	455	1009P	CSC	DBTG	TQ	-	TQ	8.4		3	1
22C-1	455	1009Q	CSC	DBTG	TQ	-	TQ	DH		3	1
22C-1	455	1009R	CSC	DBTG	TQ	-	TQ	7.2		3	1
22C-1	455	1009R	CSC	DBTG	TQ	-	TQ	8.1		3	1
22C-1	455	1009S	CSC	DBTG	TQ	-	TQ	7.9		3	1
22C-1	455	1009S	CSC	DBTG	-	-	I	8.2		3	1
22C-1	455	1009T	CSC	DBTG	-	-	I	9.3		3	1
22C-1	455	1009U	CSC	DBTG	-	-	I	7.9		3	1
22C-1	455	1009V	CSC	DBTG	-	-	I	8.8		3	1
22C-1	455	1009W	CSC	DBTG	-	-	I	10.8		3	1
22C-1	455	979	CSC	PRJPT	FS	-	FS	9.9		3	1
22C-1	455	980	CSC	PRJPT	TQ	-	TQ	10.9		3	1
22C-1	455	981	CSC	PRJPT	I	MH	MH			3	1
22C-1	455	982	CSC	BIFACE	TQ	-	TQ			3	1
22C-1	455	983	CSC	FLKTL	I	SV	SV			3	1
22C-1	455	984	CSC	FLKTL	I	FS	FS			3	1
22C-1	455	985	CSC	FLKTL	TQ	-	TQ			3	1
22C-1	455	986	CSC	FRMFLKTL	TQ	-	TQ	8.6	1.8	3	1
23-A	474	80A	CSC	DBTG	I	CD	CD	4.7		3	1
23-A	474	80B	CSC	DBTG	I	CD	CD	4.2		3	1
23-A	474	80C	CSC	DBTG	I	CD	CD	1.3		3	1
23-A	474	80D	CSC	DBTG	I	MGM/MC	M	4.4		3	1
23-A	474	80E	CSC	DBTG	I	TQ	TQ	4.1		3	1
23-A	474	80F	CSC	DBTG	I	QI	QI	4.2		3	1
23-A	474	80G	CSC	DBTG	I	CD	CD			3	1
23-A	474	80H	CSC	DBTG	I	CD	CD			3	1
23-A	474	80I	CSC	DBTG	I	CD	CD			3	1
23-A	474	80J	CSC	DBTG	TQ	-	TQ	4.7		3	1
23-A	474	80K	CSC	DBTG	TQ	-	TQ			3	1
23-A	474	80L	CSC	DBTG	TQ	-	TQ			3	1
23-A	474	80M	CSC	DBTG	TQ	-	TQ	4.2		3	1
23-A	474	80N	CSC	DBTG	TQ	-	TQ			3	1
23-A	474	80O	CSC	DBTG	TQ	-	TQ			3	1
23-A	474	81A	EXC	DBTG	-	-	I	5.0		3	1

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
23-A	474	81B	EXC	DBTG	-	-	I	3.4		3	1
23-A	474	81C	EXC	DBTG	-	-	I	3.4		3	1
23-A	474	81D	EXC	DBTG	-	-	I	3.4		3	1
23-A	474	81E	EXC	DBTG	-	-	I	3.0		3	1
2464	392	8004	CSC	BIFACE	TQ	-	TQ			1	2
2464	392	8005	CSC	FLKTL	I	CD	CD			1	2
2464	392	8006	CSC	FLKTL	CD	-	CD			1	2
2464	392	8012	CSC	BIFACE	I	MH	MH			1	2
2464	392	8016	CSC	BIFACE	TQ	-	TQ			1	2
2464	392	8017	CSC	FLKTL	TQ	-	TQ			1	2
2464	392	8022	CSC	FLKTL	TQ	-	TQ			1	2
2464	392	8027	CSC	FLKTL	TQ	-	TQ			1	2
2464	392	8028	CSC	FLKTL	TQ	-	TQ			1	2
2464	392	8032	CSC	BIFACE	FS	FS	FS			1	2
2464	392	8033	CSC	BIFACE	TQ	-	TQ			1	2
2464	392	8036	CSC	FLKTL	TQ	-	TQ			1	2
2464	392	8037	CSC	FLKTL	I	MGM/MC	M			1	2
2464	392	8040	CSC	FLKTL	TQ	-	TQ			1	2
2464	392	8041	CSC	FLKTL	I	MH	MH			1	2
2464	392	8049	CSC	FLKTL	TQ	-	TQ			1	2
2464	392	8050	CSC	FLKTL	TQ	-	TQ			1	2
2464	392	8056		PRJPT	CD	-	CD			1	2
2464	392	8057	CSC	BIFACE	I	MC	MC	6.1		1	2
2464	392	8058	CSC	BIFACE	TQ	-	TQ			1	2
2464	392	8059	CSC	FLKTL	TQ	-	TQ			1	2
2464	392	8060	CSC	FLKTL	I	MGM	MG			1	2
2464	392	8061	CSC	FLKTL	TQ	-	TQ			1	2
2464	392	8062	CSC	FLKTL	I	SV/CD	I			1	2
2464	392	8063	CSC	FLKTL	I	SV	SV			1	2
2464	392	8064	CSC	FLKTL	I	MGM	MG			1	2
2464	392	8071	CSC	FLKTL	TQ	-	TQ			1	2
2464	392	8072	CSC	FLKTL	CD	-	CD			1	2
2464	392	8077	CSC	FLKTL	TQ	-	TQ			1	2
2464	392	8089		PRJPT	CD	-	CD	5.8		1	2
2464	392	8091		PRJPT	I	MGM/MC	M	3.4	8.9	1	2
2464	392	8092		PRJPT	FS	-	FS	5.5		1	2

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2464	392	8097		PRJPT	I	TQ	TQ	5.4		1	2
2464	392	8098		PRJPT	I	TQ	TQ	5.8		1	2
2464	392	8099		PRJPT	FS	FS	FS	4.9		1	2
2464	392	8100		PRJPT	TQ	-	TQ	5.0		1	2
2464	392	8101		PRJPT	CD	-	CD	DH		1	2
2464	392	8102		PRJPT	TQ	-	TQ	5.6		1	2
2464	392	8103		PRJPT	I	-	I			1	2
2464	392	8104		PRJPT	I	-	I			1	2
2464	392	8105	SUR	BIFACE	TQ	-	TQ			1	2
2464	392	8106	SUR	BIFACE	CD	-	CD			1	2
2464	392	8107	SUR	BIFACE	I	TQ	TQ			1	2
2464	392	8108	SUR	BIFACE	I	CD	CD			1	2
2464	392	8109	SUR	BIFACE	CD	-	CD			1	2
2464	392	8110	SUR	BIFACE	I	QI/TQ	I			1	2
2464	392	8111	SUR	BIFACE	CD	-	CD			1	2
2464	392	8112	SUR	BIFACE	TQ	-	TQ			1	2
2464	392	8113	SUR	BIFACE	I	TQ	TQ			1	2
2464	392	8114	SUR	BIFACE	CD	-	CD			1	2
2464	392	8115	SUR	BIFACE	CD	-	CD			1	2
2464	392	8116	SUR	BIFACE	TQ	-	TQ			1	2
2464	392	8117	SUR	BIFACE	TQ	-	TQ			1	2
2464	392	8118	SUR	BIFACE	I	CD	CD			1	2
2464	392	8119	SUR	BIFACE	CD	-	CD			1	2
2464	392	8120	SUR	BIFACE	TQ	-	TQ			1	2
2464	392	8121	SUR	BIFACE	TQ	-	TQ			1	2
2464	392	8125	SUR	FLKTL	TQ	-	TQ			1	2
2464	392	8126	SUR	FLKTL	I	CD	CD			1	2
2464	392	8127	SUR	FLKTL	TQ	-	TQ			1	2
2464	392	8128	SUR	FLKTL	TQ	-	TQ			1	2
2464	392	8129	SUR	FLKTL	TQ	-	TQ			1	2
2464	392	8130	SUR	FLKTL	I	MC/MGM	M			1	2
2464	392	8131	SUR	FLKTL	I	MC/MGM	M			1	2
2464	392	8132	SUR	FLKTL	I	MGM	MG			1	2
2464	392	8133	SUR	FLKTL	TQ	-	TQ			1	2
2464	392	8134	SUR	FLKTL	CD	-	CD			1	2
2464	392	8135	SUR	FLKTL	CD	-	CD			1	2

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2464	392	8136	SUR	CORE	I	MGM/MC	M	1.9		1	2
2464	392	8158	EXC	DBTG	TQ	-	TQ	4.7		1	2
2464	392	8158L	EXC	DBTG	TQ	TQ	TQ	4.3		1	2
2464	392	8158M	EXC	DBTG	TQ	TQ	TQ	4.4		1	2
2464	392	8158S	EXC	DBTG	TQ	TQ	TQ	4.3		1	2
2464	392	8163	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8163	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8163	EXC	DBTG	I	-	I			1	2
2464	392	8163	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8163	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8163	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8163	EXC	DBTG	I	-	I			1	2
2464	392	8163D	EXC	DBTG	I	CD	CD			1	2
2464	392	8163L	EXC	DBTG	I	M	M			1	2
2464	392	8166	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8166	EXC	DBTG	I	-	I			1	2
2464	392	8166	EXC	DBTG	I	-	I			1	2
2464	392	8166	EXC	DBTG	I	-	I			1	2
2464	392	8166	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8166	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8166	EXC	DBTG	I	-	I			1	2
2464	392	8166	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8168	EXC	BIFACE	TQ	-	TQ			1	2
2464	392	8171	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8171	EXC	DBTG	I	-	I			1	2
2464	392	8171	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8171	EXC	DBTG	I	-	I			1	2
2464	392	8171	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8171	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8171	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8171	EXC	DBTG	I	-	I			1	2
2464	392	8181	EXC	DBTG	TQ	-	TQ	5.0		1	2
2464	392	8181	EXC	DBTG	TQ	-	TQ	4.4		1	2
2464	392	8181	EXC	DBTG	TQ	-	TQ	5.0		1	2
2464	392	8181	EXC	DBTG	TQ	-	TQ	6.0		1	2
2464	392	8181	EXC	DBTG	TQ	-	TQ			1	2

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2464	392	8181	EXC	DBTG	TQ	-	TQ	6.0		1	2
2464	392	8184	EXC	DBTG	FS	-	FS			1	2
2464	392	8184	EXC	DBTG	FS	-	FS			1	2
2464	392	8184	EXC	DBTG	I	-	I			1	2
2464	392	8184	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8184	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8184	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8184	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8184	EXC	DBTG	I	-	I			1	2
2464	392	8184	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8184	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8184	EXC	DBTG	I	-	I			1	2
2464	392	8184AX	EXC	DBTG	I	TQ	TQ			1	2
2464	392	8184BX	EXC	DBTG	I	CD	CD			1	2
2464	392	8184L	EXC	DBTG	I	TQ	TQ			1	2
2464	392	8184M	EXC	DBTG	I	TQ	TQ			1	2
2464	392	8184S	EXC	DBTG	I	M	M			1	2
2464	392	8189	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8189	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8189	EXC	DBTG	CD	-	CD			1	2
2464	392	8189	EXC	DBTG	CD	-	CD			1	2
2464	392	8189	EXC	DBTG	CD	-	CD			1	2
2464	392	8189	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8189	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8189	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8189	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8189	EXC	DBTG	I	-	I			1	2
2464	392	8189	EXC	DBTG	I	-	I			1	2
2464	392	8189	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8189L	EXC	DBTG	I	TQ	TQ			1	2
2464	392	8189S	EXC	DBTG	I	CD	CD			1	2
2464	392	8191	EXC	FLKTL	TQ	-	TQ			1	2
2464	392	8193	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8193	EXC	DBTG	CD	-	CD			1	2
2464	392	8193	EXC	DBTG	I	-	I			1	2
2464	392	8193	EXC	DBTG	TQ	-	TQ			1	2

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2464	392	8193	EXC	DBTG	CD	-	CD			1	2
2464	392	8193	EXC	DBTG	I	-	I			1	2
2464	392	8193	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8193	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8193	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8193	EXC	DBTG	I	-	I			1	2
2464	392	8193	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8193	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8193	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8193	EXC	DBTG	I	-	I			1	2
2464	392	8200	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8200	EXC	DBTG	I	-	I			1	2
2464	392	8200	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8200	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8200	EXC	DBTG	I	-	I			1	2
2464	392	8200	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8200	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8200	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8200	EXC	DBTG	I	-	I			1	2
2464	392	8200	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8200	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8200AC	EXC	DBTG	I	TQ	TQ			1	2
2464	392	8200B	EXC	DBTG	I	TQ	TQ			1	2
2464	392	8200C	EXC	DBTG	I	TQ	TQ			1	2
2464	392	8200D	EXC	DBTG	I	CD	CD			1	2
2464	392	8206	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8206	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8206	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8206	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8206	EXC	DBTG	I	-	I			1	2
2464	392	8206	EXC	DBTG	CD	-	CD			1	2
2464	392	8206	EXC	DBTG	I	-	I			1	2
2464	392	8206	EXC	DBTG	I	-	I			1	2
2464	392	8206	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8206	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8206B	EXC	DBTG	I	CD	CD			1	2

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2464	392	8206O	EXC	DBTG	I	I	I			1	2
2464	392	8215	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8215	EXC	DBTG	I	-	I			1	2
2464	392	8215	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8215	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8215	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8215	EXC	DBTG	I	-	I			1	2
2464	392	8215	EXC	DBTG	I	-	I			1	2
2464	392	8215	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8215	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8215	EXC	DBTG	I	-	I			1	2
2464	392	8215	EXC	DBTG	TQ	-	TQ			1	2
2464	392	8217	EXC	FLKTL	I	TQ	TQ			1	2
2465	392	10000	EXC	BIFACE	TQ	-	TQ			1	3
2465	392	10001	EXC	BIFACE	I	MGM/MH	I			1	3
2465	392	10002	EXC	FLKTL	CD	-	CD			1	3
2465	392	10003	EXC	FLKTL	I	MGM	MG			1	3
2465	392	10004	EXC	FLKTL	I	MH	MH			1	3
2465	392	10005	EXC	FLKTL	CD	-	CD			1	3
2465	392	10006	EXC	FLKTL	CD	-	CD			1	3
2465	392	10007	EXC	FLKTL	TQ	-	TQ			1	3
2465	392	10018	EXC	FLKTL	I	CD	CD			1	3
2465	392	10032	EXC	BIFACE	TQ	-	TQ			1	3
2465	392	10033	EXC	DBTG	TQ	-	TQ			1	3
2465	392	10033	EXC	DBTG	TQ	-	TQ			1	3
2465	392	10033	EXC	DBTG	TQ	-	TQ			1	3
2465	392	10033	EXC	DBTG	CD	-	CD			1	3
2465	392	10033	EXC	DBTG	CD	-	CD			1	3
2465	392	10033	EXC	DBTG	I	-	I			1	3
2465	392	10033	EXC	DBTG	TQ	-	TQ			1	3
2465	392	10033	EXC	DBTG	TQ	-	TQ			1	3
2465	392	10033	EXC	DBTG	CD	-	CD			1	3
2465	392	10033	EXC	DBTG	CD	-	CD			1	3
2465	392	10033	EXC	DBTG	I	-	I			1	3
2465	392	10033	EXC	DBTG	TQ	-	TQ			1	3
2465	392	10033	EXC	DBTG	CD	-	CD			1	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2465	392	10033	EXC	DBTG	I	-	I			1	3
2465	392	10033	EXC	DBTG	TQ	-	TQ			1	3
2465	392	10033	EXC	DBTG	I	-	I			1	3
2465	392	10033	EXC	DBTG	I	-	I			1	3
2465	392	10033	EXC	DBTG	I	-	I			1	3
2465	392	10038	EXC	PTBLNK	I	SV	SV	2.7		1	3
2465	392	10039	EXC	BIFACE	CD	-	CD			1	3
2465	392	10040	EXC	BIFACE	CD	-	CD			1	3
2465	392	10044	EXC	PTBLNK	I	MH	MH	2.6		1	3
2465	392	10045	EXC	FLKTL	CD	-	CD			1	3
2465	392	10046	EXC	FLKTL	TQ	-	TQ			1	3
2465	392	10047	EXC	FLKTL	CD	-	CD			1	3
2465	392	10048	EXC	FLKTL	TQ	-	TQ			1	3
2465	392	10049	EXC	FLKTL	TQ	-	TQ			1	3
2465	392	10050	EXC	FLKTL	CD	-	CD			1	3
2465	392	10061	EXC	DBTG	CD	-	CD			1	3
2465	392	10061	EXC	DBTG	I	-	I			1	3
2465	392	10061	EXC	DBTG	I	-	I			1	3
2465	392	10061	EXC	DBTG	CD	-	CD			1	3
2465	392	10061	EXC	DBTG	TQ	-	TQ			1	3
2465	392	10061	EXC	DBTG	CD	-	CD			1	3
2465	392	10061	EXC	DBTG	I	-	I			1	3
2465	392	10061	EXC	DBTG	TQ	-	TQ			1	3
2465	392	10061	EXC	DBTG	I	-	I			1	3
2465	392	10061	EXC	DBTG	I	-	I			1	3
2465	392	10064	EXC	FLKTL	CD	-	CD			1	3
2465	392	10069	EXC	BIFACE	TQ	-	TQ			1	3
2465	392	10070	EXC	FLKTL	I	SV	SV			1	3
2465	392	10071	EXC	FLKTL	TQ	-	TQ			1	3
2465	392	10075	EXC	PRJPT	TQ	-	TQ			1	3
2465	392	10076	EXC	PRJPT	I	-	I			1	3
2465	392	9003	CSC	BIFACE	CD	-	CD			1	3
2465	392	9004	CSC	BIFACE	TQ	-	TQ			1	3
2465	392	9005	CSC	BIFACE	TQ	-	TQ			1	3
2465	392	9007	CSC	FLKTL	I	MGM	MG			1	3
2465	392	9008	CSC	FLKTL	I	MGM	MG			1	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2465	392	9012	CSC	FLKTL	I	MGM	MG			1	3
2465	392	9013	CSC	FLKTL	I	SV	SV			1	3
2465	392	9014	CSC	FLKTL	I	MH	MH			1	3
2465	392	9018	CSC	BIFACE	CD	-	CD			1	3
2465	392	9019	CSC	BIFACE	I	MH	MH			1	3
2465	392	9024	CSC	FLKTL	I	SV	SV			1	3
2465	392	9030	CSC	DRILL	I	-	I			1	3
2465	392	9031	CSC	BIFACE	TQ	-	TQ			1	3
2465	392	9032	CSC	FLKTL	I	MC/MGM	M			1	3
2465	392	9038	CSC	PRJPT	CD	-	CD	DH		1	3
2465	392	9039	CSC	PRJPT	TQ	-	TQ	4.6		1	3
2465	392	9041	CSC	FLKTL	I	MGM	MG			1	3
2465	392	9042	CSC	FLKTL	I	MGM	MG			1	3
2465	392	9047	CSC	PRJPT	TQ	-	TQ			1	3
2465	392	9048	CSC	BIFACE	CD	-	CD			1	3
2465	392	9049	CSC	BIFACE	TQ	-	TQ			1	3
2465	392	9052	CSC	FLKTL	CD	-	CD			1	3
2465	392	9053	CSC	FLKTL	TQ	-	TQ			1	3
2465	392	9058	CSC	FLKTL	CD	-	CD			1	3
2465	392	9059	CSC	FLKTL	TQ	-	TQ			1	3
2465	392	9064	CSC	BIFACE	CD	-	CD			1	3
2465	392	9073	CSC	PRJPT	CD	-	CD			1	3
2465	392	9076	CSC	PRJPT	CD	-	CD			1	3
2465	392	9077	CSC	FLKTL	I	SV	SV			1	3
2465	392	9078	CSC	FLKTL	I	CD	CD			1	3
2465	392	9079	CSC	FLKTL	CD	-	CD			1	3
2465	392	9080	CSC	FLKTL	TQ	-	TQ			1	3
2465	392	9081	CSC	FLKTL	I	SV	SV			1	3
2465	392	9082	CSC	FLKTL	I	SV	SV			1	3
2465	392	9083	CSC	FLKTL	TQ	-	TQ			1	3
2465	392	9084	CSC	FLKTL	TQ	-	TQ			1	3
2465	392	9085	CSC	FLKTL	CD	-	CD			1	3
2465	392	9086	CSC	FLKTL	CD	-	CD			1	3
2465	392	9093	CSC	PRJPT	CD	-	CD	5.1		1	3
2465	392	9094	CSC	BIFACE	TQ	-	TQ			1	3
2465	392	9095	CSC	BIFACE	TQ	-	TQ			1	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2465	392	9096	CSC	FLKTL	I	MGM	MG			1	3
2465	392	9100	CSC	PRJPT	TQ	-	TQ	1.6		1	3
2465	392	9101	CSC	BIFACE	TQ	-	TQ			1	3
2465	392	9102	CSC	BIFACE	TQ	-	TQ			1	3
2465	392	9103	CSC	FLKTL	CD	-	CD			1	3
2465	392	9104	CSC	FLKTL	CD	-	CD			1	3
2465	392	9105	CSC	FLKTL	CD	-	CD			1	3
2465	392	9106	CSC	FLKTL	CD	-	CD			1	3
2465	392	9107	CSC	FLKTL	CD	-	CD			1	3
2465	392	9108	CSC	FLKTL	I	MGM	MG			1	3
2465	392	9112	CSC	PRJPT	CD	-	CD			1	3
2465	392	9113	CSC	BIFACE	CD	-	CD			1	3
2465	392	9114	CSC	BIFACE	CD	-	CD			1	3
2465	392	9115	CSC	FLKTL	I	MGM	MG			1	3
2465	392	9116	CSC	FLKTL	CD	-	CD			1	3
2465	392	9117	CSC	FLKTL	TQ	-	TQ			1	3
2465	392	9121	CSC	PRJPT	TQ	-	TQ	1.9		1	3
2465	392	9122	CSC	FLKTL	I	CD/SV	I			1	3
2465	392	9123	CSC	FLKTL	I	MGM	MG			1	3
2465	392	9124	CSC	FLKTL	I	SV	SV			1	3
2465	392	9129	CSC	PRJPT	I	CD	CD	1.0		1	3
2465	392	9130	CSC	PRJPT	I	TQ	TQ	1.8		1	3
2465	392	9131	CSC	PRJPT	CD	-	CD	4.7		1	3
2465	392	9132	CSC	PRJPT	CD	-	CD			1	3
2465	392	9133	CSC	BIFACE	CD	-	CD			1	3
2465	392	9134	CSC	BIFACE	TQ	-	TQ			1	3
2465	392	9135	CSC	BIFACE	TQ	-	TQ			1	3
2465	392	9136	CSC	BIFACE	CD	-	CD			1	3
2465	392	9138	CSC	FLKTL	I	CD/SV	I			1	3
2465	392	9139	CSC	FLKTL	CD	-	CD			1	3
2465	392	9140	CSC	FLKTL	I	FS	FS			1	3
2465	392	9141	CSC	FLKTL	CD	-	CD			1	3
2465	392	9142	CSC	FLKTL	CD	-	CD			1	3
2465	392	9143	CSC	FLKTL	CD	-	CD			1	3
2465	392	9144	CSC	FLKTL	I	SV	SV			1	3
2465	392	9151	CSC	PRJPT	TQ	TQ	TQ	2.5		1	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2465	392	9152	CSC	PRJPT	TQ	-	TQ	3.2		1	3
2465	392	9153	CSC	BIFACE	TQ	-	TQ			1	3
2465	392	9154	CSC	BIFACE	TQ	-	TQ			1	3
2465	392	9155	CSC	BIFACE	CD	-	CD			1	3
2465	392	9156	CSC	FRMFLKTL	I	MH	MH	DH		1	3
2465	392	9157	CSC	FLKTL	I	MGM	MG			1	3
2465	392	9158	CSC	FLKTL	TQ	-	TQ			1	3
2465	392	9159	CSC	FLKTL	TQ	-	TQ			1	3
2465	392	9160	CSC	FLKTL	I	MH	MH			1	3
2465	392	9161	CSC	FLKTL	I	MH	MH			1	3
2465	392	9168	CSC	BIFACE	CD	-	CD			1	3
2465	392	9169	CSC	BIFACE	TQ	-	TQ			1	3
2465	392	9170	CSC	FLKTL	I	MGM	MG			1	3
2465	392	9174	CSC	FLKTL	I	MGM	MG			1	3
2465	392	9179	CSC	FLKTL	CD	-	CD			1	3
2465	392	9193	CSC	PRJPT	TQ	-	TQ			1	3
2465	392	9194	CSC	FLKTL	CD	-	CD			1	3
2465	392	9195	CSC	FLKTL	I	SV	SV			1	3
2465	392	9210	CSC	FLKTL	I	CD	CD			1	3
2465	392	9216	CSC	PRJPT	I	-	I			1	3
2465	392	9217	CSC	FLKTL	TQ	-	TQ			1	3
2465	392	9218	CSC	FLKTL	TQ	-	TQ			1	3
2465	392	9221	CSC	BIFACE	I	MGM	MG			1	3
2465	392	9230	CSC	PRJPT	I	MGM/MC	M	3.4		1	3
2465	392	9231	CSC	FLKTL	TQ	-	TQ			1	3
2465	392	9233	CSC	FRMFLKTL	CD	-	CD	2.4		1	3
2465	392	9237	CSC	BIFACE	CD	-	CD			1	3
2465	392	9238	CSC	BIFACE	TQ	-	TQ			1	3
2465	392	9239	CSC	FLKTL	CD	-	CD			1	3
2465	392	9244	CSC	FLKTL	CD	-	CD			1	3
2465	392	9250	CSC	FLKTL	TQ	-	TQ			1	3
2465	392	9251	CSC	FLKTL	TQ	-	TQ			1	3
2465	392	9264	CSC	FLKTL	CD	-	CD			1	3
2465	392	9271	CSC	FLKTL	CD	-	CD			1	3
2465	392	9272	CSC	FLKTL	TQ	-	TQ			1	3
2465	392	9275	CSC	FLKTL	CD	-	CD			1	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2465	392	9281	CSC	BIFACE	I	MH	MH			1	3
2465	392	9284	CSC	FLKTL	I	MGM	MG			1	3
2465	392	9286	CSC	FLKTL	CD	-	CD			1	3
2465	392	9294	CSC	FLKTL	TQ	-	TQ			1	3
2465	392	9302	CSC	FLKTL	TQ	-	TQ			1	3
2465	392	9304	CSC	FLKTL	CD	-	CD			1	3
2465	392	9314	CSC	FLKTL	I	SV	SV			1	3
2465	392	9315	CSC	PRJPT	TQ	-	TQ			1	3
2465	392	9317	CSC	BIFACE	CD	-	CD			1	3
2465	392	9327	CSC	FLKTL	CD	-	CD			1	3
2465	392	9331	CSC	BIFACE	I	MGM	MG			1	3
2465	392	9337	CSC	PTBLNK	CD	-	CD	3.6	10.4	1	3
2465	392	9339	CSC	BIFACE	TQ	-	TQ			1	3
2465	392	9347	CSC	PTBLNK	CD	-	CD	4.4	DH	1	3
2465	392	9356	SUR	PRJPT	CD	-	CD	2.0		1	3
2465	392	9363	SUR	PRJPT	I	-	I			1	3
2465	392	9364	SUR	PRJPT	FS	FS	FS	3.1		1	3
2465	392	9365	SUR	PRJPT	I	CD	CD			1	3
2465	392	9366	SUR	PRJPT	I	CD	CD	4.0		1	3
2465	392	9367	SUR	PRJPT	TQ	-	TQ			1	3
2465	392	9368	SUR	PRJPT	TQ	-	TQ			1	3
2465	392	9369	SUR	PRJPT	I	CD	CD	3.9		1	3
2465	392	9370	SUR	PRJPT	CD	-	CD	2.6		1	3
2465	392	9371	SUR	PRJPT	I	-	I			1	3
2465	392	9372	SUR	DRILL	I	-	I			1	3
2465	392	9373	SUR	DRILL	I	-	I			1	3
2465	392	9374	SUR	DRILL	CD	-	CD			1	3
2465	392	9375	SUR	BIFACE	TQ	-	TQ			1	3
2465	392	9376	SUR	BIFACE	TQ	-	TQ			1	3
2465	392	9377	SUR	BIFACE	I	MH	MH			1	3
2465	392	9378	SUR	BIFACE	I	MH	MH			1	3
2465	392	9379	SUR	BIFACE	I	TQ	TQ			1	3
2465	392	9380	SUR	BIFACE	I	SV	SV			1	3
2465	392	9381	SUR	BIFACE	TQ	-	TQ			1	3
2465	392	9382	SUR	BIFACE	TQ	-	TQ			1	3
2465	392	9383	SUR	BIFACE	I	FS	FS			1	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2465	392	9384	SUR	BIFACE	CD	-	CD			1	3
2465	392	9385	SUR	BIFACE	TQ	-	TQ			1	3
2465	392	9386	SUR	BIFACE	I	TQ	TQ			1	3
2465	392	9387	SUR	BIFACE	CD	-	CD			1	3
2465	392	9388	SUR	BIFACE	TQ	-	TQ			1	3
2465	392	9389	SUR	BIFACE	TQ	-	TQ			1	3
2465	392	9390	SUR	BIFACE	TQ	-	TQ			1	3
2465	392	9391	SUR	BIFACE	CD	-	CD			1	3
2465	392	9392	SUR	BIFACE	I	SV	SV			1	3
2465	392	9393	SUR	BIFACE	I	CD	CD			1	3
2465	392	9394	SUR	BIFACE	TQ	-	TQ			1	3
2465	392	9395	SUR	BIFACE	TQ	-	TQ			1	3
2465	392	9396	SUR	BIFACE	CD	-	CD			1	3
2465	392	9397	SUR	BIFACE	CD	-	CD			1	3
2465	392	9398	SUR	BIFACE	CD	-	CD			1	3
2465	392	9399	SUR	BIFACE	I	MH	MH			1	3
2465	392	9400	SUR	BIFACE	TQ	-	TQ			1	3
2465	392	9401	SUR	BIFACE	I	CD	CD			1	3
2465	392	9402	SUR	BIFACE	I	SV	SV			1	3
2465	392	9403	SUR	FRMFLKTL	CD	-	CD	2.5		1	3
2465	392	9404	SUR	FRMFLKTL	TQ	-	TQ	8.7		1	3
2465	392	9405	SUR	FRMFLKTL	I	CD	CD	5.9	2.3	1	3
2465	392	9406	SUR	FRMFLKTL	I	MGM/MH	I	3.1		1	3
2465	392	9407	SUR	FRMFLKTL	CD	-	CD	3.0		1	3
2465	392	9408	SUR	FRMFLKTL	CD	-	CD	3.1		1	3
2465	392	9409	SUR	FLKTL	-	-	-			1	3
2465	392	9410	SUR	FLKTL	-	-	-			1	3
2465	392	9411	SUR	FLKTL	-	-	-			1	3
2465	392	9412	SUR	FLKTL	-	-	-			1	3
2465	392	9413	SUR	FLKTL	-	-	-			1	3
2465	392	9414	SUR	FLKTL	-	-	-			1	3
2465	392	9415	SUR	FLKTL	-	-	-			1	3
2465	392	9416	SUR	FLKTL	-	-	-			1	3
2465	392	9417	SUR	FLKTL	-	-	-			1	3
2465	392	9418	SUR	FLKTL	-	-	-			1	3
2465	392	9419	SUR	FLKTL	-	-	-			1	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2465	392	9420	SUR	FLKTL	-	-	-			1	3
2465	392	9421	SUR	FLKTL	-	-	-			1	3
2465	392	9422	SUR	FLKTL	-	-	-			1	3
2465	392	9423	SUR	FLKTL	-	-	-			1	3
2465	392	9424	SUR	FLKTL	-	-	-			1	3
2465	392	9425	SUR	FLKTL	-	-	-			1	3
2465	392	9426	SUR	FLKTL	-	-	-			1	3
2465	392	9427	SUR	FLKTL	-	-	-			1	3
2465	392	9428	SUR	FLKTL	-	-	-			1	3
2465	392	9429	SUR	FLKTL	-	-	-			1	3
2465	392	9430	SUR	FLKTL	-	-	-			1	3
2465	392	9431	SUR	FLKTL	-	-	-			1	3
2465	392	9432	SUR	FLKTL	-	-	-			1	3
2465	392	9433	SUR	FLKTL	-	-	-			1	3
2465	392	9434	SUR	FLKTL	-	-	-			1	3
2465	392	9435	SUR	FLKTL	-	-	-			1	3
2465	392	9436	SUR	FLKTL	-	-	-			1	3
2465	392	9437	SUR	FLKTL	-	-	-			1	3
2465	392	9438	SUR	FLKTL	-	-	-			1	3
2465	392	9439	SUR	FLKTL	-	-	-			1	3
2465	392	9440	SUR	FLKTL	-	-	-			1	3
2465	392	9441	SUR	FLKTL	-	-	-			1	3
2465	392	9442	SUR	FLKTL	-	-	-			1	3
2465	392	9443	SUR	FLKTL	-	-	-			1	3
2465	392	9444	SUR	FLKTL	-	-	-			1	3
2465	392	9445	SUR	FLKTL	-	-	-			1	3
2465	392	9446	SUR	FLKTL	-	-	-			1	3
2465	392	9447	SUR	FLKTL	-	-	-			1	3
2465	392	9448	SUR	FLKTL	-	-	-			1	3
2465	392	9449	SUR	FLKTL	-	-	-			1	3
2465	392	9450	SUR	FLKTL	-	-	-			1	3
2465	392	9451	SUR	FLKTL	-	-	-			1	3
2465	392	9452	SUR	FLKTL	-	-	-			1	3
2465	392	9453	SUR	FLKTL	-	-	-			1	3
2465	392	9454	SUR	FLKTL	-	-	-			1	3
2465	392	9455	SUR	FLKTL	-	-	-			1	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2465	392	9456	SUR	FLKTL	-	-	-			1	3
2465	392	9457	SUR	FLKTL	-	-	-			1	3
2465	392	9458	SUR	FLKTL	-	-	-			1	3
2465	392	9459	SUR	FLKTL	-	-	-			1	3
2465	392	9460	SUR	FLKTL	-	-	-			1	3
2465	392	9461	SUR	FLKTL	-	-	-			1	3
2465	392	9462	SUR	FLKTL	-	-	-			1	3
2465	392	9463	SUR	FLKTL	-	-	-			1	3
2465	392	9464	SUR	FLKTL	-	-	-			1	3
2465	392	9465	SUR	FLKTL	-	-	-			1	3
2465	392	9466	SUR	FLKTL	-	-	-			1	3
2465	392	9467	SUR	FLKTL	-	-	-			1	3
2465	392	9468	SUR	FLKTL	-	-	-			1	3
2465	392	9469	SUR	FLKTL	-	-	-			1	3
2465	392	9470	SUR	FLKTL	-	-	-			1	3
2465	392	9496	CSC	BIFACE	CD	-	CD			1	3
2465	392	9497	CSC	FLKTL	CD	-	CD			1	3
2465	392	9514	CSC	BIFACE	I	MGM	MG			1	3
2465	392	9516	CSC	FLKTL	TQ	-	TQ			1	3
2465	392	9524	CSC	FLKTL	TQ	-	TQ			1	3
2465	392	9525	CSC	FLKTL	TQ	-	TQ			1	3
2465	392	9526	CSC	PRJPT	I	MGM/MC	M	1.5	4.3	1	3
2465	392	9532	CSC	FLKTL	TQ	-	TQ			1	3
2465	392	9539	CSC	FLKTL	I	MGM	MG			1	3
2465	392	9540	CSC	FLKTL	TQ	-	TQ			1	3
2465	392	9543	CSC	BIFACE	TQ	-	TQ	5.4		1	3
2465	392	9554	EXC	DBTG	TQ	-	TQ	2.5		1	3
2465	392	9554	EXC	DBTG	TQ	-	TQ	5.1		1	3
2465	392	9554	EXC	DBTG	TQ	-	TQ	2.5		1	3
2465	392	9554	EXC	DBTG	TQ	-	TQ	3.7		1	3
2465	392	9554	EXC	DBTG	TQ	-	TQ	2.4		1	3
2465	392	9558	EXC	BIFACE	TQ	-	TQ			1	3
2465	392	9559	EXC	BIFACE	CD	-	CD			1	3
2465	392	9565	EXC	DBTG	TQ	-	TQ	1.2		1	3
2465	392	9570	EXC	BIFACE	TQ	-	TQ			1	3
2465	392	9571	EXC	BIFACE	CD	-	CD			1	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2465	392	9572	EXC	FLKTL	I	QI	QI			1	3
2465	392	9573	EXC	FLKTL	TQ	-	TQ			1	3
2465	392	9580	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9580	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9580	EXC	DBTG	CD	-	CD			1	3
2465	392	9580	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9580	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9580	EXC	DBTG	CD	-	CD			1	3
2465	392	9580	EXC	DBTG	CD	-	CD			1	3
2465	392	9580	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9580	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9580	EXC	DBTG	I	-	I			1	3
2465	392	9580	EXC	DBTG	I	-	I			1	3
2465	392	9580	EXC	DBTG	I	-	I			1	3
2465	392	9580A	EXC	DBTG	I	CD	CD			1	3
2465	392	9580B	EXC	DBTG	I	M	M			1	3
2465	392	9580C	EXC	DBTG	I	M	M			1	3
2465	392	9580D	EXC	DBTG	I	M	M			1	3
2465	392	9580E	EXC	DBTG	I	M	M			1	3
2465	392	9580F	EXC	DBTG	I	CD	CD			1	3
2465	392	9580G	EXC	DBTG	I	CD	CD			1	3
2465	392	9580H	EXC	DBTG	I	CD	CD			1	3
2465	392	9580I	EXC	DBTG	I	CD	CD			1	3
2465	392	9580J	EXC	DBTG	I	CD	CD			1	3
2465	392	9580K	EXC	DBTG	I	CD	CD			1	3
2465	392	9580L	EXC	DBTG	I	CD	CD			1	3
2465	392	9580M	EXC	DBTG	I	CD	CD			1	3
2465	392	9580N	EXC	DBTG	I	CD	CD			1	3
2465	392	9580O	EXC	DBTG	I	CD	CD			1	3
2465	392	9584	EXC	FLKTL	TQ	-	TQ			1	3
2465	392	9585	EXC	FLKTL	I	MGM	MG			1	3
2465	392	9586	EXC	FLKTL	CD	-	CD			1	3
2465	392	9587	EXC	FLKTL	TQ	-	TQ			1	3
2465	392	9597	EXC	BIFACE	TQ	-	TQ			1	3
2465	392	9598	EXC	BIFACE	CD	-	CD			1	3
2465	392	9599	EXC	BIFACE	CD	-	CD			1	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2465	392	9600	EXC	BIFACE	I	SV	SV			1	3
2465	392	9601	EXC	FLKTL	I	CD/SV	I			1	3
2465	392	9606	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9606	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9606	EXC	DBTG	CD	-	CD			1	3
2465	392	9606	EXC	DBTG	CD	-	CD			1	3
2465	392	9606	EXC	DBTG	CD	-	CD			1	3
2465	392	9606	EXC	DBTG	I	-	I			1	3
2465	392	9606	EXC	DBTG	I	-	I			1	3
2465	392	9606	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9606	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9606	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9606	EXC	DBTG	I	-	I			1	3
2465	392	9606	EXC	DBTG	CD	-	CD			1	3
2465	392	9606	EXC	DBTG	I	-	I			1	3
2465	392	9606	EXC	DBTG	I	-	I			1	3
2465	392	9608	EXC	BIFACE	TQ	-	TQ			1	3
2465	392	9609	EXC	BIFACE	I	SV	SV			1	3
2465	392	9611	EXC	DBTG	CD	-	CD			1	3
2465	392	9611	EXC	DBTG	I	-	I			1	3
2465	392	9611	EXC	DBTG	I	-	I			1	3
2465	392	9611	EXC	DBTG	I	-	I			1	3
2465	392	9611	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9611	EXC	DBTG	CD	-	CD			1	3
2465	392	9611	EXC	DBTG	CD	-	CD			1	3
2465	392	9611	EXC	DBTG	I	-	I			1	3
2465	392	9611	EXC	DBTG	CD	-	CD			1	3
2465	392	9611	EXC	DBTG	CD	-	CD			1	3
2465	392	9611	EXC	DBTG	CD	-	CD			1	3
2465	392	9611	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9611	EXC	DBTG	I	-	I			1	3
2465	392	9611	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9611	EXC	DBTG	I	-	I			1	3
2465	392	9611	EXC	DBTG	I	-	I			1	3
2465	392	9613	EXC	FLKTL	CD	-	CD			1	3
2465	392	9614	EXC	FLKTL	TQ	-	TQ			1	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2465	392	9621	EXC	PRJPT	I	-	I			1	3
2465	392	9623	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9623	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9623	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9623	EXC	DBTG	CD	-	CD			1	3
2465	392	9623	EXC	DBTG	CD	-	CD			1	3
2465	392	9623	EXC	DBTG	I	-	I			1	3
2465	392	9623	EXC	DBTG	I	-	I			1	3
2465	392	9623	EXC	DBTG	I	-	I			1	3
2465	392	9623	EXC	DBTG	I	-	I			1	3
2465	392	9623	EXC	DBTG	CD	-	CD			1	3
2465	392	9623	EXC	DBTG	I	-	I			1	3
2465	392	9623	EXC	DBTG	I	-	I			1	3
2465	392	9627	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9627	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9627	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9627	EXC	DBTG	CD	-	CD			1	3
2465	392	9627	EXC	DBTG	I	-	I			1	3
2465	392	9627	EXC	DBTG	CD	-	CD			1	3
2465	392	9627	EXC	DBTG	I	-	I			1	3
2465	392	9627	EXC	DBTG	CD	-	CD			1	3
2465	392	9627	EXC	DBTG	I	-	I			1	3
2465	392	9627	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9627	EXC	DBTG	CD	-	CD			1	3
2465	392	9627	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9627	EXC	DBTG	I	-	I			1	3
2465	392	9627	EXC	DBTG	I	-	I			1	3
2465	392	9630	EXC	FRMFLKTL	TQ	-	TQ	4.7		1	3
2465	392	9631	EXC	FLKTL	I	MGM	MG			1	3
2465	392	9632	EXC	FLKTL	TQ	-	TQ			1	3
2465	392	9635	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9635	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9635	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9635	EXC	DBTG	CD	-	CD			1	3
2465	392	9635	EXC	DBTG	CD	-	CD			1	3
2465	392	9635	EXC	DBTG	I	-	I			1	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2465	392	9635	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9635	EXC	DBTG	CD	-	CD			1	3
2465	392	9635	EXC	DBTG	CD	-	CD			1	3
2465	392	9635	EXC	DBTG	CD	-	CD			1	3
2465	392	9635	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9635	EXC	DBTG	I	-	I			1	3
2465	392	9635	EXC	DBTG	I	-	I			1	3
2465	392	9635	EXC	DBTG	I	-	I			1	3
2465	392	9643	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9643	EXC	DBTG	CD	-	CD			1	3
2465	392	9643	EXC	DBTG	I	-	I			1	3
2465	392	9643	EXC	DBTG	I	-	I			1	3
2465	392	9643	EXC	DBTG	I	-	I			1	3
2465	392	9643	EXC	DBTG	CD	-	CD			1	3
2465	392	9643	EXC	DBTG	CD	-	CD			1	3
2465	392	9643	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9643	EXC	DBTG	CD	-	CD			1	3
2465	392	9643	EXC	DBTG	CD	-	CD			1	3
2465	392	9643	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9643	EXC	DBTG	I	-	I			1	3
2465	392	9643	EXC	DBTG	I	-	I			1	3
2465	392	9643	EXC	DBTG	I	-	I			1	3
2465	392	9645	EXC	PRJPT	TQ	MH	MH	2.0		1	3
2465	392	9647	EXC	BIFACE	I	SV	SV			1	3
2465	392	9655	EXC	PRJPT	TQ	-	TQ	4.9		1	3
2465	392	9656	EXC	PRJPT	TQ	-	TQ			1	3
2465	392	9657	EXC	BIFACE	I	MH	MH			1	3
2465	392	9666	EXC	DBTG	CD	-	CD			1	3
2465	392	9666	EXC	DBTG	FS	-	FS			1	3
2465	392	9666	EXC	DBTG	I	-	I			1	3
2465	392	9666	EXC	DBTG	I	-	I			1	3
2465	392	9666	EXC	DBTG	I	-	I			1	3
2465	392	9666	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9666	EXC	DBTG	CD	-	CD			1	3
2465	392	9666	EXC	DBTG	I	-	I			1	3
2465	392	9666	EXC	DBTG	TQ	-	TQ			1	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2465	392	9666	EXC	DBTG	CD	-	CD			1	3
2465	392	9666	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9666	EXC	DBTG	I	-	I			1	3
2465	392	9666	EXC	DBTG	I	-	I			1	3
2465	392	9670	EXC	PRJPT	CD	-	CD	2.5		1	3
2465	392	9671	EXC	BIFACE	TQ	-	TQ			1	3
2465	392	9672	EXC	BIFACE	I	SV	SV	5.7		1	3
2465	392	9673	EXC	BIFACE	TQ	-	TQ			1	3
2465	392	9674	EXC	FRMFLKTL	I	MH	MH	DH		1	3
2465	392	9675	EXC	FLKTL	I	SV	SV			1	3
2465	392	9676	EXC	FLKTL	I	MGM	MG			1	3
2465	392	9680	EXC	FLKTL	CD	-	CD			1	3
2465	392	9686	EXC	BIFACE	TQ	-	TQ			1	3
2465	392	9687	EXC	BIFACE	TQ	-	TQ			1	3
2465	392	9688	EXC	FLKTL	I	SV	SV			1	3
2465	392	9689	EXC	FLKTL	CD	-	CD			1	3
2465	392	9690	EXC	FLKTL	I	MGM/MH	I			1	3
2465	392	9691	EXC	FLKTL	I	SV	SV			1	3
2465	392	9692	EXC	FLKTL	TQ	-	TQ			1	3
2465	392	9693	EXC	FLKTL	TQ	-	TQ			1	3
2465	392	9699	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9699	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9699	EXC	DBTG	I	-	I			1	3
2465	392	9699	EXC	DBTG	I	-	I			1	3
2465	392	9699	EXC	DBTG	CD	-	CD			1	3
2465	392	9699	EXC	DBTG	I	-	I			1	3
2465	392	9699	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9699	EXC	DBTG	CD	-	CD			1	3
2465	392	9699	EXC	DBTG	I	-	I			1	3
2465	392	9699	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9699	EXC	DBTG	CD	-	CD			1	3
2465	392	9699	EXC	DBTG	I	-	I			1	3
2465	392	9699	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9699	EXC	DBTG	I	-	I			1	3
2465	392	9699	EXC	DBTG	I	-	I			1	3
2465	392	9704	EXC	PRJPT	TQ	-	TQ			1	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2465	392	9705	EXC	PRJPT	TQ	-	TQ			1	3
2465	392	9706	EXC	BIFACE	CD	-	CD			1	3
2465	392	9708	EXC	FLKTL	I	MGM	MG			1	3
2465	392	9709	EXC	FLKTL	I	MH	MH			1	3
2465	392	9710	EXC	FLKTL	I	MH	MH			1	3
2465	392	9711	EXC	FLKTL	CD	-	CD			1	3
2465	392	9726	EXC	BIFACE	TQ	-	TQ			1	3
2465	392	9727	EXC	FLKTL	I	SV	SV			1	3
2465	392	9735	EXC	PRJPT	FS	-	FS			1	3
2465	392	9737	EXC	DRILL	TQ	-	TQ			1	3
2465	392	9738	EXC	BIFACE	TQ	-	TQ			1	3
2465	392	9739	EXC	PTBLNK	I	SV	SV	2.4	DH	1	3
2465	392	9740	EXC	PTBLNK	I	MH	MH	1.5		1	3
2465	392	9741	EXC	FRMFLKTL	TQ	-	TQ	4.6		1	3
2465	392	9743	EXC	FLKTL	TQ	-	TQ			1	3
2465	392	9744	EXC	FLKTL	I	SV	SV			1	3
2465	392	9745	EXC	FLKTL	TQ	-	TQ			1	3
2465	392	9756	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9756	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9756	EXC	DBTG	CD	-	CD			1	3
2465	392	9756	EXC	DBTG	CD	-	CD			1	3
2465	392	9756	EXC	DBTG	CD	-	CD			1	3
2465	392	9756	EXC	DBTG	CD	-	CD			1	3
2465	392	9756	EXC	DBTG	I	-	I			1	3
2465	392	9756	EXC	DBTG	I	-	I			1	3
2465	392	9756	EXC	DBTG	CD	-	CD			1	3
2465	392	9756	EXC	DBTG	I	-	I			1	3
2465	392	9756	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9756	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9756	EXC	DBTG	CD	-	CD			1	3
2465	392	9756	EXC	DBTG	I	-	I			1	3
2465	392	9756	EXC	DBTG	I	-	I			1	3
2465	392	9760	EXC	PRJPT	I	TQ	TQ	1.5		1	3
2465	392	9761	EXC	BIFACE	TQ	-	TQ			1	3
2465	392	9762	EXC	BIFACE	CD	-	CD			1	3
2465	392	9763	EXC	FLKTL	CD	-	CD			1	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2465	392	9764	EXC	FLKTL	CD	-	CD			1	3
2465	392	9765	EXC	FLKTL	TQ	-	TQ			1	3
2465	392	9772	EXC	PRJPT	I	-	I			1	3
2465	392	9777	EXC	FLKTL	TQ	-	TQ			1	3
2465	392	9788	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9788	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9788	EXC	DBTG	CD	-	CD			1	3
2465	392	9788	EXC	DBTG	CD	-	CD			1	3
2465	392	9788	EXC	DBTG	I	-	I			1	3
2465	392	9788	EXC	DBTG	I	-	I			1	3
2465	392	9788	EXC	DBTG	I	-	I			1	3
2465	392	9788	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9788	EXC	DBTG	CD	-	CD			1	3
2465	392	9788	EXC	DBTG	CD	-	CD			1	3
2465	392	9788	EXC	DBTG	I	-	I			1	3
2465	392	9788	EXC	DBTG	CD	-	CD			1	3
2465	392	9788	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9788	EXC	DBTG	I	-	I			1	3
2465	392	9788	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9788	EXC	DBTG	I	-	I			1	3
2465	392	9788	EXC	DBTG	I	-	I			1	3
2465	392	9791	EXC	BIFACE	CD	-	CD			1	3
2465	392	9792	EXC	BIFACE	I	MH	MH			1	3
2465	392	9793	EXC	FLKTL	CD	-	CD			1	3
2465	392	9794	EXC	FLKTL	CD	-	CD			1	3
2465	392	9804	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9804	EXC	DBTG	I	-	I			1	3
2465	392	9804	EXC	DBTG	CD	-	CD			1	3
2465	392	9804	EXC	DBTG	CD	-	CD			1	3
2465	392	9804	EXC	DBTG	I	-	I			1	3
2465	392	9804	EXC	DBTG	I	-	I			1	3
2465	392	9804	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9804	EXC	DBTG	CD	-	CD			1	3
2465	392	9804	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9804	EXC	DBTG	CD	-	CD			1	3
2465	392	9804	EXC	DBTG	TQ	-	TQ			1	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2465	392	9804	EXC	DBTG	I	-	I			1	3
2465	392	9804	EXC	DBTG	I	-	I			1	3
2465	392	9808	EXC	FLKTL	CD	-	CD			1	3
2465	392	9809	EXC	FLKTL	TQ	-	TQ			1	3
2465	392	9816	EXC	FLKTL	CD	-	CD			1	3
2465	392	9817	EXC	FLKTL	I	MH	MH			1	3
2465	392	9818	EXC	FLKTL	I	SV	SV			1	3
2465	392	9821	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9821	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9821	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9821	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9821	EXC	DBTG	CD	-	CD			1	3
2465	392	9821	EXC	DBTG	I	-	I			1	3
2465	392	9821	EXC	DBTG	I	-	I			1	3
2465	392	9821	EXC	DBTG	I	-	I			1	3
2465	392	9824	EXC	DBTG	TQ	-	TQ	3.0		1	3
2465	392	9824	EXC	DBTG	TQ	-	TQ	6.3		1	3
2465	392	9824	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9824	EXC	DBTG	TQ	-	TQ	3.2		1	3
2465	392	9824	EXC	DBTG	TQ	-	TQ	3.6		1	3
2465	392	9824	EXC	DBTG	TQ	-	TQ	2.9		1	3
2465	392	9828	EXC	BIFACE	CD	-	CD			1	3
2465	392	9829	EXC	FLKTL	CD	-	CD			1	3
2465	392	9835	EXC	BIFACE	I	MH	MH			1	3
2465	392	9836	EXC	FLKTL	CD	-	CD			1	3
2465	392	9839	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9839	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9839	EXC	DBTG	I	-	I			1	3
2465	392	9841	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9841	EXC	DBTG	I	-	I			1	3
2465	392	9842	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9842	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9842	EXC	DBTG	CD	-	CD			1	3
2465	392	9842	EXC	DBTG	CD	-	CD			1	3
2465	392	9842	EXC	DBTG	I	-	I			1	3
2465	392	9842	EXC	DBTG	I	-	I			1	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2465	392	9842	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9842	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9842	EXC	DBTG	I	-	I			1	3
2465	392	9842	EXC	DBTG	I	-	I			1	3
2465	392	9845	EXC	PRJPT	I	MH	MH	1.4	10.8	1	3
2465	392	9846	EXC	FLKTL	TQ	-	TQ			1	3
2465	392	9852	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9852	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9852	EXC	DBTG	CD	-	CD			1	3
2465	392	9852	EXC	DBTG	CD	-	CD			1	3
2465	392	9852	EXC	DBTG	CD	-	CD			1	3
2465	392	9852	EXC	DBTG	CD	-	CD			1	3
2465	392	9852	EXC	DBTG	I	-	I			1	3
2465	392	9852	EXC	DBTG	I	-	I			1	3
2465	392	9857	EXC	FLKTL	TQ	-	TQ			1	3
2465	392	9870L	EXC	DBTG	TQ	M	M	1.5	6.3	1	3
2465	392	9870S	EXC	DBTG	TQ	M	M	1.3	6.5	1	3
2465	392	9872	EXC	BIFACE	CD	-	CD			1	3
2465	392	9873	EXC	BIFACE	CD	-	CD			1	3
2465	392	9874	EXC	FLKTL	TQ	-	TQ			1	3
2465	392	9875	EXC	FLKTL	I	MGM	MG			1	3
2465	392	9882	EXC	DBTG	TQ	M	M	1.3		1	3
2465	392	9884	EXC	PRJPT	I	CD	CD	3.1		1	3
2465	392	9885	EXC	BIFACE	CD	-	CD			1	3
2465	392	9892	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9892	EXC	DBTG	CD	-	CD			1	3
2465	392	9892	EXC	DBTG	I	-	I			1	3
2465	392	9892	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9892	EXC	DBTG	I	-	I			1	3
2465	392	9892	EXC	DBTG	I	-	I			1	3
2465	392	9892A	EXC	DBTG	I	CD	CD			1	3
2465	392	9892B	EXC	DBTG	I	CD	CD			1	3
2465	392	9892C	EXC	DBTG	I	CD	CD			1	3
2465	392	9892D	EXC	DBTG	I	CD	CD			1	3
2465	392	9892E	EXC	DBTG	I	CD	CD			1	3
2465	392	9894	EXC	FLKTL	TQ	-	TQ			1	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2465	392	9897	EXC	DBTG	TQ	-	TQ	7.1		1	3
2465	392	9897	EXC	DBTG	TQ	-	TQ	3.0		1	3
2465	392	9897	EXC	DBTG	TQ	-	TQ	2.4		1	3
2465	392	9897	EXC	DBTG	TQ	-	TQ	4.3		1	3
2465	392	9897	EXC	DBTG	TQ	-	TQ	3.7		1	3
2465	392	9897	EXC	DBTG	TQ	-	TQ	4.1		1	3
2465	392	9902	EXC	PRJPT	I	-	I			1	3
2465	392	9903	EXC	BIFACE	TQ	-	TQ			1	3
2465	392	9904	EXC	BIFACE	I	CD	CD			1	3
2465	392	9905	EXC	BIFACE	CD	-	CD	3.1		1	3
2465	392	9906	EXC	FRMFLKTL	CD	-	CD	4.7	1.5	1	3
2465	392	9907	EXC	FRMFLKTL	CD	-	CD	4.0	1.5	1	3
2465	392	9908	EXC	FLKTL	TQ	-	TQ			1	3
2465	392	9909	EXC	FLKTL	TQ	-	TQ			1	3
2465	392	9910	EXC	FLKTL	TQ	-	TQ			1	3
2465	392	9911	EXC	FLKTL	TQ	-	TQ			1	3
2465	392	9912	EXC	FLKTL	TQ	-	TQ			1	3
2465	392	9913	EXC	FLKTL	TQ	-	TQ			1	3
2465	392	9914	EXC	FLKTL	I	SV/MGM	I			1	3
2465	392	9915	EXC	FLKTL	I	SV	SV			1	3
2465	392	9916	EXC	FLKTL	I	SV	SV			1	3
2465	392	9917	EXC	FLKTL	CD	-	CD			1	3
2465	392	9918	EXC	FLKTL	CD	-	CD			1	3
2465	392	9919	EXC	FLKTL	TQ	-	TQ			1	3
2465	392	9920	EXC	FLKTL	I	SV/CD	I			1	3
2465	392	9921	EXC	FLKTL	I	SV	SV			1	3
2465	392	9922	EXC	FLKTL	I	MGM/MH	I			1	3
2465	392	9923	EXC	FLKTL	TQ	-	TQ			1	3
2465	392	9924	EXC	FLKTL	CD	-	CD			1	3
2465	392	9925	EXC	FLKTL	TQ	-	TQ			1	3
2465	392	9926	EXC	FLKTL	CD	-	CD			1	3
2465	392	9927	EXC	FLKTL	I	MGM	MG			1	3
2465	392	9928	EXC	FLKTL	I	SV/QI	I			1	3
2465	392	9929	EXC	FLKTL	I	SV	SV			1	3
2465	392	9930	EXC	FLKTL	TQ	-	TQ			1	3
2465	392	9931	EXC	FLKTL	I	MH	MH			1	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2465	392	9932	EXC	FLKTL	CD	-	CD			1	3
2465	392	9960	EXC	DBTG	CD	-	CD			1	3
2465	392	9960	EXC	DBTG	I	-	I			1	3
2465	392	9960	EXC	DBTG	CD	-	CD			1	3
2465	392	9960	EXC	DBTG	CD	-	CD			1	3
2465	392	9960	EXC	DBTG	I	-	I			1	3
2465	392	9960	EXC	DBTG	CD	-	CD			1	3
2465	392	9960	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9960	EXC	DBTG	I	-	I			1	3
2465	392	9960	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9960	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9960	EXC	DBTG	I	-	I			1	3
2465	392	9960	EXC	DBTG	I	-	I			1	3
2465	392	9964	EXC	DRILL	TQ	-	TQ			1	3
2465	392	9965	EXC	BIFACE	TQ	-	TQ			1	3
2465	392	9966	EXC	BIFACE	I	MH	MH			1	3
2465	392	9967	EXC	BIFACE	CD	-	CD			1	3
2465	392	9968	EXC	BIFACE	I	MH	MH			1	3
2465	392	9969	EXC	PTBLNK	TQ	-	TQ	1.7		1	3
2465	392	9970	EXC	FLKTL	CD	-	CD			1	3
2465	392	9971	EXC	FLKTL	CD	-	CD			1	3
2465	392	9972	EXC	FLKTL	CD	-	CD			1	3
2465	392	9973	EXC	FLKTL	TQ	-	TQ			1	3
2465	392	9974	EXC	FLKTL	I	MGM	MG			1	3
2465	392	9975	EXC	FLKTL	CD	-	CD			1	3
2465	392	9976	EXC	FLKTL	CD	-	CD			1	3
2465	392	9977	EXC	FLKTL	TQ	-	TQ			1	3
2465	392	9978	EXC	FLKTL	TQ	-	TQ			1	3
2465	392	9979	EXC	FLKTL	CD	-	CD			1	3
2465	392	9980	EXC	FLKTL	I	SV	SV			1	3
2465	392	9981	EXC	FLKTL	TQ	-	TQ			1	3
2465	392	9995	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9995	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9995	EXC	DBTG	CD	-	CD			1	3
2465	392	9995	EXC	DBTG	CD	-	CD			1	3
2465	392	9995	EXC	DBTG	CD	-	CD			1	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2465	392	9995	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9995	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9995	EXC	DBTG	I	-	I			1	3
2465	392	9995	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9995	EXC	DBTG	CD	-	CD			1	3
2465	392	9995	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9995	EXC	DBTG	I	-	I			1	3
2465	392	9995	EXC	DBTG	TQ	-	TQ			1	3
2465	392	9995	EXC	DBTG	I	-	I			1	3
2465	392	9995A	EXC	DBTG	I	M	M			1	3
2465	392	9995B	EXC	DBTG	I	CD	CD			1	3
2465	392	9995C	EXC	DBTG	I	M	M			1	3
2465	392	9995D	EXC	DBTG	I	CD	CD			1	3
2465	392	9995E	EXC	DBTG	I	TQ	TQ			1	3
2465	392	9995F	EXC	DBTG	I	M	M			1	3
2465	392	9995G	EXC	DBTG	I	CD	CD			1	3
2465	392	9995H	EXC	DBTG	I	CD	CD			1	3
2465	392	9995I	EXC	DBTG	I	CD	CD			1	3
2465	392	9995J	EXC	DBTG	I	CD	CD			1	3
24-A	474	18	SUR	PRJPT	I	MH	MH	10.1		3	1
24-A	474	27	SUR	PRJPT	CD	-	CD	8.5		3	1
24-A	474	82A	CSC	DBTG	I	FS	FS	7.8		3	1
24-A	474	82B	CSC	DBTG	I	FS	FS			3	1
24-A	474	82C	CSC	DBTG	I	CO	CO	9.7		3	1
24-A	474	82D	CSC	DBTG	I	MC	MC	10.5		3	1
24-A	474	82E	CSC	DBTG	I	CD	CD	11.9		3	1
24-A	474	82F	CSC	DBTG	I	TQ	TQ	10.5		3	1
24-A	474	82G	CSC	DBTG	TQ	-	TQ	8.2		3	1
24-A	474	82H	CSC	DBTG	TQ	-	TQ			3	1
24-A	474	82I	CSC	DBTG	TQ	-	TQ			3	1
24-A	474	82J	CSC	DBTG	TQ	-	TQ			3	1
24-A	474	82K	CSC	DBTG	TQ	-	TQ			3	1
24-A	474	82L	CSC	DBTG	TQ	-	TQ			3	1
24-A	474	82M	CSC	DBTG	CD	-	CD			3	1
24-A	474	82N	CSC	DBTG	CD	-	CD			3	1
24-A	474	82O	CSC	DBTG	CD	-	CD			3	1

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
24-A	474	83A	EXC	DBTG	-	-	I	8.6		3	1
24-A	474	83B	EXC	DBTG	-	-	I	7.7		3	1
24-A	474	83C	EXC	DBTG	-	-	I	10.8		3	1
24-A	474	83D	EXC	DBTG	-	-	I	10.8		3	1
24-A	474	83E	EXC	DBTG	-	-	I	7.2		3	1
24A-1	455	897	SUR	PRJPT	I	FS	FS			3	2
24-B	474	84	CSC	FLKTL	CD	-	CD			3	1
24-B	474	85	CSC	FLKTL	I	SV	SV			3	1
24-B	474	86A	CSC	DBTG	I	CD	CD	8.3		3	1
24-B	474	86B	CSC	DBTG	I	MH	MH	8.6		3	1
24-B	474	86C	CSC	DBTG	I	TQ	TQ	9.5		3	1
24-B	474	86D	CSC	DBTG	I	CD	CD	7.9		3	1
24-B	474	86E	CSC	DBTG	I	CD	CD			3	1
24-B	474	86F	CSC	DBTG	TQ	-	TQ			3	1
24-B	474	86G	CSC	DBTG	TQ	-	TQ			3	1
24-B	474	86H	CSC	DBTG	TQ	-	TQ			3	1
24-B	474	86I	CSC	DBTG	TQ	-	TQ			3	1
24-B	474	86J	CSC	DBTG	TQ	-	TQ			3	1
24-B	474	86K	CSC	DBTG	TQ	-	TQ			3	1
24-B	474	86L	CSC	DBTG	TQ	-	TQ			3	1
24-B	474	86M	CSC	DBTG	TQ	-	TQ			3	1
24-B	474	86N	CSC	DBTG	TQ	-	TQ			3	1
24-B	474	86O	CSC	DBTG	CD	-	CD			3	1
24-B	474	88A	EXC	DBTG	-	-	I	9.5		3	1
24-B	474	88B	EXC	DBTG	-	-	I	9.2		3	1
24-B	474	88C	EXC	DBTG	-	-	I	7.3		3	1
24-B	474	88D	EXC	DBTG	-	-	I	9.2		3	1
24-B	474	88E	EXC	DBTG	-	-	I	UNR		3	1
24-C	474	45	SUR	PRJPT	TQ	-	TQ	8.0		3	1
24-C	474	89A	CSC	DBTG	I	MGM	MG	8.6		3	1
24-C	474	89B	CSC	DBTG	I	CD	CD			3	1
24-C	474	89C	CSC	DBTG	I	CD	CD			3	1
24-C	474	89D	CSC	DBTG	I	TQ	TQ	9.0		3	1
24-C	474	89E	CSC	DBTG	I	MC	MC	8.6		3	1
24-C	474	89F	CSC	DBTG	I	MGM/MC	M	8.6		3	1
24-C	474	89G	CSC	DBTG	I	CD	CD	5.9		3	1

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
24-C	474	89H	CSC	DBTG	TQ	-	TQ			3	1
24-C	474	89I	CSC	DBTG	TQ	-	TQ			3	1
24-C	474	89J	CSC	DBTG	TQ	-	TQ			3	1
24-C	474	89K	CSC	DBTG	TQ	-	TQ			3	1
24-C	474	89L	CSC	DBTG	TQ	-	TQ			3	1
24-C	474	89M	CSC	DBTG	TQ	-	TQ			3	1
24-C	474	89N	CSC	DBTG	CD	-	CD			3	1
24-C	474	89O	CSC	DBTG	TQ	-	TQ			3	1
24-C	474	90A	EXC	DBTG	-	-	I	6.1		3	1
24-C	474	90B	EXC	DBTG	-	-	I	8.6		3	1
24-C	474	90C	EXC	DBTG	-	-	I	9.1		3	1
24-C	474	90D	EXC	DBTG	-	-	I	8.9		3	1
24-C	474	90E	EXC	DBTG	-	-	I	1.5		3	1
26B-1	455	1013A	CSC	DBTG	I	MGM	MG			3	2
26B-1	455	1013B	CSC	DBTG	I	SV/CD	I			3	2
26B-1	455	1013C	CSC	DBTG	I	MGM/MC	M			3	2
26B-1	455	1013D	CSC	DBTG	I	TQ	TQ	12.7		3	2
26B-1	455	1013E	CSC	DBTG	I	MGM	MG	12.5		3	2
26B-1	455	1013F	CSC	DBTG	CD	-	CD	11.7		3	2
26B-1	455	1013G	CSC	DBTG	CD	-	CD	10.7		3	2
26B-1	455	1013H	CSC	DBTG	TQ	-	TQ	9.7		3	2
26B-1	455	1013I	CSC	DBTG	TQ	-	TQ	10.1		3	2
26B-1	455	1013J	CSC	DBTG	TQ	-	TQ			3	2
26B-1	455	1013K	CSC	DBTG	CD	-	CD	10.0		3	2
26B-1	455	1013L	CSC	DBTG	CD	-	CD	9.9		3	2
26B-1	455	1013M	CSC	DBTG	TQ	-	TQ			3	2
26B-1	455	1013N	CSC	DBTG	TQ	-	TQ			3	2
26B-1	455	1013O	CSC	DBTG	TQ	-	TQ			3	2
26B-1	455	1013P	CSC	DBTG	TQ	-	TQ	9.9		3	2
26B-1	455	1013Q	CSC	DBTG	TQ	-	TQ	9.8		3	2
26B-1	455	1013R	CSC	DBTG	-	-	I	10.6		3	2
26B-1	455	1013S	CSC	DBTG	-	-	I	11.8		3	2
26B-1	455	1013T	CSC	DBTG	-	-	I	9.5		3	2
26B-1	455	1013U	CSC	DBTG	-	-	I	11.4		3	2
26B-1	467	1200	SUR	PRJPT	FS	FS	FS	8.6		3	2
26B-1	467	1201	SUR	PRJPT	CD	-	CD			3	2

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
26B-1	467	1202	SUR	PRJPT	I	MGM	MG			3	2
26B-1	467	1203	SUR	PRJPT	I	FS	FS	3.0		3	2
26B-1	467	1206	CSC	BIFACE	CD	-	CD	14.3		3	2
26B-1	467	1243	CSC	FLKTL	CD	-	CD			3	2
26B-1	467	1273A	CSC	DBTG	I	CD	CD			3	2
26B-1	467	1273B	CSC	DBTG	I	FS	FS			3	2
26B-1	467	1273C	CSC	DBTG	TQ	-	TQ			3	2
26B-1	467	1273D	CSC	DBTG	TQ	-	TQ			3	2
26B-1	467	1273E	CSC	DBTG	TQ	-	TQ			3	2
26B-1	467	1292A	CSC	DBTG	I	CO	CO			3	2
26B-1	467	1292B	CSC	DBTG	I	TQ	TQ			3	2
26B-1	467	1292C	CSC	DBTG	I	CD	CD			3	2
26B-1	467	1292D	CSC	DBTG	I	FS	FS			3	2
26B-1	467	1292E	CSC	DBTG	I	MGM	MG			3	2
26B-1	467	1292F	CSC	DBTG	TQ	-	TQ			3	2
26B-1	467	1292G	CSC	DBTG	TQ	-	TQ			3	2
26B-1	467	1292H	CSC	DBTG	TQ	-	TQ			3	2
26B-1	467	1292I	CSC	DBTG	TQ	-	TQ			3	2
26B-1	467	1292J	CSC	DBTG	TQ	-	TQ			3	2
26B-1	467	1292K	CSC	DBTG	TQ	-	TQ	10.4		3	2
26B-1	467	1292L	CSC	DBTG	TQ	-	TQ	9.5		3	2
26B-1	467	1313A	EXC	DBTG	I	FS	FS			3	2
26B-1	467	1313B	EXC	DBTG	I	CO	CO			3	2
26B-1	467	1313C	EXC	DBTG	I	MH	MH			3	2
26B-1	467	1313D	EXC	DBTG	I	FS	FS			3	2
26B-1	467	1313E	EXC	DBTG	I	SV/CD	I			3	2
26B-1	467	1313F	EXC	DBTG	I	FS	FS			3	2
26B-1	467	1313G	EXC	DBTG	TQ	-	TQ			3	2
26B-1	467	1313H	EXC	DBTG	TQ	-	TQ			3	2
26B-1	467	1313I	EXC	DBTG	TQ	-	TQ			3	2
26B-1	467	1313J	EXC	DBTG	TQ	-	TQ			3	2
26B-1	467	1313K	EXC	DBTG	TQ	-	TQ			3	2
26B-1	467	1313L	EXC	DBTG	TQ	-	TQ			3	2
26B-1	467	1313M	EXC	DBTG	TQ	-	TQ			3	2
26B-1	467	1313N	EXC	DBTG	CD	-	CD			3	2
26B-1	467	1313O	EXC	DBTG	CD	-	CD			3	2

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
26B-1	467	1313P	EXC	DBTG	-	-	I	12.1		3	2
26B-1	467	1313Q	EXC	DBTG	-	-	I	10.7		3	2
26B-1	467	1313R	EXC	DBTG	-	-	I	DH		3	2
26B-1	467	1313S	EXC	DBTG	-	-	I	13.3		3	2
26B-1	467	1313T	EXC	DBTG	-	-	I	10.2		3	2
26B-1	455	987	CSC	BIFACE	I	MGM	MG			3	2
26B-1	455	988	CSC	BIFACE	I	MH	MH			3	2
26B-1	455	990	CSC	FLKTL	I	MGM	MG			3	2
26B-1	455	991	CSC	FLKTL	I	MGM	MG			3	2
26B-1	455	992	CSC	FLKTL	CD	-	CD			3	2
28-A	ENF	1	SUR	PRJPT	I	MH	MH			2	3
28-A	ENF	1	SUR	BIFACE	CD	-	CD			4	3
28-A	ENF	10	SUR	BIFACE	I	MGM	MG			4	3
28-A	ENF	11	SUR	BIFACE	I	MGM	MG			4	3
28-A	ENF	12	SUR	DRILL	I	MH	MH			4	3
28-A	ENF	13	SUR	FRMFLKTL	CD	-	CD	6.1		4	3
28-A	ENF	14	SUR	FRMFLKTL	CD	-	CD	4.0		4	3
28-A	ENF	15	SUR	FRMFLKTL	I	MGM	MG	4.1		4	3
28-A	ENF	16	SUR	FLKTL	I	MGM	MG			4	3
28-A	ENF	17	SUR	FLKTL	I	CD	CD			4	3
28-A	ENF	18	SUR	FLKTL	I	PG	PG			4	3
28-A	ENF	19	SUR	FLKTL	CD	-	CD			4	3
28-A	ENF	2	SUR	FLKTL	TQ	-	TQ			4	3
28-A	ENF	2	SUR	BIFACE	CD	-	CD	11.2		4	3
28-A	ENF	20	SUR	FLKTL	I	MGM	MG			4	3
28-A	ENF	21	SUR	FLKTL	CD	-	CD			4	3
28-A	ENF	22	SUR	FLKTL	I	MGM/MC	M			4	3
28-A	ENF	23	SUR	FLKTL	CD	-	CD			4	3
28-A	ENF	24	SUR	FLKTL	I	MH	MH			4	3
28-A	ENF	25	SUR	FLKTL	I	MGM	MG			4	3
28-A	ENF	26	SUR	FLKTL	I	CD/SV	I			4	3
28-A	ENF	27	SUR	FLKTL	I	MGM	MG			4	3
28-A	ENF	28	SUR	FLKTL	I	MGM	MG			4	3
28-A	ENF	29	SUR	FLKTL	I	CD	CD			4	3
28-A	ENF	3	SUR	FLKTL	CD	-	CD			4	3
28-A	ENF	3	SUR	BIFACE	I	MGM	MG	10.5		4	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
28-A	ENF	30	SUR	FLKTL	I	MGM/MC	M			4	3
28-A	ENF	31	SUR	FLKTL	I	SV	SV			4	3
28-A	ENF	33	SUR	FLKTL	TQ	-	TQ			4	3
28-A	ENF	34	SUR	FLKTL	I	MH	MH			4	3
28-A	ENF	35	SUR	FLKTL	CD	-	CD			4	3
28-A	ENF	36	SUR	FLKTL	I	MH	MH			4	3
28-A	ENF	37	SUR	FLKTL	CD	-	CD			4	3
28-A	ENF	38	SUR	FLKTL	CD	-	CD			4	3
28-A	ENF	39	SUR	FLKTL	CD	-	CD			4	3
28-A	ENF	4	SUR	BIFACE	I	MGM	MG	8.4		4	3
28-A	ENF	40	SUR	FLKTL	CD	-	CD			4	3
28-A	ENF	41	SUR	FLKTL	I	CD	CD			4	3
28-A	ENF	42	SUR	FRMFLKTL	I	MGM	MG	6.7		4	3
28-A	ENF	43	SUR	FLKTL	TQ	-	TQ			4	3
28-A	ENF	44	SUR	FLKTL	I	MH	MH			4	3
28-A	ENF	45	SUR	FLKTL	I	SV	SV			4	3
28-A	ENF	5	SUR	BIFACE	I	SV/CD	I			4	3
28-A	ENF	6	SUR	BIFACE	I	CD	CD	8.6		4	3
28-A	ENF	7	SUR	BIFACE	CD	-	CD			4	3
28-A	ENF	8	SUR	BIFACE	I	MH	MH			4	3
28-A	ENF	9	SUR	BIFACE	TQ	-	TQ	7.0		4	3
28-A	474	92	CSC	BIFACE	CD	-	CD			4	3
28-A	474	93	CSC	FLKTL	I	SV	SV			4	3
28-A	474	94	CSC	FLKTL	TQ	-	TQ			4	3
28-A	474	95A	CSC	DBTG	I	FS	FS	7.3		4	3
28-A	474	95B	CSC	DBTG	I	CD	CD	8.9		4	3
28-A	474	95C	CSC	DBTG	I	MC/MGM	M			4	3
28-A	474	95D	CSC	DBTG	I	CD	CD			4	3
28-A	474	95E	CSC	DBTG	I	MC/MGM	M			4	3
28-A	474	95F	CSC	DBTG	I	MC	MC	6.3		4	3
28-A	474	95G	CSC	DBTG	I	CD	CD	5.8		4	3
28-A	474	95H	CSC	DBTG	I	CD	CD	5.8		4	3
28-A	474	95I	CSC	DBTG	TQ	-	TQ			4	3
28-A	474	95J	CSC	DBTG	CD	-	CD			4	3
28-A	474	95K	CSC	DBTG	CD	-	CD			4	3
28-A	474	95L	CSC	DBTG	CD	-	CD			4	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
28-A	474	95M	CSC	DBTG	CD	-	CD			4	3
28-A	474	95N	CSC	DBTG	CD	-	CD			4	3
28-A	474	95O	CSC	DBTG	CD	-	CD			4	3
28-A	474	96A	EXC	DBTG	-	-	I	5.2		4	3
28-A	474	96B	EXC	DBTG	-	-	I	5.2		4	3
28-A	474	96C	EXC	DBTG	-	-	I	5.1		4	3
28-A	474	96D	EXC	DBTG	-	-	I	3.0		4	3
28-A	474	96E	EXC	DBTG	-	-	I	5.2		4	3
2-A	ENF	1	SUR	PRJPT	I	MH	MH	5.6		1	1
2-A	ENF	2	SUR	PRJPT	TQ	-	TQ	3.2		1	1
2-A	ENF	3	SUR	BIFACE	TQ	-	TQ			1	1
2-A	ENF	4	SUR	FRMFLKTL	I	MGM	MG	3.6		2	3
2-A	474	48A	CSC	DBTG	I	TQ/MH	I			1	1
2-A	474	48B	CSC	DBTG	TQ	-	TQ	4.1		1	1
2-A	474	48C	CSC	DBTG	TQ	-	TQ			1	1
2-A	474	48D	CSC	DBTG	TQ	-	TQ	3.1		1	1
2-A	474	48E	CSC	DBTG	TQ	-	TQ	3.2		1	1
2-A	474	48F	CSC	DBTG	TQ	-	TQ	3.1		1	1
2-A	474	48G	CSC	DBTG	TQ	-	TQ			1	1
2-A	474	48H	CSC	DBTG	TQ	-	TQ	4.1		1	1
2-A	474	48I	CSC	DBTG	TQ	-	TQ	3.2		1	1
2-A	474	48J	CSC	DBTG	TQ	-	TQ	4.2		1	1
2-A	474	48K	CSC	DBTG	TQ	-	TQ			1	1
2-A	474	48L	CSC	DBTG	TQ	-	TQ			1	1
2-A	474	48M	CSC	DBTG	TQ	-	TQ			1	1
2-A	474	48N	CSC	DBTG	TQ	-	TQ			1	1
2-A	474	48O	CSC	DBTG	TQ	-	TQ			1	1
2-A	474	49A	EXC	DBTG	-	-	I	3.3		1	1
2-A	474	49B	EXC	DBTG	-	-	I	NVB		1	1
2-A	474	49C	EXC	DBTG	-	-	I	8.2		1	1
2-A	474	49D	EXC	DBTG	-	-	I	8.2		1	1
2-A	474	49E	EXC	DBTG	-	-	I	8.3		1	1
2-A	ENF	5	SUR	FRMFLKTL	I	MC/QI	I	5.0		2	3
2-A	ENF	6	SUR	FRMFLKTL	CD	SV/CD	I	3.6		2	3
2-A	ENF	7	SUR	FRMFLKTL	CD	-	CD	4.9		2	3
2-A	ENF	8	SUR	FLKTL	I	CD/SV	I			1	1

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2A-1	ENF	1	SUR	PRJPT	I	FS	FS	8.8		2	3
2A-1	ENF	10	SUR	CORE	TQ	-	TQ	2.0		2	3
2A-1	ENF	2	SUR	PRJPT	I	TQ	TQ	4.0		2	3
2A-1	ENF	3	SUR	PRJPT	I	MH	MH	3.0		2	3
2A-1	ENF	4	SUR	BIFACE	TQ	-	TQ	6.0		2	3
2A-1	ENF	5	SUR	BIFACE	I	MH	MH			2	3
2A-1	ENF	6	SUR	FLKTL	CD	-	CD			2	3
2A-1	ENF	7	SUR	FLKTL	I	SV	SV			2	3
2A-1	ENF	8	SUR	FLKTL	I	MGM	MG			2	3
2A-1	ENF	9	SUR	FLKTL	TQ	-	TQ			2	3
2A-14	ENF	1	SUR	FLKTL	I	MGM	MG			2	3
2-B	474	50A	CSC	DBTG	I	TQ	TQ	5.0		1	2
2-B	474	50B	CSC	DBTG	I	MH	MH	8.0		1	2
2-B	474	50C	CSC	DBTG	I	TQ/QI	I			1	2
2-B	474	50D	CSC	DBTG	I	SV	SV			1	2
2-B	474	50E	CSC	DBTG	TQ	-	TQ	5.0		1	2
2-B	474	50F	CSC	DBTG	TQ	-	TQ	6.7		1	2
2-B	474	50G	CSC	DBTG	TQ	-	TQ	4.9		1	2
2-B	474	50H	CSC	DBTG	TQ	-	TQ			1	2
2-B	474	50I	CSC	DBTG	CD	-	CD			1	2
2-B	474	50J	CSC	DBTG	TQ	-	TQ	5.0		1	2
2-B	474	50K	CSC	DBTG	TQ	-	TQ	2.6		1	2
2-B	474	50L	CSC	DBTG	TQ	-	TQ			1	2
2-B	474	50M	CSC	DBTG	TQ	-	TQ			1	2
2-B	474	50N	CSC	DBTG	TQ	-	TQ			1	2
2-B	474	50O	CSC	DBTG	TQ	-	TQ			1	2
2-B	474	51A	EXC	DBTG	-	-	I	4.1		1	2
2-B	474	51B	EXC	DBTG	-	-	I	5.4		1	2
2-B	474	51C	EXC	DBTG	-	-	I	4.6		1	2
2-B	474	51D	EXC	DBTG	-	-	I	4.6		1	2
2-B	474	51E	EXC	DBTG	-	-	I	4.3		1	2
2B-7	ENF	10	SUR	PRJPT	I	SV	SV			NT	-
2B-7	ENF	11	SUR	PRJPT	I	SV	SV	1.6		NT	-
2B-7	ENF	12	SUR	PRJPT	I	MH	MH	1.3		NT	-
2B-7	ENF	13	SUR	PRJPT	I	TQ/QI	I			NT	-
2B-7	ENF	14	SUR	PRJPT	I	MH/TQ	I	1.8		NT	-

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2B-7	ENF	15	SUR	PRJPT	CD	-	CD			NT	-
2B-7	ENF	16	SUR	PRJPT	I	TQ/MH	I	1.7		NT	-
2B-7	ENF	17	SUR	PRJPT	CD	-	CD	2.0		NT	-
2B-7	ENF	18	SUR	PRJPT	I	SV	SV	2.1		NT	-
2B-7	ENF	19	SUR	PRJPT	I	MH	MH	1.9		NT	-
2B-7	ENF	20	SUR	PRJPT	CD	-	CD	2.3		NT	-
2B-7	ENF	21	SUR	PRJPT	CD	-	CD	2.1		NT	-
2B-7	ENF	37	SUR	PRJPT	TQ	-	TQ	1.1		NT	-
2B-7	ENF	38	SUR	PRJPT	I	SV	SV	1.6		NT	-
2B-7	ENF	59	SUR	PRJPT	I	SV	SV			NT	-
2B-7	ENF	60	SUR	PRJPT	CD	-	CD	2.2		NT	-
2B-7	ENF	61	SUR	PRJPT	I	MH	MH	1.2		NT	-
2B-7	ENF	62	SUR	PRJPT	I	MH	MH			NT	-
2B-7	ENF	7	SUR	PRJPT	I	MH	MH	7.8		NT	-
2B-7	ENF	8	SUR	PRJPT	I	MGM	MG	6.4		NT	-
2B-7	ENF	9	SUR	PRJPT	I	CD	CD			NT	-
2D-13	ENF	1	SUR	PRJPT	I	MH	MH	2.3		3	3
2D-13	ENF	10	SUR	FLKTL	I	SV	SV			3	3
2D-13	ENF	11	SUR	FLKTL	I	TQ	TQ			3	3
2D-13	ENF	12	SUR	FLKTL	TQ	-	TQ			3	3
2D-13	ENF	13	SUR	FLKTL	I	SV	SV			3	3
2D-13	ENF	14	SUR	FLKTL	I	SV	SV			3	3
2D-13	ENF	19	SUR	BIFACE	TQ	-	TQ	7.5		3	3
2D-13	ENF	2	SUR	BIFACE	I	FS	FS	4.1		3	3
2D-13	ENF	20	SUR	FRMFLKTL	TQ	-	TQ	4.8	3.2	3	3
2D-13	ENF	21	SUR	FLKTL	I	TQ	TQ			3	3
2D-13	ENF	22	SUR	FRMFLKTL	CD	-	CD	4.8		3	3
2D-13	ENF	23	SUR	FLKTL	TQ	-	TQ			3	3
2D-13	ENF	24	SUR	FLKTL	I	SV	SV			3	3
2D-13	ENF	25	SUR	FLKTL	TQ	-	TQ			3	3
2D-13	ENF	30	SUR	PTBLNK	TQ	-	TQ	3.0		3	3
2D-13	ENF	31	SUR	BIFACE	I	TQ	TQ			3	3
2D-13	ENF	32	SUR	FLKTL	TQ	-	TQ			3	3
2D-13	ENF	33	SUR	FLKTL	TQ	-	TQ			3	3
2D-13	ENF	34	SUR	FLKTL	TQ	-	TQ			3	3
2D-13	ENF	35	SUR	FLKTL	CD	-	CD			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
2D-13	ENF	36	SUR	FLKTL	I	MH	MH			3	3
2D-13	ENF	37	SUR	FLKTL	I	CD	CD			3	3
2D-13	ENF	38	SUR	FLKTL	I	MH	MH			3	3
2D-13	ENF	39	SUR	FLKTL	I	SV	SV			3	3
2D-13	ENF	4	SUR	FRMFLKTL	I	MGM	MG	3.5		3	3
2D-13	ENF	40	SUR	FLKTL	TQ	-	TQ			3	3
2D-13	ENF	41	SUR	FLKTL	TQ	-	TQ			3	3
2D-13	ENF	42	SUR	CORE	CD	-	CD	3.3		3	3
2D-13	ENF	43A	SUR	DBTG	I	FS	FS	8.3		3	3
2D-13	ENF	43B	SUR	DBTG	I	TQ	TQ	5.9		3	3
2D-13	ENF	43C	SUR	DBTG	I	MC/MGM	M			3	3
2D-13	ENF	43D	SUR	DBTG	I	MGM	MG	1.9		3	3
2D-13	ENF	43E	SUR	DBTG	I	MGM	MG	2.0		3	3
2D-13	ENF	43F	SUR	DBTG	I	MGM	MG			3	3
2D-13	ENF	43G	SUR	DBTG	I	TQ	TQ	3.1		3	3
2D-13	ENF	43H	SUR	DBTG	I	SV/CD	I			3	3
2D-13	ENF	43I	SUR	DBTG	I	MGM	MG	1.8		3	3
2D-13	ENF	43J	SUR	DBTG	I	CD	CD	2.9		3	3
2D-13	ENF	43K	SUR	DBTG	I	TQ	TQ	9.2		3	3
2D-13	ENF	43L	SUR	DBTG	I	CD	CD			3	3
2D-13	ENF	43M	SUR	DBTG	I	CD	CD			3	3
2D-13	ENF	43N	SUR	DBTG	I	MGM	MG			3	3
2D-13	ENF	43O	SUR	DBTG	CD	-	CD			3	3
2D-13	ENF	5	SUR	FLKTL	I	MGM	MG			3	3
2D-13	ENF	6	SUR	FLKTL	CD	-	CD			3	3
2D-13	ENF	7	SUR	FLKTL	I	CD	CD			3	3
2D-13	ENF	8	SUR	FLKTL	I	MGM	MG			3	3
2D-13	ENF	9	SUR	FLKTL	CD	-	CD			3	3
30-A	474	100A	EXC	DBTG	-	-	I	8.8		3	3
30-A	474	100B	EXC	DBTG	-	-	I	7.0		3	3
30-A	474	100C	EXC	DBTG	-	-	I	7.1		3	3
30-A	474	100D	EXC	DBTG	-	-	I	9.1		3	3
30-A	474	100E	EXC	DBTG	-	-	I	UNR		3	3
30-A	474	19	SUR	PRJPT	I	TQ	TQ	11.1		3	3
30-A	474	28	SUR	PRJPT	CD	-	CD	10.2		3	3
30-A	474	33	SUR	PRJPT	TQ	-	TQ	11.4		3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
30-A	474	34	SUR	PRJPT	TQ	-	TQ			3	3
30-A	474	97A	CSC	DBTG	I	CD	CD	10.0		3	3
30-A	474	97B	CSC	DBTG	I	MC/MGM	M			3	3
30-A	474	97C	CSC	DBTG	I	MC	MC	11.2		3	3
30-A	474	97D	CSC	DBTG	I	TQ	TQ	9.5		3	3
30-A	474	97E	CSC	DBTG	I	FS	FS	8.0		3	3
30-A	474	97F	CSC	DBTG	I	TQ	TQ			3	3
30-A	474	97G	CSC	DBTG	I	TQ	TQ			3	3
30-A	474	97H	CSC	DBTG	TQ	-	TQ	10.2		3	3
30-A	474	97I	CSC	DBTG	CD	-	CD			3	3
30-A	474	97J	CSC	DBTG	CD	-	CD			3	3
30-A	474	97K	CSC	DBTG	TQ	-	TQ			3	3
30-A	474	97L	CSC	DBTG	TQ	-	TQ			3	3
30-A	474	97M	CSC	DBTG	TQ	-	TQ			3	3
30-A	474	97N	CSC	DBTG	TQ	-	TQ			3	3
30-A	474	97O	CSC	DBTG	TQ	-	TQ			3	3
30-A	474	98A	CSC	DBTG	I	MC/MGM	M	9.3		3	3
30-A	474	98B	CSC	DBTG	I	QI/TQ	I			3	3
30-A	474	98C	CSC	DBTG	I	QI/TQ	I			3	3
30-A	474	98D	CSC	DBTG	I	TQ	TQ	7.6		3	3
30-A	474	98E	CSC	DBTG	I	TQ/FS	I			3	3
30-A	474	98F	CSC	DBTG	I	CD	CD	9.2		3	3
30-A	474	98G	CSC	DBTG	TQ	-	TQ	9.9		3	3
30-A	474	98H	CSC	DBTG	TQ	-	TQ	9.9		3	3
30-A	474	98I	CSC	DBTG	TQ	-	TQ	8.3		3	3
30-A	474	98J	CSC	DBTG	TQ	-	TQ			3	3
30-A	474	98K	CSC	DBTG	CD	-	CD			3	3
30-A	474	98L	CSC	DBTG	TQ	-	TQ			3	3
30-A	474	98M	CSC	DBTG	TQ	-	TQ	7.4		3	3
30-A	474	98N	CSC	DBTG	TQ	-	TQ	9.9		3	3
30-A	474	98O	CSC	DBTG	CD	-	CD			3	3
30-A	474	99A	EXC	DBTG	-	-	I	NVB		3	3
30-A	474	99B	EXC	DBTG	-	-	I	10.2		3	3
30-A	474	99C	EXC	DBTG	-	-	I	10.2		3	3
30-A	474	99D	EXC	DBTG	-	-	I	7.2		3	3
30-A	474	99E	EXC	DBTG	-	-	I	12.4		3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
30-B	474	101A	CSC	DBTG	I	MGM/MC	M			3	2
30-B	474	101B	CSC	DBTG	I	MGM	MG	8.4		3	2
30-B	474	101C	CSC	DBTG	I	MC	MC	10.6		3	2
30-B	474	101D	CSC	DBTG	I	MC/MGM	M			3	2
30-B	474	101E	CSC	DBTG	I	MC	MC			3	2
30-B	474	101F	CSC	DBTG	I	FS	FS	7.2		3	2
30-B	474	101G	CSC	DBTG	I	MC/MGM	M			3	2
30-B	474	101H	CSC	DBTG	FS	-	FS			3	2
30-B	474	101I	CSC	DBTG	FS	-	FS	7.3		3	2
30-B	474	101J	CSC	DBTG	FS	-	FS	7.2		3	2
30-B	474	101K	CSC	DBTG	FS	-	FS	7.2		3	2
30-B	474	101L	CSC	DBTG	FS	-	FS			3	2
30-B	474	101M	CSC	DBTG	TQ	-	TQ	7.5		3	2
30-B	474	101N	CSC	DBTG	FS	-	FS			3	2
30-B	474	101O	CSC	DBTG	FS	-	FS			3	2
30-B	474	102A	CSC	DBTG	I	MC	MC	5.3		3	2
30-B	474	102B	CSC	DBTG	I	MC	MC	7.4		3	2
30-B	474	102C	CSC	DBTG	I	TQ	TQ	9.0		3	2
30-B	474	102D	CSC	DBTG	I	MC/MGM	M			3	2
30-B	474	102E	CSC	DBTG	I	CO	CO	7.3		3	2
30-B	474	102F	CSC	DBTG	I	MC	MC			3	2
30-B	474	102G	CSC	DBTG	I	MC/MGM	M			3	2
30-B	474	102H	CSC	DBTG	I	MC/MGM	M			3	2
30-B	474	102I	CSC	DBTG	I	CO/MC	I			3	2
30-B	474	102J	CSC	DBTG	I	MC	MC			3	2
30-B	474	102K	CSC	DBTG	I	CD	CD			3	2
30-B	474	102L	CSC	DBTG	TQ	-	TQ	5.2		3	2
30-B	474	102M	CSC	DBTG	TQ	-	TQ	5.2		3	2
30-B	474	102N	CSC	DBTG	TQ	-	TQ			3	2
30-B	474	102O	CSC	DBTG	CD	-	CD			3	2
30-B	474	103A	EXC	DBTG	-	-	I	6.6		3	2
30-B	474	103B	EXC	DBTG	-	-	I	6.8		3	2
30-B	474	103C	EXC	DBTG	-	-	I	9.0		3	2
30-B	474	103D	EXC	DBTG	-	-	I	6.8		3	2
30-B	474	103E	EXC	DBTG	-	-	I	9.5		3	2
30-B	474	104	EXC	PRJPT	I	MH	MH			3	2

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
30-B	474	105A	EXC	DBTG	-	-	I	5.2		3	2
30-B	474	105B	EXC	DBTG	-	-	I	4.5		3	2
30-B	474	105C	EXC	DBTG	-	-	I	5.1		3	2
30-B	474	105D	EXC	DBTG	-	-	I	5.3		3	2
30-B	474	105E	EXC	DBTG	-	-	I	5.4		3	2
30-B	474	20	SUR	PRJPT	I	TQ	TQ	10.0		3	2
30-B	474	21	SUR	PRJPT	I	MC	MC	15.4		3	2
30-B	474	29	SUR	PRJPT	CD	-	CD			3	2
30-B	474	30	SUR	PRJPT	CD	-	CD			3	2
30-B	474	39	SUR	PRJPT	TQ	-	TQ			3	2
30-B	474	40	SUR	PRJPT	TQ	-	TQ			3	2
30-B	474	44	SUR	PRJPT	TQ	-	TQ	7.4		3	2
399i	392	6003	EXC	FLKTL	I	TQ	TQ			3	3
399i	392	6004	EXC	FLKTL	TQ	-	TQ			3	3
399i	392	6005	EXC	DBTG	TQ	-	TQ			3	3
399i	392	6005	EXC	DBTG	TQ	-	TQ			3	3
399i	392	6005	EXC	DBTG	I	-	I			3	3
399i	392	6005	EXC	DBTG	I	-	I			3	3
399i	392	6005	EXC	DBTG	I	-	I			3	3
399i	392	6005	EXC	DBTG	I	-	I			3	3
399i	392	6005	EXC	DBTG	TQ	-	TQ			3	3
399i	392	6005	EXC	DBTG	CD	-	CD			3	3
399i	392	6005	EXC	DBTG	I	-	I			3	3
399i	392	6005	EXC	DBTG	I	-	I			3	3
399i	392	6005	EXC	DBTG	TQ	-	TQ			3	3
399i	392	6005	EXC	DBTG	TQ	-	TQ			3	3
399i	392	6005	EXC	DBTG	TQ	-	TQ			3	3
399i	392	6005	EXC	DBTG	TQ	-	TQ			3	3
399i	392	6014	EXC	BIFACE	-	-	-			3	3
399i	392	6015	EXC	BIFACE	I	TQ	TQ			3	3
399i	392	6016	EXC	BIFACE	I	MGM	MG			3	3
399i	392	6030	EXC	BIFACE	-	-	-			3	3
399i	392	6031	EXC	DBTG	TQ	-	TQ			3	3
399i	392	6031	EXC	DBTG	CD	-	CD			3	3
399i	392	6031	EXC	DBTG	CD	-	CD			3	3
399i	392	6031	EXC	DBTG	I	-	I			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
399i	392	6031	EXC	DBTG	I	-	I			3	3
399i	392	6031	EXC	DBTG	I	-	I			3	3
399i	392	6031	EXC	DBTG	TQ	-	TQ			3	3
399i	392	6031	EXC	DBTG	I	-	I			3	3
399i	392	6031	EXC	DBTG	TQ	-	TQ			3	3
399i	392	6031	EXC	DBTG	TQ	-	TQ			3	3
399i	392	6031	EXC	DBTG	I	-	I			3	3
399i	392	6031	EXC	DBTG	TQ	-	TQ			3	3
399i	392	6031	EXC	DBTG	I	-	I			3	3
399i	392	6031	EXC	DBTG	TQ	-	TQ			3	3
399i	392	6031	EXC	DBTG	TQ	-	TQ			3	3
399i	392	6031	EXC	DBTG	TQ	-	TQ			3	3
399i	392	6041	EXC	DBTG	TQ	-	TQ			3	3
399i	392	6041	EXC	DBTG	CD	-	CD			3	3
399i	392	6041	EXC	DBTG	I	-	I			3	3
399i	392	6041	EXC	DBTG	I	-	I			3	3
399i	392	6041	EXC	DBTG	I	-	I			3	3
399i	392	6041	EXC	DBTG	I	-	I			3	3
399i	392	6041	EXC	DBTG	TQ	-	TQ			3	3
399i	392	6041	EXC	DBTG	TQ	-	TQ			3	3
399i	392	6041	EXC	DBTG	TQ	-	TQ			3	3
399i	392	6041	EXC	DBTG	TQ	-	TQ			3	3
399i	392	6041	EXC	DBTG	TQ	-	TQ			3	3
399i	392	6050	EXC	FLKTL	FS	-	FS			3	3
399i	392	6051	EXC	DBTG	TQ	-	TQ			3	3
399i	392	6051	EXC	DBTG	FS	-	FS			3	3
399i	392	6051	EXC	DBTG	I	-	I			3	3
399i	392	6051	EXC	DBTG	TQ	-	TQ			3	3
399i	392	6051	EXC	DBTG	TQ	-	TQ			3	3
399i	392	6051	EXC	DBTG	TQ	-	TQ			3	3
399i	392	6051	EXC	DBTG	I	-	I			3	3
399i	392	6051	EXC	DBTG	I	-	I			3	3
399i	392	6051	EXC	DBTG	TQ	-	TQ			3	3
399i	392	6051	EXC	DBTG	TQ	-	TQ			3	3
399i	392	6051	EXC	DBTG	TQ	-	TQ			3	3
399i	392	6063	EXC	FLKTL	I	FS	FS			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
399i	392	6081	EXC	DBTG	TQ	-	TQ			3	3
399i	392	6081	EXC	DBTG	CD	-	CD			3	3
399i	392	6081	EXC	DBTG	I	-	I			3	3
399i	392	6081	EXC	DBTG	I	-	I			3	3
399i	392	6081	EXC	DBTG	I	-	I			3	3
399i	392	6081	EXC	DBTG	TQ	-	TQ			3	3
399i	392	6081	EXC	DBTG	TQ	-	TQ			3	3
399i	392	6081	EXC	DBTG	I	-	I			3	3
399i	392	6081	EXC	DBTG	I	-	I			3	3
399i	392	6081	EXC	DBTG	TQ	-	TQ			3	3
399i	392	6081	EXC	DBTG	TQ	-	TQ			3	3
399i	392	6081	EXC	DBTG	TQ	-	TQ			3	3
399i	392	6081	EXC	DBTG	TQ	-	TQ			3	3
399i	392	6081	EXC	DBTG	TQ	-	TQ			3	3
399i	392	6101	EXC	DBTG	I	-	I			3	3
399i	392	6101	EXC	DBTG	TQ	-	TQ			3	3
399i	392	6101	EXC	DBTG	TQ	-	TQ			3	3
399i	392	6101	EXC	DBTG	TQ	-	TQ			3	3
399i	392	6101	EXC	DBTG	I	-	I			3	3
399i	392	6101	EXC	DBTG	I	-	I			3	3
399i	392	6106	EXC	BIFACE	CD	-	CD			3	3
399i	392	6111	EXC	DBTG	I	-	I			3	3
399i	392	6111	EXC	DBTG	TQ	-	TQ			3	3
399i	392	6111	EXC	DBTG	I	-	I			3	3
399i	392	6111	EXC	DBTG	TQ	-	TQ			3	3
399i	392	6111	EXC	DBTG	TQ	-	TQ			3	3
399i	392	6111	EXC	DBTG	I	-	I			3	3
399i	392	6111	EXC	DBTG	TQ	-	TQ			3	3
399i	392	6111	EXC	DBTG	TQ	-	TQ			3	3
399i	392	6128	EXC	DBTG	TQ	-	TQ	5.7		3	3
399i	392	6128	EXC	DBTG	TQ	-	TQ	3.9		3	3
399i	392	6128	EXC	DBTG	TQ	-	TQ	2.5		3	3
399i	392	6128	EXC	DBTG	TQ	-	TQ	4.6		3	3
399i	392	6158	EXC	BIFACE	I	MGM	MG			3	3
399ii	392	6176	EXC	DBTG	CD	-	CD			3	3
399ii	392	6176	EXC	DBTG	I	-	I			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
399ii	392	6176	EXC	DBTG	I	-	I			3	3
399ii	392	6176	EXC	DBTG	I	-	I			3	3
399ii	392	6193	EXC	DBTG	TQ	-	TQ			3	3
399ii	392	6193	EXC	DBTG	CD	-	CD			3	3
399ii	392	6193	EXC	DBTG	CD	-	CD			3	3
399ii	392	6193	EXC	DBTG	I	-	I			3	3
399ii	392	6193	EXC	DBTG	I	-	I			3	3
399ii	392	6193	EXC	DBTG	I	-	I			3	3
399ii	392	6200	EXC	FLKTL	I	CD	CD			3	3
399ii	392	6201	EXC	DBTG	TQ	-	TQ	5.6		3	3
399ii	392	6201	EXC	DBTG	CD	-	CD			3	3
399ii	392	6201	EXC	DBTG	CD	-	CD			3	3
399ii	392	6201	EXC	DBTG	I	-	I			3	3
399ii	392	6201	EXC	DBTG	I	-	I			3	3
399ii	392	6201	EXC	DBTG	I	-	I			3	3
399ii	392	6201	EXC	DBTG	I	-	I			3	3
399ii	392	6201	EXC	DBTG	I	-	I			3	3
399ii	392	6211	EXC	DBTG	TQ	-	TQ	4.8		3	3
399ii	392	6211	EXC	DBTG	TQ	-	TQ	5.0		3	3
399ii	392	6211	EXC	DBTG	CD	-	CD			3	3
399ii	392	6211	EXC	DBTG	CD	-	CD			3	3
399ii	392	6211	EXC	DBTG	I	-	I			3	3
399ii	392	6211	EXC	DBTG	I	-	I			3	3
399ii	392	6211	EXC	DBTG	I	-	I			3	3
399ii	392	6211	EXC	DBTG	I	-	I			3	3
399ii	392	6230	EXC	DBTG	TQ	-	TQ			3	3
399ii	392	6230	EXC	DBTG	CD	-	CD			3	3
399ii	392	6230	EXC	DBTG	TQ	-	TQ			3	3
399ii	392	6230	EXC	DBTG	I	-	I			3	3
399ii	392	6230	EXC	DBTG	I	-	I			3	3
399ii	392	6230	EXC	DBTG	I	-	I			3	3
399ii	392	6235	EXC	BIFACE	CD	-	CD			3	3
399ii	392	6236	EXC	BIFACE	TQ	-	TQ			3	3
399ii	392	6252	EXC	FLKTL	CD	-	CD			3	3
399ii	392	6253	EXC	DBTG	TQ	-	TQ			3	3
399ii	392	6253	EXC	DBTG	TQ	-	TQ			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
399ii	392	6253	EXC	DBTG	I	-	I			3	3
399ii	392	6253	EXC	DBTG	I	-	I			3	3
399ii	392	6253	EXC	DBTG	I	-	I			3	3
399ii	392	6253	EXC	DBTG	I	-	I			3	3
399ii	392	6257	EXC	DBTG	TQ	-	TQ			3	3
399ii	392	6257	EXC	DBTG	I	-	I			3	3
399ii	392	6257	EXC	DBTG	I	-	I			3	3
3A-5	ENF	1	SUR	PRJPT	I	MH	MH			3	3
3A-5	ENF	10	SUR	BIFACE	I	MGM	MG	3.8		3	3
3A-5	ENF	11	SUR	BIFACE	TQ	-	TQ	4.3		3	3
3A-5	ENF	12	SUR	BIFACE	I	TQ	TQ	3.9	DH	3	3
3A-5	ENF	13	SUR	BIFACE	I	MH	MH	3.9		3	3
3A-5	ENF	14	SUR	BIFACE	I	MGM/MH	I	3.7		3	3
3A-5	ENF	15	SUR	BIFACE	I	MH	MH			3	3
3A-5	ENF	16	SUR	BIFACE	TQ	-	TQ			3	3
3A-5	ENF	17	SUR	BIFACE	I	FS	FS	4.1		3	3
3A-5	ENF	18	SUR	BIFACE	TQ	-	TQ	4.0		3	3
3A-5	ENF	19	SUR	BIFACE	I	TQ/MH	I			3	3
3A-5	ENF	2	SUR	PRJPT	CD	-	CD			3	3
3A-5	ENF	20	SUR	PTBLNK	I	SV	SV	4.5		3	3
3A-5	ENF	21	SUR	FLKTL	CD	-	CD			3	3
3A-5	ENF	22	SUR	FLKTL	I	MC/MGM	M			3	3
3A-5	ENF	23	SUR	FLKTL	CD	-	CD			3	3
3A-5	ENF	24	SUR	FLKTL	TQ	-	TQ			3	3
3A-5	ENF	25	SUR	FLKTL	TQ	-	TQ			3	3
3A-5	ENF	26	SUR	FLKTL	I	MGM	MG			3	3
3A-5	ENF	27	SUR	FLKTL	CD	-	CD			3	3
3A-5	ENF	28	SUR	FLKTL	TQ	-	TQ			3	3
3A-5	ENF	29	SUR	FLKTL	I	SV	SV			3	3
3A-5	ENF	3	SUR	BIFACE	TQ	TQ	TQ	6.3		3	3
3A-5	ENF	30	SUR	BIFACE	I	TQ	TQ			3	3
3A-5	ENF	31	SUR	FLKTL	I	TQ	TQ			3	3
3A-5	ENF	32	SUR	PTBLNK	TQ	-	TQ	2.5		3	3
3A-5	ENF	33	SUR	FLKTL	CD	-	CD			3	3
3A-5	ENF	4	SUR	PRJPT	I	FS	FS	11.6		3	3
3A-5	ENF	5	SUR	BIFACE	I	MGM	MG			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
3A-5	ENF	6	SUR	BIFACE	TQ	-	TQ	3.9		3	3
3A-5	ENF	7	SUR	BIFACE	I	SV	SV			3	3
3A-5	ENF	8	SUR	BIFACE	CD	-	CD			3	3
3A-5	ENF	9	SUR	BIFACE	CD	-	CD			3	3
4-A	474	41	SUR	PRJPT	TQ	-	TQ	2.7		1	3
4-A	474	42	SUR	PRJPT	TQ	-	TQ	3.0		1	3
4-A	474	52	CSC	FLKTL	I	SV	SV			1	3
4-A	474	53	CSC	FLKTL	I	SV	SV			1	3
4-A	474	54A	CSC	DBTG	I	CD	CD			1	3
4-A	474	54B	CSC	DBTG	I	SV	SV			1	3
4-A	474	54C	CSC	DBTG	I	CD	CD			1	3
4-A	474	54D	CSC	DBTG	I	CD	CD	3.5		1	3
4-A	474	54E	CSC	DBTG	I	MGM	MG	3.8		1	3
4-A	474	54F	CSC	DBTG	I	SV	SV			1	3
4-A	474	54G	CSC	DBTG	I	SV	SV			1	3
4-A	474	54H	CSC	DBTG	I	CD	CD			1	3
4-A	474	54I	CSC	DBTG	I	CD	CD			1	3
4-A	474	54J	CSC	DBTG	I	MGM/MC	M	5.3		1	3
4-A	474	54K	CSC	DBTG	I	SV	SV			1	3
4-A	474	54L	CSC	DBTG	I	MH	MH	5.3		1	3
4-A	474	54M	CSC	DBTG	CD	-	CD			1	3
4-A	474	54N	CSC	DBTG	CD	-	CD			1	3
4-A	474	54O	CSC	DBTG	CD	-	CD			1	3
4-A	474	55A	CSC	DBTG	I	MGM	MG			1	3
4-A	474	55B	CSC	DBTG	I	CD	CD			1	3
4-A	474	55C	CSC	DBTG	I	MGM	MG	3.3		1	3
4-A	474	55D	CSC	DBTG	I	SV/CD	I			1	3
4-A	474	55E	CSC	DBTG	I	CD/SV	I			1	3
4-A	474	55F	CSC	DBTG	I	CD	CD			1	3
4-A	474	55G	CSC	DBTG	I	MGM	MG	3.8		1	3
4-A	474	55H	CSC	DBTG	I	SV	SV			1	3
4-A	474	55I	CSC	DBTG	TQ	-	TQ	3.4		1	3
4-A	474	55J	CSC	DBTG	TQ	-	TQ	3.4		1	3
4-A	474	55K	CSC	DBTG	TQ	-	TQ			1	3
4-A	474	55L	CSC	DBTG	TQ	-	TQ	3.7		1	3
4-A	474	55M	CSC	DBTG	TQ	-	TQ			1	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
4-A	474	55N	CSC	DBTG	CD	-	CD			1	3
4-A	474	55O	CSC	DBTG	CD	-	CD	3.3		1	3
4-A	474	56A	EXC	DBTG	-	-	I	3.9		1	3
4-A	474	56B	EXC	DBTG	-	-	I	3.6		1	3
4-A	474	56C	EXC	DBTG	-	-	I	3.3		1	3
4-A	474	56D	EXC	DBTG	-	-	I	3.4		1	3
4-A	474	56E	EXC	DBTG	-	-	I	3.6		1	3
4-A	474	57A	EXC	DBTG	-	-	I	3.6		1	3
4-A	474	57B	EXC	DBTG	-	-	I	3.3		1	3
4-A	474	57C	EXC	DBTG	-	-	I	5.0		1	3
4-A	474	57D	EXC	DBTG	-	-	I	3.3		1	3
4-A	474	57E	EXC	DBTG	-	-	I	UNR		1	3
4-B	474	58	CSC	FLKTL	CD	-	CD			1	1
4-B	474	59A	CSC	DBTG	I	MGM/MH	I			1	1
4-B	474	59B	CSC	DBTG	I	MGM/MC	M			1	1
4-B	474	59C	CSC	DBTG	I	MC/MGM	M			1	1
4-B	474	59D	CSC	DBTG	I	MGM	MG	3.2		1	1
4-B	474	59E	CSC	DBTG	I	MGM	MG	2.9		1	1
4-B	474	59F	CSC	DBTG	I	MH	MH	2.8		1	1
4-B	474	59G	CSC	DBTG	I	MGM	MG			1	1
4-B	474	59H	CSC	DBTG	I	MGM	MG			1	1
4-B	474	59I	CSC	DBTG	I	MH	MH			1	1
4-B	474	59J	CSC	DBTG	I	MH	MH	2.9		1	1
4-B	474	59K	CSC	DBTG	I	MH	MH			1	1
4-B	474	59L	CSC	DBTG	I	MGM	MG			1	1
4-B	474	59M	CSC	DBTG	CD	-	CD			1	1
4-B	474	59N	CSC	DBTG	CD	-	CD			1	1
4-B	474	59O	CSC	DBTG	CD	-	CD			1	1
4C-1	455	1023	SUR	BIFACE	I	CD	CD			2	4
4C-1	455	1024	SUR	FLKTL	TQ	-	TQ			2	4
4C-1	455	1025A	CSC	DBTG	I	MGM	MG	7.0		2	4
4C-1	455	1025B	CSC	DBTG	I	TQ	TQ	1.4		2	4
4C-1	455	1025C	CSC	DBTG	I	MGM/MC	M	8.1		2	4
4C-1	455	1025D	CSC	DBTG	I	TQ	TQ	1.2		2	4
4C-1	455	1025E	CSC	DBTG	I	MGM	MG	DH		2	4
4C-1	455	1025F	CSC	DBTG	TQ	-	TQ	5.3		2	4

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
4C-1	455	1025G	CSC	DBTG	I	-	I			2	4
4C-1	455	1025H	CSC	DBTG	I	-	I			2	4
4L-11	ENF	1	SUR	BIFACE	I	MGM	MG	10.8		4	3
4L-11	ENF	10	SUR	FRMFLKTL	TQ	-	TQ	5.3	3.9	4	3
4L-11	ENF	11	SUR	FRMFLKTL	CD	-	CD	4.0		4	3
4L-11	ENF	12	SUR	FLKTL	I	MGM	MG			4	3
4L-11	ENF	13	SUR	FLKTL	CD	-	CD			4	3
4L-11	ENF	14	SUR	FLKTL	I	MH	MH			4	3
4L-11	ENF	15	SUR	FLKTL	I	SV	SV			4	3
4L-11	ENF	16	SUR	FLKTL	I	SV	SV			4	3
4L-11	ENF	17	SUR	FLKTL	I	MH	MH			4	3
4L-11	ENF	18	SUR	FLKTL	CD	-	CD			4	3
4L-11	ENF	19	SUR	FLKTL	I	SV	SV			4	3
4L-11	ENF	2	SUR	BIFACE	TQ	-	TQ	4.5		4	3
4L-11	ENF	20	SUR	FLKTL	CD	-	CD			4	3
4L-11	ENF	21	SUR	FLKTL	I	MGM	MG			4	3
4L-11	ENF	22	SUR	FLKTL	TQ	-	TQ			4	3
4L-11	ENF	23	SUR	FLKTL	I	SV	SV			4	3
4L-11	ENF	24	SUR	DRILL	I	MH	MH			4	3
4L-11	ENF	25	SUR	FLKTL	I	SV	SV			4	3
4L-11	ENF	26	SUR	BIFACE	CD	-	CD			4	3
4L-11	ENF	27	SUR	FLKTL	CD	-	CD			4	3
4L-11	ENF	28	SUR	FLKTL	I	MH	MH			4	3
4L-11	ENF	29	SUR	FLKTL	I	SV/MH	I			4	3
4L-11	ENF	3	SUR	BIFACE	CD	-	CD			4	3
4L-11	ENF	30	SUR	FLKTL	I	MH	MH			4	3
4L-11	ENF	31	SUR	FLKTL	I	SV	SV			4	3
4L-11	ENF	32	SUR	FLKTL	CD	-	CD			4	3
4L-11	ENF	33	SUR	FLKTL	CD	-	CD			4	3
4L-11	ENF	34	SUR	FLKTL	I	SV	SV			4	3
4L-11	ENF	35	SUR	FLKTL	I	SV	SV			4	3
4L-11	ENF	36	SUR	FLKTL	I	SV	SV			4	3
4L-11	ENF	38	SUR	FLKTL	I	SV/MH	I			4	3
4L-11	ENF	39A	SUR	DBTG	I	MGM	MG	3.2		4	3
4L-11	ENF	39B	SUR	DBTG	I	CD	CD	5.7		4	3
4L-11	ENF	39C	SUR	DBTG	I	SV	SV			4	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
4L-11	ENF	39D	SUR	DBTG	I	CD	CD	5.8		4	3
4L-11	ENF	39E	SUR	DBTG	I	FS	FS	3.0		4	3
4L-11	ENF	39F	SUR	DBTG	I	CD	CD			4	3
4L-11	ENF	39G	SUR	DBTG	I	FS	FS			4	3
4L-11	ENF	39H	SUR	DBTG	I	SV	SV			4	3
4L-11	ENF	39I	SUR	DBTG	I	CD	CD			4	3
4L-11	ENF	39J	SUR	DBTG	I	CD	CD			4	3
4L-11	ENF	39K	SUR	DBTG	I	CD	CD			4	3
4L-11	ENF	39L	SUR	DBTG	I	SV	SV			4	3
4L-11	ENF	39M	SUR	DBTG	I	MC	MC	4.5		4	3
4L-11	ENF	39N	SUR	DBTG	I	SV	SV			4	3
4L-11	ENF	39O	SUR	DBTG	I	CD	CD			4	3
4L-11	ENF	4	SUR	BIFACE	I	SV	SV			4	3
4L-11	ENF	5	SUR	BIFACE	CD	-	CD	5.8		4	3
4L-11	ENF	6	SUR	PRJPT	I	MH	MH			4	3
4L-11	ENF	7	SUR	BIFACE	CD	-	CD			4	3
4L-11	ENF	8	SUR	BIFACE	TQ	TQ	TQ	10.1		4	3
4L-11	ENF	9	SUR	FRMFLKTL	CD	-	CD	4.9		4	3
4L-13A	ENF	1	SUR	PRJPT	TQ	-	TQ			4	2
4L-13A	ENF	2	SUR	PRJPT	I	SV	SV			4	2
4L-13A	ENF	3	SUR	BIFACE	CD	CD	CD	9.0		4	2
4L-13A	ENF	4	SUR	PRJPT	CD	-	CD			4	2
4L-13A	ENF	5	SUR	FLKTL	I	CD	CD			4	2
4L-13A	ENF	6	SUR	FLKTL	CD	-	CD			4	2
533	455	566	CSC	BIFACE	I	-	I			3	3
533	455	577	CSC	BIFACE	CD	-	CD			3	3
533	455	588	CSC	BIFACE	CD	-	CD			3	3
533	455	594	CSC	BIFACE	I	SV	SV			3	3
533	455	609	CSC	BIFACE	CD	-	CD			3	3
533	455	616	CSC	FLKTL	TQ	-	TQ			3	3
533	455	620	CSC	BIFACE	TQ	-	TQ			3	3
533	455	627	CSC	BIFACE	TQ	-	TQ	5.9		3	3
533	455	634	CSC	FLKTL	I	CD	CD			3	3
533	455	636	CSC	BIFACE	TQ	-	TQ			3	3
533	455	642	CSC	FLKTL	I	MH	MH			3	3
533	455	650	CSC	BIFACE	CD	-	CD			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
533	455	654	CSC	PRJPT	I	TQ/MH	I			3	3
533	455	655	CSC	BIFACE	I	MH	MH			3	3
533	455	670	CSC	BIFACE	I	MGM/MC	M			3	3
533	455	676	CSC	PRJPT	TQ	-	TQ	5.5		3	3
533	455	711	CSC	BIFACE	TQ	-	TQ			3	3
533	455	725	CSC	FLKTL	I	PG	PG			3	3
533	455	733	CSC	BIFACE	TQ	-	TQ			3	3
533	455	760	EXC	PRJPT	TQ	-	TQ	5.5		3	3
533	455	761A	EXC	DBTG	I	CD	CD	5.0		3	3
533	455	761B	EXC	DBTG	I	MGM	MG	4.9		3	3
533	455	761C	EXC	DBTG	I	MGM	MG	5.0		3	3
533	455	761D	EXC	DBTG	I	CD	CD			3	3
533	455	761E	EXC	DBTG	I	SV/CD	I			3	3
533	455	761F	EXC	DBTG	I	SV/CD	I			3	3
533	455	761G	EXC	DBTG	I	MGM	MG			3	3
533	455	761H	EXC	DBTG	I	MGM/MC	M			3	3
533	455	761I	EXC	DBTG	I	CD	CD			3	3
533	455	761J	EXC	DBTG	TQ	-	TQ	4.2		3	3
533	455	761K	EXC	DBTG	TQ	-	TQ			3	3
533	455	761L	EXC	DBTG	TQ	-	TQ			3	3
533	455	761M	EXC	DBTG	TQ	-	TQ			3	3
533	455	761N	EXC	DBTG	TQ	-	TQ			3	3
533	455	761O	EXC	DBTG	TQ	-	TQ			3	3
533	455	761P	EXC	DBTG	TQ	-	TQ	4.9		3	3
533	455	761Q	EXC	DBTG	TQ	-	TQ	4.2		3	3
533	455	771A	EXC	DBTG	I	CD	CD			3	3
533	455	771B	EXC	DBTG	I	CD	CD			3	3
533	455	771C	EXC	DBTG	CD	-	CD			3	3
533	455	775A	EXC	DBTG	I	CD	CD			3	3
533	455	775B	EXC	DBTG	I	PG	PG			3	3
533	455	775C	EXC	DBTG	I	MGM	MG			3	3
533	455	775D	EXC	DBTG	I	CD	CD			3	3
533	455	775E	EXC	DBTG	I	BH	BH			3	3
533	455	775F	EXC	DBTG	TQ	-	TQ			3	3
533	455	775G	EXC	DBTG	TQ	-	TQ			3	3
533	455	775H	EXC	DBTG	TQ	-	TQ			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
533	455	775I	EXC	DBTG	TQ	-	TQ			3	3
533	455	775J	EXC	DBTG	TQ	-	TQ			3	3
533	455	775K	EXC	DBTG	TQ	-	TQ	3.6		3	3
533	455	775L	EXC	DBTG	TQ	-	TQ	3.7		3	3
533	455	775M	EXC	DBTG	-	-	I	4.7		3	3
533	455	775N	EXC	DBTG	-	-	I	5.3		3	3
533	455	775O	EXC	DBTG	-	-	I	3.8		3	3
533	455	775P	EXC	DBTG	-	-	I	4.6		3	3
533	455	775Q	EXC	DBTG	-	-	I	4.3		3	3
533	455	783	EXC	BIFACE	TQ	-	TQ			3	3
533	455	785	EXC	FLKTL	I	SV	SV			3	3
533	455	800	EXC	FLKTL	I	CD	CD			3	3
533	455	810	EXC	BIFACE	CD	-	CD			3	3
533	455	840	EXC	PRJPT	TQ	-	TQ	5.5		3	3
533	455	853	EXC	BIFACE	I	MGM	MG			3	3
533	455	854	EXC	BIFACE	CD	-	CD			3	3
533	455	855	EXC	BIFACE	I	SV	SV			3	3
533	455	858	EXC	BIFACE	CD	-	CD			3	3
533	455	859A	EXC	DBTG	I	CD	CD	11.8		3	3
533	455	859B	EXC	DBTG	I	MGM	MG	11.8		3	3
533	455	859C	EXC	DBTG	I	TQ	TQ			3	3
533	455	859D	EXC	DBTG	I	TQ	TQ			3	3
533	455	859E	EXC	DBTG	I	MH/TQ	I			3	3
533	455	859F	EXC	DBTG	I	TQ	TQ	11.9		3	3
533	455	859G	EXC	DBTG	I	QI	QI	5.8		3	3
533	455	859H	EXC	DBTG	I	CD	CD	9.9		3	3
533	455	859I	EXC	DBTG	I	TQ	TQ	9.3		3	3
533	455	859J	EXC	DBTG	I	SV	SV			3	3
533	455	859K	EXC	DBTG	TQ	-	TQ	8.6		3	3
533	455	859L	EXC	DBTG	TQ	-	TQ	9.7		3	3
533	455	859M	EXC	DBTG	TQ	-	TQ			3	3
533	455	859N	EXC	DBTG	TQ	-	TQ			3	3
533	455	859O	EXC	DBTG	TQ	-	TQ			3	3
533	455	859P	EXC	DBTG	-	-	I	10.0		3	3
533	455	859Q	EXC	DBTG	-	-	I	8.0		3	3
533	455	859R	EXC	DBTG	-	-	I	9.8		3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
533	455	859S	EXC	DBTG	-	-	I	13.5		3	3
533	455	859T	EXC	DBTG	-	-	I	9.8		3	3
533	455	879	EXC	BIFACE	I	CD	CD	8.8		3	3
533	455	881	SUR	BIFACE	TQ	-	TQ			3	3
533	455	882	SUR	BIFACE	I	TQ	TQ			3	3
533	455	901	CSC	FLKTL	TQ	-	TQ			3	3
533	455	902	CSC	BIFACE	I	FS	FS			3	3
533	455	903	CSC	FLKTL	TQ	-	TQ			3	3
533	455	904	CSC	PRJPT	TQ	-	TQ	3.8		3	3
533	455	905	CSC	BIFACE	I	MGM/MH	I			3	3
533	455	907	CSC	BIFACE	I	MGM	MG	4.5		3	3
533	455	908	CSC	BIFACE	I	CD	CD			3	3
533	455	909	CSC	FLKTL	TQ	-	TQ			3	3
533	455	914	EXC	FLKTL	TQ	-	TQ			3	3
533	455	915	SUR	PRJPT	CD	-	CD	5.1		3	3
5A-12	ENF	1	SUR	PRJPT	TQ	-	TQ			1	2
5A-12	ENF	10	SUR	BIFACE	TQ	TQ	TQ	4.4		1	2
5A-12	ENF	11	SUR	BIFACE	I	TQ	TQ			1	2
5A-12	ENF	12	SUR	BIFACE	CD	-	CD	4.7		1	2
5A-12	ENF	13	SUR	BIFACE	I	CD	CD			1	2
5A-12	ENF	14	SUR	BIFACE	I	SV	SV			1	2
5A-12	ENF	16	SUR	DRILL	TQ	-	TQ			1	2
5A-12	ENF	17	SUR	FRMFLKTL	I	TQ	TQ	7.8		1	2
5A-12	ENF	18	SUR	FRMFLKTL	TQ	-	TQ	4.4		1	2
5A-12	ENF	19	SUR	FRMFLKTL	TQ	-	TQ	3.2		1	2
5A-12	ENF	2	SUR	PRJPT	CD	-	CD	2.1		1	2
5A-12	ENF	21	SUR	FLKTL	I	MGM	MG			1	2
5A-12	ENF	22	SUR	FLKTL	I	MGM	MG			1	2
5A-12	ENF	23	SUR	FLKTL	I	TQ	TQ			1	2
5A-12	ENF	24	SUR	FLKTL	TQ	-	TQ			1	2
5A-12	ENF	25	SUR	FLKTL	I	CD	CD			1	2
5A-12	ENF	26	SUR	FLKTL	TQ	-	TQ			1	2
5A-12	ENF	27	SUR	FLKTL	I	CD	CD			1	2
5A-12	ENF	28	SUR	FLKTL	I	MGM/MC	M			1	2
5A-12	ENF	29	SUR	FLKTL	I	MC/MGM	M			1	2
5A-12	ENF	3	SUR	BIFACE	TQ	-	TQ	3.4		1	2

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
5A-12	ENF	30	SUR	FLKTL	CD	-	CD			1	2
5A-12	ENF	31	SUR	FLKTL	I	MGM	MG			1	2
5A-12	ENF	32	SUR	FLKTL	CD	-	CD			1	2
5A-12	ENF	33	SUR	FLKTL	TQ	-	TQ			1	2
5A-12	ENF	34	SUR	FLKTL	TQ	-	TQ			1	2
5A-12	ENF	35	SUR	FLKTL	CD	-	CD			1	2
5A-12	ENF	36	SUR	FLKTL	I	MH	MH			1	2
5A-12	ENF	37	SUR	FLKTL	TQ	-	TQ			1	2
5A-12	ENF	38	SUR	FLKTL	TQ	-	TQ			1	2
5A-12	ENF	39	SUR	FLKTL	I	MH	MH			1	2
5A-12	ENF	4	SUR	BIFACE	I	CD	CD	3.8		1	2
5A-12	ENF	40	SUR	FLKTL	I	CD	CD			1	2
5A-12	ENF	41	SUR	FLKTL	I	MH	MH			1	2
5A-12	ENF	42	SUR	FLKTL	I	CD	CD			1	2
5A-12	ENF	43	SUR	FLKTL	I	TQ	TQ			1	2
5A-12	ENF	44	SUR	FLKTL	I	SV	SV			1	2
5A-12	ENF	45	SUR	FLKTL	TQ	-	TQ			1	2
5A-12	ENF	46	SUR	FLKTL	CD	-	CD			1	2
5A-12	ENF	47	SUR	FLKTL	I	CD	CD			1	2
5A-12	ENF	48	SUR	FLKTL	CD	-	CD			1	2
5A-12	ENF	49	SUR	FLKTL	I	TQ	TQ			1	2
5A-12	ENF	5	SUR	BIFACE	TQ	-	TQ			1	2
5A-12	ENF	50	SUR	FLKTL	TQ	-	TQ			1	2
5A-12	ENF	51	SUR	FLKTL	TQ	-	TQ			1	2
5A-12	ENF	52	SUR	FLKTL	TQ	-	TQ			1	2
5A-12	ENF	53	SUR	FLKTL	I	MGM	MG			1	2
5A-12	ENF	54	SUR	FLKTL	CD	-	CD			1	2
5A-12	ENF	55	SUR	FLKTL	CD	-	CD			1	2
5A-12	ENF	56	SUR	BIFACE	CD	-	CD			1	2
5A-12	ENF	59A	SUR	DBTG	I	MGM/MC	M	4.0		1	2
5A-12	ENF	59B	SUR	DBTG	I	CD	CD			1	2
5A-12	ENF	59C	SUR	DBTG	I	TQ	TQ			1	2
5A-12	ENF	59D	SUR	DBTG	I	TQ	TQ			1	2
5A-12	ENF	59E	SUR	DBTG	I	TQ	TQ			1	2
5A-12	ENF	59F	SUR	DBTG	I	TQ	TQ	3.9		1	2
5A-12	ENF	59G	SUR	DBTG	I	TQ	TQ	2.8		1	2

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
5A-12	ENF	59H	SUR	DBTG	TQ	-	TQ	2.0		1	2
5A-12	ENF	59I	SUR	DBTG	CD	-	CD	5.2		1	2
5A-12	ENF	59J	SUR	DBTG	CD	-	CD			1	2
5A-12	ENF	59K	SUR	DBTG	CD	-	CD	2.7		1	2
5A-12	ENF	59L	SUR	DBTG	TQ	-	TQ			1	2
5A-12	ENF	59M	SUR	DBTG	TQ	-	TQ	5.5		1	2
5A-12	ENF	59N	SUR	DBTG	TQ	-	TQ	4.8		1	2
5A-12	ENF	59O	SUR	DBTG	TQ	-	TQ			1	2
5A-12	ENF	6	SUR	BIFACE	I	SV	SV			1	2
5A-12	ENF	7	SUR	BIFACE	I	BH	BH	3.9		1	2
5A-12	ENF	8	SUR	BIFACE	I	CD/SV	I	6.1		1	2
5A-12	ENF	9	SUR	BIFACE	CD	-	CD	4.1		1	2
5B-14	ENF	1	SUR	FLKTL	I	MGM	MG			1	3
5B-16A	ENF	1	SUR	BIFACE	I	MGM	MG	6.2		2	3
5B-16A	ENF	2	SUR	BIFACE	TQ	-	TQ	4.4		2	3
5B-16A	ENF	3	SUR	PRJPT	I	TQ	TQ			2	3
5B-16A	ENF	4	SUR	BIFACE	CD	-	CD	5.2	4.0	2	3
5B-16A	ENF	5	SUR	FLKTL	I	MGM/MC	M			2	3
5B-16A	ENF	6	SUR	FLKTL	TQ	-	TQ			2	3
5B-18	ENF	1	SUR	PRJPT	TQ	-	TQ	6.4		2	3
5B-18	ENF	10	SUR	BIFACE	I	CD	CD			2	3
5B-18	ENF	11	SUR	BIFACE	TQ	TQ	TQ	4.5		2	3
5B-18	ENF	12	SUR	BIFACE	CD	-	CD			2	3
5B-18	ENF	13	SUR	BIFACE	FS	-	FS	2.4		2	3
5B-18	ENF	14	SUR	BIFACE	TQ	-	TQ	6.3		2	3
5B-18	ENF	15	SUR	BIFACE	TQ	-	TQ	7.4		2	3
5B-18	ENF	16	SUR	BIFACE	TQ	-	TQ	4.6		2	3
5B-18	ENF	17	SUR	BIFACE	TQ	-	TQ			2	3
5B-18	ENF	19	SUR	DRILL	TQ	-	TQ			2	3
5B-18	ENF	2	SUR	PRJPT	TQ	-	TQ	5.4		2	3
5B-18	ENF	20	SUR	FRMFLKTL	CD	-	CD	7.4		2	3
5B-18	ENF	21	SUR	FLKTL	TQ	-	TQ			2	3
5B-18	ENF	22	SUR	FLKTL	I	MH	MH			2	3
5B-18	ENF	23	SUR	FLKTL	CD	-	CD			2	3
5B-18	ENF	24	SUR	FLKTL	CD	-	CD			2	3
5B-18	ENF	25	SUR	FLKTL	CD	-	CD			2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
5B-18	ENF	26	SUR	FLKTL	TQ	-	TQ			2	3
5B-18	ENF	27	SUR	FLKTL	CD	-	CD			2	3
5B-18	ENF	28	SUR	FLKTL	I	TQ	TQ			2	3
5B-18	ENF	29	SUR	FLKTL	CD	-	CD			2	3
5B-18	ENF	3	SUR	PRJPT	CD	-	CD	8.1		2	3
5B-18	ENF	30	SUR	FLKTL	TQ	-	TQ			2	3
5B-18	ENF	31	SUR	FLKTL	I	SV	SV			2	3
5B-18	ENF	32	SUR	FLKTL	I	SV	SV			2	3
5B-18	ENF	33	SUR	FLKTL	I	TQ	TQ			2	3
5B-18	ENF	34	SUR	FLKTL	I	CD	CD			2	3
5B-18	ENF	35	SUR	FLKTL	I	MGM	MG			2	3
5B-18	ENF	36	SUR	FLKTL	I	CD	CD			2	3
5B-18	ENF	37	SUR	FLKTL	I	MGM	MG			2	3
5B-18	ENF	38	SUR	FLKTL	I	MH	MH			2	3
5B-18	ENF	39	SUR	FLKTL	I	MH	MH			2	3
5B-18	ENF	4	SUR	PRJPT	I	CD	CD			2	3
5B-18	ENF	40	SUR	FLKTL	CD	-	CD			2	3
5B-18	ENF	41	SUR	FLKTL	CD	-	CD			2	3
5B-18	ENF	42	SUR	FLKTL	I	MH	MH			2	3
5B-18	ENF	43	SUR	FLKTL	I	SV	SV			2	3
5B-18	ENF	44	SUR	FLKTL	I	MGM	MG			2	3
5B-18	ENF	45	SUR	FLKTL	I	MGM	MG			2	3
5B-18	ENF	47	SUR	FLKTL	I	TQ	TQ			2	3
5B-18	ENF	48	SUR	FLKTL	CD	-	CD			2	3
5B-18	ENF	5	SUR	PRJPT	I	TQ	TQ	2.0		2	3
5B-18	ENF	50	SUR	PTBLNK	I	MH	MH	3.4		2	3
5B-18	ENF	51	SUR	FLKTL	TQ	-	TQ			2	3
5B-18	ENF	52	SUR	FLKTL	TQ	-	TQ			2	3
5B-18	ENF	53	SUR	CORE	CD	-	CD	3.5		2	3
5B-18	ENF	54A	SUR	DBTG	I	MGM/MC	M			2	3
5B-18	ENF	54B	SUR	DBTG	I	MGM	MG	2.1		2	3
5B-18	ENF	54C	SUR	DBTG	I	MGM	MG	4.8		2	3
5B-18	ENF	54D	SUR	DBTG	I	MGM	MG			2	3
5B-18	ENF	54E	SUR	DBTG	I	MGM/MC	M			2	3
5B-18	ENF	54F	SUR	DBTG	I	MGM	MG			2	3
5B-18	ENF	54G	SUR	DBTG	TQ	-	TQ	12.2		2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
5B-18	ENF	54H	SUR	DBTG	TQ	-	TQ	6.3		2	3
5B-18	ENF	54I	SUR	DBTG	TQ	-	TQ			2	3
5B-18	ENF	54J	SUR	DBTG	FS	-	FS			2	3
5B-18	ENF	54K	SUR	DBTG	TQ	-	TQ			2	3
5B-18	ENF	54L	SUR	DBTG	TQ	-	TQ	3.7		2	3
5B-18	ENF	54M	SUR	DBTG	CD	-	CD	4.9		2	3
5B-18	ENF	54N	SUR	DBTG	CD	-	CD	4.9		2	3
5B-18	ENF	54O	SUR	DBTG	TQ	-	TQ	5.4		2	3
5B-18	ENF	6	SUR	PRJPT	I	MGM	MG			2	3
5B-18	ENF	7	SUR	BIFACE	CD	-	CD	5.2		2	3
5B-18	ENF	8	SUR	BIFACE	CD	-	CD			2	3
5B-18	ENF	9	SUR	BIFACE	I	CD	CD	5.8		2	3
5B-18A	ENF	1	SUR	FLKTL	I	MC	MC			2	4
5B-18C	ENF	1	SUR	PRJPT	CD	-	CD			2	4
5B-18C	ENF	2	SUR	BIFACE	I	MC	MC	5.1		2	4
5B-18C	ENF	3	SUR	BIFACE	I	MH	MH			2	4
5B-18C	ENF	4	SUR	FLKTL	I	SV	SV			2	4
5B-18C	ENF	6	SUR	FLKTL	I	MH/PG	I			2	4
5B-18C	ENF	7	SUR	FRMFLKTL	TQ	-	TQ	3.9		2	4
5B-2	ENF	1	SUR	BIFACE	CD	-	CD			1	2
5B-2	ENF	2	SUR	FRMFLKTL	CD	-	CD	9.0		1	2
5B-2	ENF	3	SUR	FRMFLKTL	TQ	-	TQ	1.9		1	2
5B-2	ENF	4	SUR	FLKTL	I	SV	SV			1	2
5B-2	ENF	5	SUR	FLKTL	TQ	-	TQ			1	2
5B-2	ENF	6	SUR	FLKTL	TQ	-	TQ			1	2
5B-2	ENF	7	SUR	FLKTL	CD	-	CD			1	2
5B-2	ENF	8	SUR	FLKTL	I	SV	SV			1	2
5B-5	ENF	1	SUR	PRJPT	TQ	-	TQ	5.2		2	2
5B-5	ENF	10	SUR	FLKTL	TQ	-	TQ			2	2
5B-5	ENF	11	SUR	FLKTL	TQ	-	TQ			2	2
5B-5	ENF	12	SUR	DRILL	TQ	-	TQ			2	2
5B-5	ENF	13A	SUR	DBTG	TQ	-	TQ	4.9		2	2
5B-5	ENF	13B	SUR	DBTG	TQ	-	TQ	5.0		2	2
5B-5	ENF	13C	SUR	DBTG	TQ	-	TQ	5.0		2	2
5B-5	ENF	13D	SUR	DBTG	TQ	-	TQ	5.0		2	2
5B-5	ENF	13E	SUR	DBTG	TQ	-	TQ			2	2

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
5B-5	ENF	13F	SUR	DBTG	TQ	-	TQ			2	2
5B-5	ENF	13G	SUR	DBTG	TQ	-	TQ			2	2
5B-5	ENF	13H	SUR	DBTG	TQ	-	TQ			2	2
5B-5	ENF	13I	SUR	DBTG	TQ	-	TQ			2	2
5B-5	ENF	13J	SUR	DBTG	TQ	-	TQ			2	2
5B-5	ENF	13K	SUR	DBTG	TQ	-	TQ	4.8		2	2
5B-5	ENF	13L	SUR	DBTG	TQ	-	TQ	7.6	4.7	2	2
5B-5	ENF	13M	SUR	DBTG	TQ	-	TQ	4.9		2	2
5B-5	ENF	13N	SUR	DBTG	TQ	-	TQ	5.0		2	2
5B-5	ENF	13O	SUR	DBTG	TQ	-	TQ			2	2
5B-5	ENF	15	SUR	PRJPT	TQ	-	TQ	5.9		2	2
5B-5	ENF	16	SUR	PRJPT	CD	-	CD			2	2
5B-5	ENF	17	SUR	PRJPT	I	CD	CD	6.2		2	2
5B-5	ENF	18	SUR	PRJPT	I	TQ	TQ			2	2
5B-5	ENF	19	SUR	BIFACE	TQ	-	TQ	5.7		2	2
5B-5	ENF	2	SUR	BIFACE	TQ	TQ	TQ	5.5		2	2
5B-5	ENF	20	SUR	BIFACE	TQ	-	TQ	6.5		2	2
5B-5	ENF	21	SUR	FLKTL	CD	-	CD			2	2
5B-5	ENF	23	SUR	BIFACE	TQ	-	TQ	5.3		2	2
5B-5	ENF	24	SUR	BIFACE	I	SV	SV			2	2
5B-5	ENF	25	SUR	FLKTL	TQ	-	TQ			2	2
5B-5	ENF	26	SUR	FLKTL	TQ	-	TQ			2	2
5B-5	ENF	27	SUR	FLKTL	I	CD	CD			2	2
5B-5	ENF	28	SUR	FLKTL	I	TQ	TQ			2	2
5B-5	ENF	29	SUR	FLKTL	I	CD	CD			2	2
5B-5	ENF	3	SUR	BIFACE	CD	-	CD			2	2
5B-5	ENF	30	SUR	FLKTL	TQ	-	TQ			2	2
5B-5	ENF	4	SUR	BIFACE	TQ	-	TQ			2	2
5B-5	ENF	5	SUR	FLKTL	TQ	-	TQ			2	2
5B-5	ENF	6	SUR	FLKTL	TQ	-	TQ			2	2
5B-5	ENF	7	SUR	FLKTL	TQ	-	TQ			2	2
5B-5	ENF	8	SUR	FLKTL	TQ	-	TQ			2	2
5B-5	ENF	9	SUR	FLKTL	TQ	-	TQ			2	2
5B-8	ENF	1	SUR	FRMFLKTL	I	SV	SV	3.1		1	2
5B-8	ENF	10	SUR	FLKTL	I	MGM/MH	I			1	2
5B-8	ENF	11	SUR	FLKTL	I	TQ	TQ			1	2

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
5B-8	ENF	14	SUR	BIFACE	TQ	-	TQ			1	2
5B-8	ENF	15	SUR	BIFACE	TQ	-	TQ			1	2
5B-8	ENF	16	SUR	BIFACE	I	MGM	MG	3.3		1	2
5B-8	ENF	17	SUR	BIFACE	I	CD	CD	3.3		1	2
5B-8	ENF	18	SUR	FLKTL	I	MC/MGM	M			1	2
5B-8	ENF	2	SUR	FLKTL	I	TQ	TQ			1	2
5B-8	ENF	8	SUR	BIFACE	I	MGM/MC	M	2.9		1	2
5B-8	ENF	9	SUR	FLKTL	I	TQ/QI	I			1	2
5C-19	ENF	1	SUR	PRJPT	TQ	-	TQ	2.4		4	3
5C-19	ENF	2	SUR	FLKTL	I	CD	CD			4	3
5C-20	ENF	1	SUR	PRJPT	CD	-	CD	13.3		4	1
5C-20	ENF	2	SUR	PRJPT	I	SV/CD	I			4	1
5C-20	ENF	3	SUR	BIFACE	I	MH	MH			4	1
5C-6/7	ENF	1	SUR	PRJPT	TQ	-	TQ			2	3
5C-6/7	ENF	2	SUR	BIFACE	TQ	TQ	TQ	1.5		2	3
5C-6/7	ENF	3	SUR	FLKTL	CD	-	CD			2	3
5D-3	ENF	1	SUR	PRJPT	I	TQ	TQ	10.0		4	3
5D-3	ENF	10	SUR	FLKTL	I	SV/MH	I			4	3
5D-3	ENF	11A	SUR	DBTG	I	FS	FS	7.6		4	3
5D-3	ENF	11B	SUR	DBTG	I	FS	FS	7.6		4	3
5D-3	ENF	11C	SUR	DBTG	I	MGM	MG			4	3
5D-3	ENF	11D	SUR	DBTG	I	CD	CD	6.5		4	3
5D-3	ENF	11E	SUR	DBTG	I	FS	FS	7.8		4	3
5D-3	ENF	11F	SUR	DBTG	I	MGM	MG	8.6		4	3
5D-3	ENF	11G	SUR	DBTG	I	CD	CD	6.0		4	3
5D-3	ENF	11H	SUR	DBTG	I	CD	CD			4	3
5D-3	ENF	11I	SUR	DBTG	I	MGM	MG			4	3
5D-3	ENF	11J	SUR	DBTG	CD	-	CD			4	3
5D-3	ENF	11K	SUR	DBTG	CD	-	CD			4	3
5D-3	ENF	11L	SUR	DBTG	CD	-	CD			4	3
5D-3	ENF	11M	SUR	DBTG	CD	-	CD			4	3
5D-3	ENF	11N	SUR	DBTG	CD	-	CD			4	3
5D-3	ENF	11O	SUR	DBTG	CD	-	CD			4	3
5D-3	ENF	13	SUR	FLKTL	I	FS	FS			4	3
5D-3	ENF	2	SUR	BIFACE	I	-	I	7.1		4	3
5D-3	ENF	3	SUR	BIFACE	I	CD	CD	4.2		4	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
5D-3	ENF	4	SUR	BIFACE	TQ	-	TQ	7.9		4	3
5D-3	ENF	5	SUR	BIFACE	I	MGM	MG			4	3
5D-3	ENF	6	SUR	BIFACE	TQ	-	TQ	5.7		4	3
5D-3	ENF	7	SUR	FRMFLKTL	CD	-	CD	7.3		4	3
5D-3	ENF	8	SUR	FLKTL	CD	-	CD			4	3
5D-3	ENF	9	SUR	FLKTL	I	CD	CD			4	3
5G-17	ENF	1	SUR	PRJPT	TQ	-	TQ	2.1		1	4
5R-19	ENF	1	SUR	PTBLNK	TQ	-	TQ	4.5		2	4
5R-19	ENF	2	SUR	FLKTL	CD	-	CD			2	4
5S-11	ENF	1	SUR	PRJPT	TQ	-	TQ	4.3		1	3
5S-11	ENF	10	SUR	BIFACE	CD	-	CD			1	3
5S-11	ENF	11	SUR	BIFACE	CD	-	CD			1	3
5S-11	ENF	12	SUR	BIFACE	I	MH	MH			1	3
5S-11	ENF	13	SUR	BIFACE	CD	-	CD			1	3
5S-11	ENF	14	SUR	BIFACE	CD	-	CD	3.0		1	3
5S-11	ENF	15	SUR	BIFACE	I	MGM	MG			1	3
5S-11	ENF	16	SUR	BIFACE	I	MGM	MG			1	3
5S-11	ENF	17	SUR	BIFACE	I	MH	MH	3.4		1	3
5S-11	ENF	18	SUR	BIFACE	CD	-	CD	7.1		1	3
5S-11	ENF	19	SUR	BIFACE	I	TQ	TQ			1	3
5S-11	ENF	2	SUR	PRJPT	TQ	-	TQ	9.1		1	3
5S-11	ENF	20	SUR	PTBLNK	I	CD	CD	2.9		1	3
5S-11	ENF	21	SUR	FLKTL	CD	-	CD			1	3
5S-11	ENF	22	SUR	FLKTL	I	CD	CD			1	3
5S-11	ENF	23	SUR	FLKTL	I	MGM	MG			1	3
5S-11	ENF	24	SUR	FLKTL	I	MGM	MG			1	3
5S-11	ENF	25	SUR	FLKTL	I	CD	CD			1	3
5S-11	ENF	26	SUR	FLKTL	TQ	-	TQ			1	3
5S-11	ENF	27	SUR	FLKTL	TQ	-	TQ			1	3
5S-11	ENF	28	SUR	PTBLNK	TQ	-	TQ	4.5		1	3
5S-11	ENF	29A	SUR	DBTG	I	MGM	MG			1	3
5S-11	ENF	29B	SUR	DBTG	I	SV	SV			1	3
5S-11	ENF	29C	SUR	DBTG	I	CD	CD			1	3
5S-11	ENF	29D	SUR	DBTG	I	SV	SV			1	3
5S-11	ENF	29E	SUR	DBTG	I	TQ	TQ	5.8		1	3
5S-11	ENF	29F	SUR	DBTG	I	CD/SV	I			1	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
5S-11	ENF	29G	SUR	DBTG	TQ	-	TQ	3.1		1	3
5S-11	ENF	29H	SUR	DBTG	TQ	-	TQ	3.3		1	3
5S-11	ENF	29I	SUR	DBTG	TQ	-	TQ	3.3		1	3
5S-11	ENF	29J	SUR	DBTG	CD	-	CD	2.5		1	3
5S-11	ENF	29K	SUR	DBTG	TQ	-	TQ			1	3
5S-11	ENF	29L	SUR	DBTG	TQ	-	TQ			1	3
5S-11	ENF	29M	SUR	DBTG	TQ	-	TQ	8.3		1	3
5S-11	ENF	29N	SUR	DBTG	TQ	-	TQ	5.0		1	3
5S-11	ENF	29O	SUR	DBTG	CD	-	CD	7.2		1	3
5S-11	ENF	3	SUR	PRJPT	I	MH	MH			1	3
5S-11	ENF	4	SUR	PRJPT	I	CD	CD			1	3
5S-11	ENF	5	SUR	PRJPT	TQ	-	TQ	3.3		1	3
5S-11	ENF	6	SUR	BIFACE	CD	CD	CD			1	3
5S-11	ENF	7	SUR	BIFACE	TQ	-	TQ	5.8		1	3
5S-11	ENF	8	SUR	BIFACE	I	CD	CD	10.5		1	3
5S-11	ENF	9	SUR	BIFACE	I	CD	CD			1	3
5S-12	ENF	1	SUR	FLKTL	TQ	-	TQ			1	3
5S-12	ENF	2	SUR	FLKTL	TQ	-	TQ			1	3
5S-12	ENF	7	SUR	FLKTL	CD	-	CD			1	3
5S-14	ENF	1	SUR	FLKTL	I	CD	CD			1	2
5S-14	ENF	2	SUR	FLKTL	I	MH/TQ	I			1	2
5S-14	ENF	3	SUR	FLKTL	I	SV/CD	I			1	2
5S-14	ENF	4	SUR	FLKTL	I	CD	CD			1	2
5S-14	ENF	5	SUR	FLKTL	I	MC/MGM	M			1	2
5S-14	ENF	6	SUR	FLKTL	I	SV	SV			1	2
5S-15	ENF	1	SUR	PRJPT	I	CD	CD	3.7		NT	-
5S-4	ENF	1	SUR	PRJPT	I	MC/MGM	M	6.5		2	3
5S-4	ENF	2	SUR	PRJPT	TQ	-	TQ			2	3
5S-4	ENF	3	SUR	PTBLNK	I	BH/SV	I	2.4	5.1	2	3
5S-6	ENF	1	SUR	BIFACE	CD	-	CD	12.5	3.2	2	3
5S-6	ENF	10	SUR	BIFACE	I	MC	MC			2	3
5S-6	ENF	11	SUR	BIFACE	TQ	FS	FS	4.1		2	3
5S-6	ENF	12	SUR	FRMFLKTL	I	TQ	TQ	13.0	6.5	2	3
5S-6	ENF	13	SUR	FRMFLKTL	CD	-	CD	4.8		2	3
5S-6	ENF	14	SUR	FLKTL	I	CD	CD			2	3
5S-6	ENF	15	SUR	FLKTL	I	SV	SV			2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
5S-6	ENF	16	SUR	FLKTL	I	CD	CD			2	3
5S-6	ENF	17	SUR	FLKTL	TQ	-	TQ			2	3
5S-6	ENF	18	SUR	FLKTL	I	CD	CD			2	3
5S-6	ENF	19	SUR	FLKTL	CD	-	CD			2	3
5S-6	ENF	2	SUR	PRJPT	I	SV	SV			2	3
5S-6	ENF	20	SUR	FLKTL	TQ	-	TQ			2	3
5S-6	ENF	21	SUR	FLKTL	CD	-	CD			2	3
5S-6	ENF	22	SUR	FLKTL	I	MGM/MC	M			2	3
5S-6	ENF	23	SUR	FLKTL	I	SV	SV			2	3
5S-6	ENF	24	SUR	FLKTL	I	MGM/MH	I			2	3
5S-6	ENF	25	SUR	FLKTL	CD	-	CD			2	3
5S-6	ENF	26	SUR	FLKTL	I	MGM	MG			2	3
5S-6	ENF	28	SUR	FLKTL	I	MGM	MG			2	3
5S-6	ENF	3	SUR	PRJPT	I	SV	SV	3.6		2	3
5S-6	ENF	4	SUR	BIFACE	CD	-	CD	4.0		2	3
5S-6	ENF	5	SUR	BIFACE	CD	-	CD			2	3
5S-6	ENF	6	SUR	BIFACE	I	SV	SV			2	3
5S-6	ENF	7	SUR	BIFACE	CD	-	CD	6.0		2	3
5S-6	ENF	8	SUR	BIFACE	CD	-	CD			2	3
5S-6	ENF	9	SUR	BIFACE	CD	-	CD	3.8		2	3
5S-9	ENF	1	SUR	PRJPT	CD	-	CD	3.7		NT	-
5S-9	ENF	2	SUR	PRJPT	CD	-	CD	3.1	1.0	NT	-
5S-9	ENF	25	SUR	PRJPT	CD	-	CD	2.4		NT	-
5S-9	ENF	26	SUR	PRJPT	I	CD	CD	1.3		NT	-
5S-9	ENF	3	SUR	PRJPT	I	SV	SV	5.4		NT	-
5T-16	ENF	1	SUR	PRJPT	CD	-	CD	9.8		1	3
5T-16	ENF	2	SUR	BIFACE	I	TQ	TQ	3.1		1	3
5T-16	ENF	3	SUR	PRJPT	CD	-	CD	3.0		1	3
5T-16	ENF	4	SUR	FRMFLKTL	TQ	-	TQ	4.1		1	3
5T-16	ENF	5	SUR	FLKTL	CD	-	CD			1	3
5T-16	ENF	6	SUR	FLKTL	I	MH	MH			1	3
5T-16	ENF	7	SUR	FLKTL	I	SV	SV			1	3
5T-16	ENF	8	SUR	FLKTL	I	CD	CD			1	3
5T-16	ENF	9A	SUR	DBTG	I	TQ	TQ			1	3
5T-16	ENF	9B	SUR	DBTG	I	CD	CD			1	3
5T-16	ENF	9C	SUR	DBTG	I	CD	CD			1	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
5T-16	ENF	9D	SUR	DBTG	TQ	-	TQ	3.7		1	3
5T-16	ENF	9E	SUR	DBTG	TQ	-	TQ	8.5		1	3
5T-16	ENF	9F	SUR	DBTG	TQ	-	TQ	3.9		1	3
5T-16	ENF	9G	SUR	DBTG	CD	-	CD	10.3		1	3
5T-16	ENF	9H	SUR	DBTG	CD	-	CD			1	3
5T-16	ENF	9I	SUR	DBTG	CD	-	CD			1	3
5T-16	ENF	9J	SUR	DBTG	TQ	-	TQ			1	3
5T-16	ENF	9K	SUR	DBTG	TQ	-	TQ	3.6		1	3
5T-16	ENF	9L	SUR	DBTG	TQ	-	TQ	7.9		1	3
5T-16	ENF	9M	SUR	DBTG	TQ	-	TQ	5.5		1	3
5T-16	ENF	9N	SUR	DBTG	TQ	-	TQ	3.6		1	3
5T-16	ENF	9O	SUR	DBTG	CD	-	CD			1	3
5T-18	ENF	1	SUR	FLKTL	TQ	-	TQ			1	4
5T-18	ENF	2	SUR	FLKTL	TQ	-	TQ			1	4
5T-18	ENF	3	SUR	FLKTL	I	MH/TQ	I			1	4
5T-19	ENF	1	SUR	PRJPT	TQ	-	TQ	4.7		1	2
5T-19	ENF	10	SUR	PRJPT	I	MGM/MH	I	3.6	6.4	1	2
5T-19	ENF	100	SUR	FLKTL	I	MGM	MG			1	2
5T-19	ENF	101	SUR	FLKTL	I	SV	SV			1	2
5T-19	ENF	102	SUR	FLKTL	I	MGM	MG			1	2
5T-19	ENF	103	SUR	FLKTL	I	-	I			1	2
5T-19	ENF	104	SUR	FLKTL	CD	-	CD			1	2
5T-19	ENF	105	SUR	FLKTL	I	CD	CD			1	2
5T-19	ENF	106	SUR	FLKTL	CD	-	CD			1	2
5T-19	ENF	107	SUR	FLKTL	TQ	-	TQ			1	2
5T-19	ENF	108	SUR	FLKTL	I	MGM	MG			1	2
5T-19	ENF	11	SUR	DRILL	TQ	-	TQ			1	2
5T-19	ENF	110	SUR	PTBLNK	I	MGM	MG	3.8		1	2
5T-19	ENF	111	SUR	FLKTL	TQ	-	TQ			1	2
5T-19	ENF	112	SUR	FLKTL	I	CD	CD			1	2
5T-19	ENF	113	SUR	FLKTL	I	MGM/MC	M			1	2
5T-19	ENF	114	SUR	FLKTL	TQ	-	TQ			1	2
5T-19	ENF	115	SUR	FLKTL	I	MC/MGM	M			1	2
5T-19	ENF	116	SUR	FLKTL	CD	-	CD			1	2
5T-19	ENF	117	SUR	FLKTL	CD	-	CD			1	2
5T-19	ENF	118	SUR	FLKTL	TQ	-	TQ			1	2

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
5T-19	ENF	119	SUR	FLKTL	I	CD	CD			1	2
5T-19	ENF	120	SUR	FLKTL	CD	-	CD			1	2
5T-19	ENF	121	SUR	FLKTL	I	MGM	MG			1	2
5T-19	ENF	122	SUR	FLKTL	TQ	-	TQ			1	2
5T-19	ENF	123	SUR	FLKTL	CD	-	CD			1	2
5T-19	ENF	124	SUR	FLKTL	I	MGM/MC	M			1	2
5T-19	ENF	125	SUR	PTBLNK	I	MGM	MG	4.6		1	2
5T-19	ENF	126	SUR	FLKTL	CD	-	CD			1	2
5T-19	ENF	127	SUR	FLKTL	CD	-	CD			1	2
5T-19	ENF	128	SUR	FLKTL	TQ	-	TQ			1	2
5T-19	ENF	129	SUR	FLKTL	CD	-	CD			1	2
5T-19	ENF	13	SUR	BIFACE	TQ	-	TQ			1	2
5T-19	ENF	130	SUR	FLKTL	TQ	-	TQ			1	2
5T-19	ENF	132A	SUR	DBTG	I	MGM/MG	M	2.6		1	3
5T-19	ENF	132B	SUR	DBTG	I	MGM/MH	I	2.8		1	3
5T-19	ENF	132C	SUR	DBTG	I	SV	SV			1	3
5T-19	ENF	132D	SUR	DBTG	I	CD	CD	4.4		1	3
5T-19	ENF	132E	SUR	DBTG	I	CD	CD			1	3
5T-19	ENF	132F	SUR	DBTG	I	MGM	MG			1	3
5T-19	ENF	132G	SUR	DBTG	I	CD	CD	2.4		1	3
5T-19	ENF	132H	SUR	DBTG	I	CD	CD	2.4		1	3
5T-19	ENF	132I	SUR	DBTG	TQ	-	TQ	3.7		1	3
5T-19	ENF	132J	SUR	DBTG	TQ	-	TQ			1	3
5T-19	ENF	132K	SUR	DBTG	TQ	-	TQ			1	3
5T-19	ENF	132L	SUR	DBTG	CD	-	CD			1	3
5T-19	ENF	132M	SUR	DBTG	TQ	-	TQ	3.1		1	3
5T-19	ENF	132N	SUR	DBTG	TQ	-	TQ	3.7		1	3
5T-19	ENF	132O	SUR	DBTG	TQ	-	TQ			1	3
5T-19	ENF	14	SUR	BIFACE	CD	-	CD	6.7		1	2
5T-19	ENF	15	SUR	BIFACE	TQ	TQ	TQ	3.4		1	2
5T-19	ENF	16	SUR	BIFACE	TQ	TQ	TQ	8.8		1	2
5T-19	ENF	17	SUR	BIFACE	CD	-	CD	4.6		1	2
5T-19	ENF	18	SUR	BIFACE	I	MGM/MC	M			1	2
5T-19	ENF	19	SUR	BIFACE	I	TQ	TQ	2.8		1	2
5T-19	ENF	2	SUR	PRJPT	TQ	-	TQ	4.9		1	2
5T-19	ENF	20	SUR	BIFACE	TQ	-	TQ	3.4		1	2

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
5T-19	ENF	21	SUR	BIFACE	CD	-	CD	3.1		1	2
5T-19	ENF	22	SUR	BIFACE	I	MH	MH	3.3		1	2
5T-19	ENF	23	SUR	BIFACE	I	MGM	MG			1	2
5T-19	ENF	24	SUR	BIFACE	I	MC/MGM	M	4.1		1	2
5T-19	ENF	25	SUR	PRJPT	CD	-	CD			1	2
5T-19	ENF	26	SUR	BIFACE	TQ	-	TQ			1	2
5T-19	ENF	27	SUR	PTBLNK	I	MGM	MG	3.1	6.1	1	2
5T-19	ENF	3	SUR	PRJPT	I	FS	FS	4.4		1	2
5T-19	ENF	30	SUR	BIFACE	TQ	-	TQ			1	2
5T-19	ENF	31	SUR	BIFACE	CD	-	CD			1	2
5T-19	ENF	32	SUR	BIFACE	TQ	TQ	TQ	5.7		1	2
5T-19	ENF	33	SUR	BIFACE	TQ	-	TQ	3.4		1	2
5T-19	ENF	34	SUR	BIFACE	TQ	-	TQ			1	2
5T-19	ENF	35	SUR	BIFACE	I	MGM	MG			1	2
5T-19	ENF	36	SUR	FRMFLKTL	CD	-	CD	1.4		1	2
5T-19	ENF	37	SUR	FLKTL	TQ	-	TQ			1	2
5T-19	ENF	38	SUR	FLKTL	I	TQ	TQ			1	2
5T-19	ENF	39	SUR	FLKTL	TQ	-	TQ			1	2
5T-19	ENF	4	SUR	PRJPT	I	MGM/MC	M	5.6		1	2
5T-19	ENF	40	SUR	FLKTL	I	CD	CD			1	2
5T-19	ENF	41	SUR	FLKTL	I	MGM/MC	M			1	2
5T-19	ENF	42	SUR	FLKTL	CD	-	CD			1	2
5T-19	ENF	43	SUR	FLKTL	I	CD	CD			1	2
5T-19	ENF	44	SUR	FLKTL	CD	-	CD			1	2
5T-19	ENF	45	SUR	FLKTL	CD	-	CD			1	2
5T-19	ENF	46	SUR	FLKTL	CD	-	CD			1	2
5T-19	ENF	47	SUR	FLKTL	TQ	-	TQ			1	2
5T-19	ENF	48	SUR	FLKTL	I	MGM/MC	M			1	2
5T-19	ENF	49	SUR	FLKTL	CD	-	CD			1	2
5T-19	ENF	5	SUR	PRJPT	TQ	-	TQ			1	2
5T-19	ENF	50	SUR	FLKTL	TQ	-	TQ			1	2
5T-19	ENF	51	SUR	FLKTL	I	TQ/QI	I			1	2
5T-19	ENF	52	SUR	FLKTL	I	MGM	MG			1	2
5T-19	ENF	53	SUR	FLKTL	I	MGM	MG			1	2
5T-19	ENF	54	SUR	FLKTL	TQ	-	TQ			1	2
5T-19	ENF	55	SUR	FLKTL	TQ	-	TQ			1	2

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
5T-19	ENF	56	SUR	FLKTL	I	MH	MH			1	2
5T-19	ENF	57	SUR	FLKTL	I	CD	CD			1	2
5T-19	ENF	58	SUR	FLKTL	TQ	-	TQ			1	2
5T-19	ENF	59	SUR	FLKTL	TQ	-	TQ			1	2
5T-19	ENF	6	SUR	PRJPT	I	MH	MH			1	2
5T-19	ENF	60	SUR	FLKTL	CD	-	CD			1	2
5T-19	ENF	61	SUR	FLKTL	CD	-	CD			1	2
5T-19	ENF	62	SUR	PTBLNK	I	MGM	MG	6.0		1	2
5T-19	ENF	63	SUR	FLKTL	TQ	-	TQ			1	2
5T-19	ENF	64	SUR	FLKTL	TQ	-	TQ			1	2
5T-19	ENF	65	SUR	FLKTL	I	MGM	MG			1	2
5T-19	ENF	66	SUR	FLKTL	CD	-	CD			1	2
5T-19	ENF	67	SUR	FLKTL	I	MGM	MG			1	2
5T-19	ENF	68	SUR	PTBLNK	I	MGM	MG	5.4		1	2
5T-19	ENF	69	SUR	FLKTL	I	MGM	MG			1	2
5T-19	ENF	7	SUR	PRJPT	TQ	-	TQ	4.5		1	2
5T-19	ENF	70	SUR	FLKTL	I	CD	CD			1	2
5T-19	ENF	71	SUR	FLKTL	TQ	-	TQ			1	2
5T-19	ENF	72	SUR	FLKTL	I	MGM	MG			1	2
5T-19	ENF	73	SUR	FLKTL	CD	-	CD			1	2
5T-19	ENF	74	SUR	FLKTL	I	MGM	MG			1	2
5T-19	ENF	75	SUR	FLKTL	CD	-	CD			1	2
5T-19	ENF	76	SUR	FLKTL	I	CD	CD			1	2
5T-19	ENF	77	SUR	FLKTL	TQ	-	TQ			1	2
5T-19	ENF	78	SUR	FLKTL	I	SV	SV			1	2
5T-19	ENF	79	SUR	FLKTL	I	MGM	MG			1	2
5T-19	ENF	8	SUR	PRJPT	I	TQ	TQ	4.3		1	2
5T-19	ENF	80	SUR	FLKTL	TQ	-	TQ			1	2
5T-19	ENF	81	SUR	FLKTL	CD	-	CD			1	2
5T-19	ENF	82	SUR	PTBLNK	CD	-	CD	1.6		1	2
5T-19	ENF	83	SUR	FLKTL	CD	-	CD			1	2
5T-19	ENF	84	SUR	FLKTL	I	MGM	MG			1	2
5T-19	ENF	85	SUR	FLKTL	TQ	-	TQ			1	2
5T-19	ENF	86	SUR	FLKTL	I	TQ	TQ			1	2
5T-19	ENF	87	SUR	FLKTL	CD	-	CD			1	2
5T-19	ENF	88	SUR	FLKTL	TQ	-	TQ			1	2

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
5T-19	ENF	89	SUR	FLKTL	I	MGM/MH	I			1	2
5T-19	ENF	9	SUR	PRJPT	CD	-	CD	4.4		1	2
5T-19	ENF	90	SUR	FLKTL	I	MGM	MG			1	2
5T-19	ENF	91	SUR	FLKTL	TQ	-	TQ			1	2
5T-19	ENF	92	SUR	FLKTL	I	MGM	MG			1	2
5T-19	ENF	93	SUR	FLKTL	CD	-	CD			1	2
5T-19	ENF	94	SUR	FLKTL	TQ	-	TQ			1	2
5T-19	ENF	95	SUR	FLKTL	I	SV	SV			1	2
5T-19	ENF	96	SUR	FLKTL	CD	-	CD			1	2
5T-19	ENF	97	SUR	FLKTL	I	MGM	MG			1	2
5T-19	ENF	98	SUR	FLKTL	I	MC	MC			1	2
5T-19	ENF	99	SUR	FLKTL	I	MH	MH			1	2
5U-10	ENF	1	SUR	PRJPT	TQ	-	TQ	4.0		3	1
5U-10	ENF	10	SUR	FLKTL	TQ	-	TQ			3	1
5U-10	ENF	2	SUR	FLKTL	TQ	-	TQ			3	1
5U-10	ENF	3	SUR	FLKTL	TQ	-	TQ			3	1
5U-10	ENF	4A	SUR	DBTG	I	FS	FS	6.2		3	1
5U-10	ENF	4B	SUR	DBTG	I	CD	CD	8.4		3	1
5U-10	ENF	4C	SUR	DBTG	I	MH	MH			3	1
5U-10	ENF	4D	SUR	DBTG	I	TQ	TQ	6.5		3	1
5U-10	ENF	4E	SUR	DBTG	I	TQ	TQ			3	1
5U-10	ENF	4F	SUR	DBTG	I	CD	CD			3	1
5U-10	ENF	4G	SUR	DBTG	I	MGM	MG	6.2		3	1
5U-10	ENF	4H	SUR	DBTG	TQ	-	TQ	6.5		3	1
5U-10	ENF	4I	SUR	DBTG	TQ	-	TQ			3	1
5U-10	ENF	4J	SUR	DBTG	TQ	-	TQ			3	1
5U-10	ENF	4K	SUR	DBTG	TQ	-	TQ			3	1
5U-10	ENF	4L	SUR	DBTG	TQ	-	TQ	6.5		3	1
5U-10	ENF	4M	SUR	DBTG	TQ	-	TQ			3	1
5U-10	ENF	4N	SUR	DBTG	TQ	-	TQ			3	1
5U-10	ENF	4O	SUR	DBTG	TQ	-	TQ			3	1
5U-10	ENF	9	SUR	CORE	I	MGM/MC	M	8.7		3	1
5U-11	ENF	1	SUR	BIFACE	TQ	-	TQ			3	4
5U-11	ENF	2	SUR	BIFACE	CD	-	CD	5.4		3	4
5U-12	ENF	1	SUR	PRJPT	TQ	-	TQ			4	3
5U-12	ENF	10	SUR	FLKTL	CD	-	CD			4	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
5U-12	ENF	11	SUR	FLKTL	CD	-	CD			4	3
5U-12	ENF	12	SUR	FLKTL	I	CD	CD			4	3
5U-12	ENF	13	SUR	FLKTL	I	TQ	TQ			4	3
5U-12	ENF	14	SUR	FLKTL	I	MGM	MG			4	3
5U-12	ENF	15	SUR	FLKTL	TQ	-	TQ			4	3
5U-12	ENF	16	SUR	FLKTL	I	CD	CD			4	3
5U-12	ENF	17	SUR	FLKTL	CD	-	CD			4	3
5U-12	ENF	18	SUR	FLKTL	TQ	-	TQ			4	3
5U-12	ENF	19	SUR	PTBLNK	I	MH	MH	3.8		4	3
5U-12	ENF	2	SUR	BIFACE	I	MH	MH			4	3
5U-12	ENF	21A	SUR	DBTG	I	FS	FS	3.7		4	3
5U-12	ENF	21B	SUR	DBTG	I	CD	CD	13.0		4	3
5U-12	ENF	21C	SUR	DBTG	I	MGM	MG	4.5		4	3
5U-12	ENF	21D	SUR	DBTG	I	CD	CD	4.8		4	3
5U-12	ENF	21E	SUR	DBTG	I	CD	CD			4	3
5U-12	ENF	21F	SUR	DBTG	I	SV	SV			4	3
5U-12	ENF	21G	SUR	DBTG	I	CD	CD	7.3	DH	4	3
5U-12	ENF	21H	SUR	DBTG	I	CD	CD	5.9	4.5	4	3
5U-12	ENF	21I	SUR	DBTG	I	CD	CD	4.6		4	3
5U-12	ENF	21J	SUR	DBTG	CD	-	CD			4	3
5U-12	ENF	21K	SUR	DBTG	CD	-	CD			4	3
5U-12	ENF	21L	SUR	DBTG	CD	-	CD			4	3
5U-12	ENF	21M	SUR	DBTG	CD	-	CD			4	3
5U-12	ENF	21N	SUR	DBTG	CD	-	CD	7.6		4	3
5U-12	ENF	21O	SUR	DBTG	TQ	-	TQ			4	3
5U-12	ENF	3	SUR	BIFACE	I	MGM/MH	I			4	3
5U-12	ENF	4	SUR	BIFACE	TQ	-	TQ			4	3
5U-12	ENF	5	SUR	BIFACE	I	SV	SV			4	3
5U-12	ENF	6	SUR	FRMFLKTL	I	CD	CD	3.5		4	3
5U-12	ENF	7	SUR	FRMFLKTL	I	QI	QI	4.1		4	3
5U-12	ENF	8	SUR	FRMFLKTL	I	MGM	MG	3.2		4	3
5U-12	ENF	9	SUR	FLKTL	I	FS	FS			4	3
5U-13	ENF	1	SUR	PRJPT	TQ	-	TQ			2	2
5U-13	ENF	2	SUR	BIFACE	TQ	-	TQ			2	2
5U-13	ENF	3	SUR	FLKTL	I	SV	SV			2	2
5U-13	ENF	4	SUR	FLKTL	TQ	-	TQ			2	2

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
5U-13	ENF	6	SUR	FLKTL	I	MH	MH			2	2
5U-13	ENF	7	SUR	FLKTL	TQ	-	TQ			2	2
5U-13	ENF	9A	SUR	DBTG	I	TQ	TQ	9.4		2	2
5U-13	ENF	9B	SUR	DBTG	TQ	-	TQ	6.8		2	2
5U-13	ENF	9C	SUR	DBTG	TQ	-	TQ	6.9		2	2
5U-13	ENF	9D	SUR	DBTG	TQ	-	TQ			2	2
5U-13	ENF	9E	SUR	DBTG	TQ	-	TQ	7.3		2	2
5U-13	ENF	9F	SUR	DBTG	TQ	-	TQ			2	2
5U-13	ENF	9G	SUR	DBTG	TQ	-	TQ			2	2
5U-13	ENF	9H	SUR	DBTG	TQ	-	TQ			2	2
5U-13	ENF	9I	SUR	DBTG	TQ	-	TQ			2	2
5U-13	ENF	9J	SUR	DBTG	TQ	-	TQ			2	2
5U-13	ENF	9K	SUR	DBTG	TQ	-	TQ	9.4		2	2
5U-13	ENF	9L	SUR	DBTG	TQ	-	TQ			2	2
5U-13	ENF	9M	SUR	DBTG	TQ	-	TQ			2	2
5U-13	ENF	9N	SUR	DBTG	TQ	-	TQ	3.8		2	2
5U-13	ENF	9O	SUR	DBTG	TQ	-	TQ	6.7		2	2
5U-13A	ENF	1	SUR	BIFACE	TQ	TQ	TQ	3.0		2	3
5U-13A	ENF	10	SUR	FLKTL	I	QI/TQ	I			2	3
5U-13A	ENF	11	SUR	FLKTL	CD	-	CD			2	3
5U-13A	ENF	12	SUR	FLKTL	I	MH	MH			2	3
5U-13A	ENF	13	SUR	FLKTL	TQ	-	TQ			2	3
5U-13A	ENF	14	SUR	FLKTL	I	TQ	TQ			2	3
5U-13A	ENF	15	SUR	FLKTL	TQ	-	TQ			2	3
5U-13A	ENF	2	SUR	BIFACE	TQ	FS/TQ	I	4.5		2	3
5U-13A	ENF	3	SUR	FRMFLKTL	I	TQ	TQ	2.7		2	3
5U-13A	ENF	4	SUR	FRMFLKTL	TQ	-	TQ	6.2		2	3
5U-13A	ENF	5	SUR	FLKTL	TQ	-	TQ			2	3
5U-13A	ENF	6	SUR	FLKTL	I	SV	SV			2	3
5U-13A	ENF	7	SUR	FLKTL	I	TQ/MH	I			2	3
5U-13A	ENF	8	SUR	FLKTL	TQ	-	TQ			2	3
5U-14	ENF	1	SUR	PRJPT	TQ	-	TQ			2	1
5U-14	ENF	2	SUR	BIFACE	I	FS	FS			2	1
5U-14	ENF	3	SUR	BIFACE	TQ	-	TQ			2	1
5U-14	ENF	4	SUR	PRJPT	TQ	-	TQ	8.1		2	1
5U-14	ENF	5	SUR	FLKTL	I	TQ	TQ			2	1

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
5U-15	ENF	10	SUR	BIFACE	CD	-	CD	5.3		2	3
5U-15	ENF	11	SUR	BIFACE	TQ	-	TQ	5.9		2	3
5U-15	ENF	12	SUR	FLKTL	TQ	-	TQ			2	3
5U-15	ENF	13	SUR	FLKTL	TQ	-	TQ			2	3
5U-15	ENF	14	SUR	FLKTL	TQ	-	TQ			2	3
5U-15	ENF	15	SUR	FLKTL	TQ	-	TQ			2	3
5U-15	ENF	16	SUR	FLKTL	I	MC/MGM	M			2	3
5U-15	ENF	17	SUR	FLKTL	TQ	-	TQ			2	3
5U-15	ENF	18	SUR	FLKTL	I	TQ	TQ			2	3
5U-15	ENF	19	SUR	FLKTL	I	MGM	MG			2	3
5U-15	ENF	20	SUR	FLKTL	TQ	-	TQ			2	3
5U-15	ENF	21	SUR	FLKTL	TQ	-	TQ			2	3
5U-15	ENF	22	SUR	FLKTL	I	SV	SV			2	3
5U-15	ENF	23	SUR	FLKTL	TQ	-	TQ			2	3
5U-15	ENF	24	SUR	FLKTL	TQ	-	TQ			2	3
5U-15	ENF	25	SUR	FLKTL	TQ	-	TQ			2	3
5U-15	ENF	26A	SUR	DBTG	I	MC/MGM	M	12.8		2	3
5U-15	ENF	26B	SUR	DBTG	I	TQ	TQ	7.3		2	3
5U-15	ENF	26C	SUR	DBTG	I	MGM	MG	12.6		2	3
5U-15	ENF	26D	SUR	DBTG	I	CD	CD	4.1		2	3
5U-15	ENF	26E	SUR	DBTG	I	TQ	TQ	7.6		2	3
5U-15	ENF	26F	SUR	DBTG	TQ	-	TQ			2	3
5U-15	ENF	26G	SUR	DBTG	TQ	-	TQ			2	3
5U-15	ENF	26H	SUR	DBTG	TQ	-	TQ			2	3
5U-15	ENF	26I	SUR	DBTG	TQ	-	TQ			2	3
5U-15	ENF	26J	SUR	DBTG	TQ	-	TQ			2	3
5U-15	ENF	26K	SUR	DBTG	TQ	-	TQ			2	3
5U-15	ENF	26L	SUR	DBTG	TQ	-	TQ			2	3
5U-15	ENF	26M	SUR	DBTG	TQ	-	TQ			2	3
5U-15	ENF	26N	SUR	DBTG	TQ	-	TQ			2	3
5U-15	ENF	26O	SUR	DBTG	TQ	-	TQ			2	3
5U-15	ENF	8	SUR	BIFACE	TQ	-	TQ			2	3
5U-15	ENF	9	SUR	BIFACE	CD	-	CD			2	3
5U-4	ENF	1	SUR	FRMFLKTL	CD	-	CD	11.2	3.7	3	3
5U-4	ENF	11	SUR	BIFACE	TQ	-	TQ			3	3
5U-4	ENF	12	SUR	FLKTL	TQ	-	TQ			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
5U-4	ENF	13	SUR	FLKTL	CD	-	CD			3	3
5U-4	ENF	2	SUR	FLKTL	CD	-	CD			3	3
5U-4	ENF	3	SUR	FLKTL	TQ	-	TQ			3	3
5U-4A	ENF	1	SUR	PRJPT	TQ	-	TQ	2.6		3	3
5U-4A	ENF	2	SUR	BIFACE	CD	CD	CD	4.6		3	3
5U-4A	ENF	3	SUR	BIFACE	CD	-	CD			3	3
5U-4A	ENF	4	SUR	FLKTL	CD	-	CD			3	3
5U-4A	ENF	5	SUR	CORE	TQ	-	TQ	2.4		3	3
5U-4B	ENF	1	SUR	PRJPT	I	CO	CO			3	3
5U-4B	ENF	2	SUR	PRJPT	CD	-	CD			3	3
5U-4B	ENF	3	SUR	BIFACE	I	MH/SV	I	3.4		3	3
5U-4B	ENF	4	SUR	FLKTL	TQ	-	TQ			3	3
5U-4F	ENF	1	SUR	FLKTL	TQ	-	TQ			3	3
5U-4F	ENF	2	SUR	FLKTL	I	MC/MGM	M			3	3
5U-4G	ENF	1	SUR	PRJPT	I	SV	SV	2.3	3.9	3	3
5U-4G	ENF	2	SUR	FLKTL	CD	-	CD			3	3
5U-4G	ENF	3	SUR	FLKTL	I	TQ	TQ			3	3
5U-4G	ENF	4	SUR	FLKTL	I	TQ	TQ			3	3
5U-4G	ENF	5	SUR	FLKTL	I	CD	CD			3	3
5U-5	ENF	1	SUR	FLKTL	CD	-	CD			1	4
5U-6	ENF	1	SUR	FLKTL	I	SV	SV			4	3
5U-8	ENF	1	SUR	PRJPT	FS	FS	FS	7.0		4	3
5U-8	ENF	2	SUR	BIFACE	TQ	-	TQ			4	3
5U-8	ENF	3	SUR	BIFACE	I	TQ	TQ			4	3
5U-8	ENF	4	SUR	PRJPT	I	SV	SV			4	3
5U-8	ENF	5	SUR	FLKTL	I	CD	CD			4	3
5U-8	ENF	8	SUR	PRJPT	I	CD	CD	8.0		4	3
5U-8	ENF	9	SUR	BIFACE	I	MGM	MG	11.1		4	3
5U-8A	ENF	1	SUR	PRJPT	I	MGM	MG	8.8		4	1
5U-8A	ENF	2	SUR	FRMFLKTL	I	MGM	MG	9.9		4	1
5U-8A	ENF	3	SUR	FRMFLKTL	TQ	-	TQ	9.4		4	1
5U-8A	ENF	4	SUR	FRMFLKTL	CD	-	CD	9.6		4	1
5U-8A	ENF	7	SUR	FLKTL	CD	-	CD			4	1
5V-11	ENF	1	SUR	PRJPT	I	MGM/MC	M			NT	-
5V-15	ENF	1	SUR	PRJPT	TQ	-	TQ	3.7		3	2
5V-15	ENF	11	SUR	PTBLNK	I	QI	QI	3.2		3	2

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
5V-15	ENF	12	SUR	PTBLNK	TQ	-	TQ	3.1		3	2
5V-15	ENF	13	SUR	BIFACE	CD	QI	QI	2.8	DH	3	2
5V-15	ENF	14	SUR	BIFACE	TQ	-	TQ	4.6		3	2
5V-15	ENF	15	SUR	PRJPT	I	MH	MH			3	2
5V-15	ENF	16	SUR	FLKTL	TQ	-	TQ			3	2
5V-15	ENF	17	SUR	FLKTL	I	QI/MC	I			3	2
5V-15	ENF	18	SUR	FLKTL	TQ	-	TQ			3	2
5V-15	ENF	19	SUR	FLKTL	TQ	-	TQ			3	2
5V-15	ENF	2	SUR	PRJPT	I	SV	SV			3	2
5V-15	ENF	20	SUR	FLKTL	I	MH	MH			3	2
5V-15	ENF	21	SUR	FLKTL	I	MH	MH			3	2
5V-15	ENF	22	SUR	FLKTL	I	QI/MH	I			3	2
5V-15	ENF	23	SUR	FLKTL	I	MH	MH			3	2
5V-15	ENF	24	SUR	FLKTL	TQ	-	TQ			3	2
5V-15	ENF	25	SUR	FLKTL	TQ	-	TQ			3	2
5V-15	ENF	26	SUR	FLKTL	I	MH	MH			3	2
5V-15	ENF	27	SUR	FLKTL	I	FS	FS			3	2
5V-15	ENF	28A	SUR	DBTG	I	FS	FS	4.6		3	2
5V-15	ENF	28B	SUR	DBTG	I	QI	QI	4.2		3	2
5V-15	ENF	28C	SUR	DBTG	I	QI	QI	1.7		3	2
5V-15	ENF	28D	SUR	DBTG	I	QI	QI	4.3		3	2
5V-15	ENF	28E	SUR	DBTG	I	QI/MH	I			3	2
5V-15	ENF	28F	SUR	DBTG	I	QI	QI			3	2
5V-15	ENF	28G	SUR	DBTG	I	QI	QI			3	2
5V-15	ENF	28H	SUR	DBTG	I	QI	QI			3	2
5V-15	ENF	28I	SUR	DBTG	I	QI	QI			3	2
5V-15	ENF	28J	SUR	DBTG	I	QI	QI			3	2
5V-15	ENF	28K	SUR	DBTG	I	QI	QI			3	2
5V-15	ENF	28L	SUR	DBTG	I	QI	QI	4.2		3	2
5V-15	ENF	28M	SUR	DBTG	I	QI	QI	4.2		3	2
5V-15	ENF	28N	SUR	DBTG	I	QI	QI	4.2		3	2
5V-15	ENF	28O	SUR	DBTG	TQ	-	TQ	1.9		3	2
5V-15	ENF	3	SUR	PRJPT	TQ	-	TQ	2.7		3	2
5V-15	ENF	4	SUR	PRJPT	I	QI	QI	7.2		3	2
5V-15	ENF	5	SUR	BIFACE	CD	-	CD			3	2
5V-15	ENF	6	SUR	BIFACE	I	MH	MH			3	2

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
5V-15	ENF	7	SUR	BIFACE	I	QI	QI			3	2
5V-15	ENF	8	SUR	BIFACE	TQ	-	TQ			3	2
5V-20	ENF	1	SUR	FLKTL	I	MGM/MH	I			3	4
5V-21	ENF	1	SUR	BIFACE	I	MGM	MG			3	3
5V-21	ENF	2	SUR	BIFACE	TQ	-	TQ	5.4		3	3
5V-21	ENF	3	SUR	FLKTL	TQ	-	TQ			3	3
5V-25	ENF	1	SUR	BIFACE	TQ	TQ	TQ	2.2		3	4
5W-3	ENF	1	SUR	PTBLNK	I	MGM	MG	3.1		3	3
5W-3	ENF	10	SUR	FLKTL	I	SV	SV			3	3
5W-3	ENF	11	SUR	FLKTL	CD	-	CD			3	3
5W-3	ENF	12	SUR	FLKTL	CD	-	CD			3	3
5W-3	ENF	13	SUR	BIFACE	TQ	-	TQ			3	3
5W-3	ENF	14A	SUR	DBTG	I	MGM	MG	5.9		3	3
5W-3	ENF	14B	SUR	DBTG	I	MH	MH	5.4		3	3
5W-3	ENF	14C	SUR	DBTG	I	MGM	MG	5.3		3	3
5W-3	ENF	14D	SUR	DBTG	I	TQ	TQ			3	3
5W-3	ENF	14E	SUR	DBTG	I	MGM	MG	1.9		3	3
5W-3	ENF	14F	SUR	DBTG	I	CD	CD	4.9		3	3
5W-3	ENF	14G	SUR	DBTG	I	MGM	MG	9.9		3	3
5W-3	ENF	14H	SUR	DBTG	I	MGM	MG			3	3
5W-3	ENF	14I	SUR	DBTG	I	CD	CD			3	3
5W-3	ENF	14J	SUR	DBTG	I	CD	CD			3	3
5W-3	ENF	14K	SUR	DBTG	TQ	-	TQ	2.4		3	3
5W-3	ENF	14L	SUR	DBTG	TQ	-	TQ			3	3
5W-3	ENF	14M	SUR	DBTG	CD	-	CD			3	3
5W-3	ENF	14N	SUR	DBTG	CD	-	CD			3	3
5W-3	ENF	14O	SUR	DBTG	TQ	-	TQ	6.6	3.1	3	3
5W-3	ENF	2	SUR	BIFACE	I	CD	CD	13.1		3	3
5W-3	ENF	3	SUR	BIFACE	TQ	-	TQ			3	3
5W-3	ENF	4	SUR	FLKTL	CD	-	CD			3	3
5W-3	ENF	5	SUR	FLKTL	I	SV	SV			3	3
5W-3	ENF	6	SUR	FRMFLKTL	TQ	-	TQ	9.7		3	3
5W-3	ENF	7	SUR	FLKTL	I	MGM	MG			3	3
5W-3	ENF	8	SUR	FLKTL	TQ	-	TQ			3	3
5W-3	ENF	9	SUR	FLKTL	TQ	-	TQ			3	3
5W-5	ENF	1	SUR	BIFACE	CD	-	CD	4.5		3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
5W-5	ENF	11	SUR	FLKTL	TQ	-	TQ			3	3
5W-5	ENF	12	SUR	FLKTL	I	MGM	MG			3	3
5W-5	ENF	2	SUR	BIFACE	CD	-	CD			3	3
5W-5	ENF	3	SUR	FLKTL	TQ	-	TQ			3	3
5W-5	ENF	4	SUR	FLKTL	I	MH	MH			3	3
5W-5	ENF	5	SUR	FLKTL	CD	-	CD			3	3
5W-5	ENF	6	SUR	FLKTL	TQ	-	TQ			3	3
5W-5	ENF	7	SUR	FLKTL	I	SV	SV			3	3
5W-5	ENF	8	SUR	FLKTL	TQ	-	TQ			3	3
5W-5	ENF	9	SUR	FLKTL	CD	-	CD			3	3
5W-6	ENF	2	SUR	BIFACE	I	MGM	MG			3	2
5W-6	ENF	3	SUR	FLKTL	TQ	-	TQ			3	2
5W-6B	ENF	1	SUR	BIFACE	CD	-	CD	6.4		3	2
5W-6B	ENF	2	SUR	BIFACE	I	CD/SV	I			3	2
5W-6B	ENF	3	SUR	BIFACE	CD	-	CD			3	2
5W-6B	ENF	5	SUR	FLKTL	CD	-	CD			3	2
5W-8	ENF	1	SUR	PRJPT	CD	-	CD	4.4		3	3
5W-8	ENF	14	SUR	PRJPT	TQ	-	TQ	6.8		3	3
5W-8	ENF	15	SUR	PRJPT	TQ	-	TQ	3.0		3	3
5W-8	ENF	16	SUR	BIFACE	I	MC	MC	6.0		3	3
5W-8	ENF	17	SUR	BIFACE	FS	FS	FS	4.3		3	3
5W-8	ENF	18	SUR	BIFACE	CD	CD	CD	9.8		3	3
5W-8	ENF	19	SUR	BIFACE	CD	-	CD	4.8		3	3
5W-8	ENF	2	SUR	BIFACE	TQ	-	TQ	4.3		3	3
5W-8	ENF	20	SUR	BIFACE	TQ	-	TQ	6.5		3	3
5W-8	ENF	21	SUR	BIFACE	CD	-	CD			3	3
5W-8	ENF	22	SUR	BIFACE	CD	-	CD			3	3
5W-8	ENF	23	SUR	FLKTL	TQ	-	TQ			3	3
5W-8	ENF	24	SUR	FLKTL	CD	-	CD			3	3
5W-8	ENF	25	SUR	FLKTL	CD	-	CD			3	3
5W-8	ENF	26	SUR	FLKTL	I	MGM/MC	M			3	3
5W-8	ENF	27	SUR	FLKTL	TQ	-	TQ			3	3
5W-8	ENF	28	SUR	FLKTL	I	FS	FS			3	3
5W-8	ENF	29	SUR	PTBLNK	I	MH	MH	3.3		3	3
5W-8	ENF	3	SUR	BIFACE	CD	-	CD	4.8		3	3
5W-8	ENF	30	SUR	FLKTL	I	MH	MH			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
5W-8	ENF	31	SUR	FLKTL	TQ	-	TQ			3	3
5W-8	ENF	32	SUR	FLKTL	I	CD	CD			3	3
5W-8	ENF	33	SUR	FLKTL	CD	-	CD			3	3
5W-8	ENF	34	SUR	FLKTL	TQ	-	TQ			3	3
5W-8	ENF	35	SUR	FLKTL	TQ	-	TQ			3	3
5W-8	ENF	36	SUR	FLKTL	I	MH	MH			3	3
5W-8	ENF	37	SUR	FLKTL	TQ	-	TQ			3	3
5W-8	ENF	38	SUR	FLKTL	TQ	-	TQ			3	3
5W-8	ENF	39	SUR	FLKTL	I	TQ	TQ			3	3
5W-8	ENF	4	SUR	BIFACE	I	MGM	MG	8.4	4.0	3	3
5W-8	ENF	41A	SUR	DBTG	I	TQ	TQ	7.3		3	3
5W-8	ENF	41B	SUR	DBTG	I	MGM	MG	6.5		3	3
5W-8	ENF	41C	SUR	DBTG	I	TQ	TQ			3	3
5W-8	ENF	41D	SUR	DBTG	I	MGM/MC	M	10.0		3	3
5W-8	ENF	41E	SUR	DBTG	I	SV/CD	I			3	3
5W-8	ENF	41F	SUR	DBTG	I	CD	CD	5.4		3	3
5W-8	ENF	41G	SUR	DBTG	TQ	-	TQ			3	3
5W-8	ENF	41H	SUR	DBTG	TQ	-	TQ			3	3
5W-8	ENF	41I	SUR	DBTG	TQ	-	TQ	5.6		3	3
5W-8	ENF	41J	SUR	DBTG	TQ	-	TQ	5.6		3	3
5W-8	ENF	41K	SUR	DBTG	TQ	-	TQ			3	3
5W-8	ENF	41L	SUR	DBTG	TQ	-	TQ			3	3
5W-8	ENF	41M	SUR	DBTG	TQ	-	TQ			3	3
5W-8	ENF	41N	SUR	DBTG	TQ	-	TQ			3	3
5W-8	ENF	41O	SUR	DBTG	TQ	-	TQ			3	3
5W-8	ENF	5	SUR	FLKTL	CD	-	CD			3	3
5W-8	ENF	6	SUR	FLKTL	TQ	-	TQ			3	3
5W-8	ENF	7	SUR	FLKTL	TQ	-	TQ			3	3
5W-8	ENF	8	SUR	FLKTL	I	MGM	MG			3	3
5X-5	ENF	1	SUR	BIFACE	TQ	-	TQ	6.1		3	3
5X-5	ENF	2	SUR	PRJPT	I	CO	CO			3	3
5Y-7	ENF	1	SUR	FRMFLKTL	I	MGM	MG	10.7		4	3
5Y-7	ENF	2	SUR	FRMFLKTL	TQ	-	TQ	6.7		4	3
6-A	474	11	SUR	PRJPT	I	MH	MH	4.1		1	3
6-A	474	60A	CSC	DBTG	I	MGM	MG			1	3
6-A	474	60B	CSC	DBTG	I	TQ	TQ	3.2		1	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
6-A	474	60C	CSC	DBTG	TQ	-	TQ	3.1		1	3
6-A	474	60D	CSC	DBTG	TQ	-	TQ	3.2		1	3
6-A	474	60E	CSC	DBTG	TQ	-	TQ	3.2		1	3
6-A	474	60F	CSC	DBTG	TQ	-	TQ	3.1		1	3
6-A	474	60G	CSC	DBTG	TQ	-	TQ	3.2		1	3
6-A	474	60H	CSC	DBTG	TQ	-	TQ			1	3
6-A	474	60I	CSC	DBTG	TQ	-	TQ			1	3
6-A	474	60J	CSC	DBTG	TQ	-	TQ			1	3
6-A	474	60K	CSC	DBTG	TQ	-	TQ			1	3
6-A	474	60L	CSC	DBTG	TQ	-	TQ			1	3
6-A	474	60M	CSC	DBTG	TQ	-	TQ			1	3
6-A	474	60N	CSC	DBTG	TQ	-	TQ			1	3
6-A	474	60O	CSC	DBTG	TQ	-	TQ			1	3
6-A	474	61A	EXC	DBTG	-	-	I	UNR		1	3
6-A	474	61B	EXC	DBTG	-	-	I	3.5		1	3
6-A	474	61C	EXC	DBTG	-	-	I	UNR		1	3
6-A	474	61D	EXC	DBTG	-	-	I	2.8		1	3
6-A	474	61E	EXC	DBTG	-	-	I	3.6		1	3
6B-14	ENF	1	SUR	PRJPT	I	MH	MH	DH		NT	-
6B-14	ENF	2	SUR	PRJPT	CD	-	CD	4.8		NT	-
6D-8	ENF	1	SUR	PRJPT	I	CD	CD	11.6	DH	3	3
6D-8	ENF	10	SUR	FLKTL	I	SV	SV			3	3
6D-8	ENF	12A	SUR	DBTG	I	MGM	MG	11.9		3	3
6D-8	ENF	12B	SUR	DBTG	I	CD	CD	3.8		3	3
6D-8	ENF	12C	SUR	DBTG	I	MGM	MG	4.8		3	3
6D-8	ENF	12D	SUR	DBTG	I	CD	CD	9.7		3	3
6D-8	ENF	12E	SUR	DBTG	I	CD	CD			3	3
6D-8	ENF	12F	SUR	DBTG	I	MGM	MG	4.8		3	3
6D-8	ENF	12G	SUR	DBTG	I	MGM	MG			3	3
6D-8	ENF	12H	SUR	DBTG	I	CD	CD			3	3
6D-8	ENF	12I	SUR	DBTG	I	MC/MGM	M			3	3
6D-8	ENF	12J	SUR	DBTG	CD	-	CD	3.8		3	3
6D-8	ENF	12K	SUR	DBTG	FS	-	FS			3	3
6D-8	ENF	12L	SUR	DBTG	TQ	-	TQ	9.5		3	3
6D-8	ENF	12M	SUR	DBTG	TQ	-	TQ			3	3
6D-8	ENF	12N	SUR	DBTG	CD	-	CD			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
6D-8	ENF	12O	SUR	DBTG	CD	-	CD			3	3
6D-8	ENF	2	SUR	BIFACE	I	MGM/MC	M			3	3
6D-8	ENF	3	SUR	BIFACE	CD	CD	CD	4.1		3	3
6D-8	ENF	4	SUR	FRMFLKTL	CD	-	CD	2.7		3	3
6D-8	ENF	5	SUR	FRMFLKTL	TQ	-	TQ	3.9	DH	3	3
6D-8	ENF	6	SUR	FLKTL	CD	-	CD			3	3
6D-8	ENF	7	SUR	FLKTL	TQ	-	TQ			3	3
6D-8	ENF	8	SUR	FLKTL	CD	-	CD			3	3
6D-8	ENF	9	SUR	FLKTL	TQ	-	TQ			3	3
6D-9	ENF	1	SUR	PRJPT	I	TQ	TQ			3	3
6D-9	ENF	10	SUR	FLKTL	CD	-	CD			3	3
6D-9	ENF	18	SUR	BIFACE	CD	-	CD			3	3
6D-9	ENF	19	SUR	FLKTL	I	TQ	TQ			3	3
6D-9	ENF	2	SUR	PRJPT	I	FS	FS			3	3
6D-9	ENF	24	SUR	BIFACE	I	MGM	MG	8.5		3	3
6D-9	ENF	25	SUR	FLKTL	I	FS	FS			3	3
6D-9	ENF	3	SUR	BIFACE	CD	CD	CD	NVB		3	3
6D-9	ENF	6	SUR	BIFACE	I	MGM	MG			3	3
6D-9	ENF	7	SUR	BIFACE	TQ	-	TQ			3	3
6D-9	ENF	8	SUR	FLKTL	TQ	-	TQ			3	3
6D-9	ENF	9	SUR	FLKTL	CD	-	CD			3	3
6E-16	ENF	1	SUR	PRJPT	I	MH	MH	2.8		4	3
6E-16	ENF	10	SUR	BIFACE	CD	-	CD			4	3
6E-16	ENF	11	SUR	BIFACE	TQ	-	TQ			4	3
6E-16	ENF	12	SUR	BIFACE	I	MH	MH			4	3
6E-16	ENF	13	SUR	BIFACE	FS	FS	FS	4.3		4	3
6E-16	ENF	14	SUR	BIFACE	CD	-	CD			4	3
6E-16	ENF	16	SUR	FRMFLKTL	CD	-	CD	4.4		4	3
6E-16	ENF	17	SUR	FRMFLKTL	CD	-	CD	4.8		4	3
6E-16	ENF	18	SUR	FRMFLKTL	CD	-	CD	5.7	4.6	4	3
6E-16	ENF	19	SUR	FRMFLKTL	I	FS	FS	4.2		4	3
6E-16	ENF	2	SUR	PRJPT	TQ	-	TQ			4	3
6E-16	ENF	21	SUR	FLKTL	I	CD	CD			4	3
6E-16	ENF	22	SUR	FLKTL	I	CD	CD			4	3
6E-16	ENF	23	SUR	FLKTL	I	FS	FS			4	3
6E-16	ENF	24	SUR	FLKTL	I	TQ	TQ			4	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
6E-16	ENF	25	SUR	FLKTL	I	FS	FS			4	3
6E-16	ENF	26	SUR	FLKTL	TQ	-	TQ			4	3
6E-16	ENF	27	SUR	FLKTL	TQ	-	TQ			4	3
6E-16	ENF	28	SUR	FLKTL	I	MH	MH			4	3
6E-16	ENF	29	SUR	FLKTL	CD	-	CD			4	3
6E-16	ENF	3	SUR	BIFACE	I	CD	CD			4	3
6E-16	ENF	30	SUR	FLKTL	CD	-	CD			4	3
6E-16	ENF	31	SUR	FLKTL	I	MH	MH			4	3
6E-16	ENF	32	SUR	FLKTL	I	MH	MH			4	3
6E-16	ENF	33	SUR	FLKTL	I	SV	SV			4	3
6E-16	ENF	34	SUR	FLKTL	I	MH	MH			4	3
6E-16	ENF	35	SUR	FLKTL	I	MH	MH			4	3
6E-16	ENF	36	SUR	FLKTL	I	MH/MGM	I			4	3
6E-16	ENF	38	SUR	FLKTL	I	MH	MH			4	3
6E-16	ENF	39	SUR	FLKTL	TQ	-	TQ			4	3
6E-16	ENF	4	SUR	BIFACE	I	SV	SV			4	3
6E-16	ENF	40	SUR	FLKTL	CD	-	CD			4	3
6E-16	ENF	45	SUR	FLKTL	CD	-	CD			4	3
6E-16	ENF	46A	SUR	DBTG	I	FS	FS	8.5		4	3
6E-16	ENF	46B	SUR	DBTG	I	FS	FS	4.6		4	3
6E-16	ENF	46C	SUR	DBTG	I	CD	CD	3.8		4	3
6E-16	ENF	46D	SUR	DBTG	I	SV/CD	I			4	3
6E-16	ENF	46E	SUR	DBTG	I	CD	CD	3.8		4	3
6E-16	ENF	46F	SUR	DBTG	I	TQ	TQ			4	3
6E-16	ENF	46G	SUR	DBTG	I	CD	CD	3.8		4	3
6E-16	ENF	46H	SUR	DBTG	I	CD	CD	4.4		4	3
6E-16	ENF	46I	SUR	DBTG	I	MGM	MG	4.0		4	3
6E-16	ENF	46J	SUR	DBTG	CD	-	CD			4	3
6E-16	ENF	46K	SUR	DBTG	CD	-	CD			4	3
6E-16	ENF	46L	SUR	DBTG	CD	-	CD			4	3
6E-16	ENF	46M	SUR	DBTG	TQ	-	TQ	2.9	4.5	4	3
6E-16	ENF	46N	SUR	DBTG	TQ	-	TQ			4	3
6E-16	ENF	46O	SUR	DBTG	TQ	-	TQ			4	3
6E-16	ENF	5	SUR	BIFACE	TQ	-	TQ	5.0		4	3
6E-16	ENF	6	SUR	BIFACE	TQ	-	TQ			4	3
6E-16	ENF	7	SUR	BIFACE	CD	-	CD	3.2		4	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
6E-16	ENF	8	SUR	BIFACE	I	SV	SV			4	3
6E-16	ENF	9	SUR	BIFACE	CD	-	CD			4	3
6Q-12	ENF	1	SUR	PRJPT	I	CD	CD			4	3
6Q-12	ENF	2	SUR	FLKTL	CD	-	CD			4	3
6Q-9	ENF	1	SUR	PRJPT	I	MH	MH			4	3
6Q-9	ENF	10	SUR	BIFACE	I	MGM/MH	I	4.7		4	3
6Q-9	ENF	11	SUR	BIFACE	CD	-	CD			4	3
6Q-9	ENF	12	SUR	BIFACE	CD	-	CD			4	3
6Q-9	ENF	13	SUR	BIFACE	CD	-	CD			4	3
6Q-9	ENF	15	SUR	PTBLNK	TQ	-	TQ	2.8		4	3
6Q-9	ENF	16	SUR	FRMFLKTL	CD	-	CD	3.2		4	3
6Q-9	ENF	17	SUR	FRMFLKTL	CD	-	CD	3.0		4	3
6Q-9	ENF	18	SUR	FLKTL	CD	-	CD			4	3
6Q-9	ENF	19	SUR	FLKTL	CD	-	CD			4	3
6Q-9	ENF	2	SUR	PRJPT	CD	-	CD	4.0		4	3
6Q-9	ENF	20	SUR	FLKTL	I	CD/SV	I			4	3
6Q-9	ENF	21	SUR	FLKTL	CD	-	CD			4	3
6Q-9	ENF	22	SUR	FLKTL	I	CD	CD			4	3
6Q-9	ENF	23	SUR	FLKTL	I	SV	SV			4	3
6Q-9	ENF	24A	SUR	DBTG	I	CD	CD	4.8		4	3
6Q-9	ENF	24B	SUR	DBTG	I	CD	CD	3.7		4	3
6Q-9	ENF	24C	SUR	DBTG	I	SV	SV	3.3	5.0	4	3
6Q-9	ENF	24D	SUR	DBTG	I	CD	CD	5.1		4	3
6Q-9	ENF	24E	SUR	DBTG	I	CD/SV	I			4	3
6Q-9	ENF	24F	SUR	DBTG	I	CD	CD	5.0		4	3
6Q-9	ENF	24G	SUR	DBTG	I	CD	CD	5.0		4	3
6Q-9	ENF	24H	SUR	DBTG	I	CD	CD			4	3
6Q-9	ENF	24I	SUR	DBTG	I	CD	CD			4	3
6Q-9	ENF	24J	SUR	DBTG	I	CD	CD			4	3
6Q-9	ENF	24K	SUR	DBTG	I	CD	CD			4	3
6Q-9	ENF	24L	SUR	DBTG	CD	-	CD			4	3
6Q-9	ENF	24M	SUR	DBTG	CD	-	CD	5.0		4	3
6Q-9	ENF	24N	SUR	DBTG	CD	-	CD	5.1		4	3
6Q-9	ENF	24O	SUR	DBTG	CD	-	CD			4	3
6Q-9	ENF	3	SUR	PRJPT	TQ	-	TQ			4	3
6Q-9	ENF	4	SUR	PRJPT	I	SV	SV			4	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
6Q-9	ENF	5	SUR	BIFACE	CD	-	CD			4	3
6Q-9	ENF	6	SUR	BIFACE	I	MGM	MG			4	3
6Q-9	ENF	7	SUR	BIFACE	I	MGM	MG	4.7		4	3
6Q-9	ENF	8	SUR	BIFACE	CD	-	CD	3.8		4	3
6Q-9	ENF	9	SUR	BIFACE	I	SV	SV			4	3
6X-1	ENF	1	SUR	BIFACE	TQ	-	TQ			3	3
6X-1	ENF	2	SUR	FLKTL	I	TQ	TQ			3	3
6X-1	ENF	3	SUR	FLKTL	TQ	-	TQ			3	3
6X-1	ENF	4	SUR	FLKTL	TQ	-	TQ			3	3
6X-1	ENF	5	SUR	FLKTL	TQ	-	TQ			3	3
6X-1	ENF	6	SUR	FLKTL	I	MH	MH			3	3
6X-1	ENF	7	SUR	FLKTL	CD	-	CD			3	3
6X-1	ENF	8	SUR	FLKTL	I	CD	CD			3	3
7Q-10	ENF	1	SUR	BIFACE	CD	-	CD			3	3
7Q-19	ENF	1	SUR	BIFACE	CD	-	CD	6.8		4	3
7Q-19	ENF	2	SUR	BIFACE	I	MGM	MG	4.7		4	3
7Q-19	ENF	3	SUR	FLKTL	CD	-	CD			4	3
7Q-19	ENF	4	SUR	FLKTL	CD	-	CD			4	3
7Q-19	ENF	5	SUR	FLKTL	CD	-	CD			4	3
7Q-19	ENF	6	SUR	FLKTL	I	SV	SV			4	3
7Q-19	ENF	7	SUR	FLKTL	CD	-	CD			4	3
7Q-19	ENF	8A	SUR	DBTG	I	FS	FS	7.1		4	3
7Q-19	ENF	8B	SUR	DBTG	I	CD	CD	9.7		4	3
7Q-19	ENF	8C	SUR	DBTG	I	MGM	MG	12.5		4	3
7Q-19	ENF	8D	SUR	DBTG	I	SV/CD	I			4	3
7Q-19	ENF	8E	SUR	DBTG	I	CD	CD			4	3
7Q-19	ENF	8F	SUR	DBTG	I	MGM	MG			4	3
7Q-19	ENF	8G	SUR	DBTG	I	MGM	MG	5.0		4	3
7Q-19	ENF	8H	SUR	DBTG	I	TQ	TQ	5.5		4	3
7Q-19	ENF	8I	SUR	DBTG	I	MGM/MC	M			4	3
7Q-19	ENF	8J	SUR	DBTG	I	MGM	MG			4	3
7Q-19	ENF	8K	SUR	DBTG	CD	-	CD	11.7		4	3
7Q-19	ENF	8L	SUR	DBTG	CD	-	CD			4	3
7Q-19	ENF	8M	SUR	DBTG	CD	-	CD			4	3
7Q-19	ENF	8N	SUR	DBTG	CD	-	CD			4	3
7Q-19	ENF	8O	SUR	DBTG	FS	-	FS			4	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
7S-16	ENF	1	SUR	PRJPT	TQ	-	TQ			NT	-
7Y-12	ENF	1	SUR	BIFACE	CD	-	CD	3.8		1	3
7Y-12	ENF	10	SUR	FLKTL	I	CD	CD			1	3
7Y-12	ENF	11	SUR	PTBLNK	I	MGM	MG	4.7		1	3
7Y-12	ENF	12	SUR	FLKTL	TQ	-	TQ			1	3
7Y-12	ENF	13	SUR	FLKTL	I	TQ	TQ			1	3
7Y-12	ENF	14	SUR	FLKTL	I	SV	SV			1	3
7Y-12	ENF	15	SUR	FLKTL	TQ	-	TQ			1	3
7Y-12	ENF	16	SUR	BIFACE	TQ	-	TQ			1	3
7Y-12	ENF	17	SUR	FLKTL	I	CD	CD			1	3
7Y-12	ENF	18	SUR	CORE	TQ	-	TQ	3.3		1	3
7Y-12	ENF	2	SUR	FRMFLKTL	I	MGM	MG	4.2		1	3
7Y-12	ENF	3	SUR	FRMFLKTL	CD	-	CD	3.2		1	3
7Y-12	ENF	4	SUR	FLKTL	CD	-	CD			1	3
7Y-12	ENF	5	SUR	FLKTL	TQ	-	TQ			1	3
7Y-12	ENF	6	SUR	FLKTL	TQ	-	TQ			1	3
7Y-12	ENF	7	SUR	FLKTL	CD	-	CD			1	3
7Y-12	ENF	8	SUR	FLKTL	I	TQ	TQ			1	3
7Y-12	ENF	9	SUR	FLKTL	CD	-	CD			1	3
7Z-2	ENF	1	SUR	PRJPT	CD	-	CD	5.6		3	3
7Z-2	ENF	2	SUR	PRJPT	TQ	-	TQ			3	3
8-A	474	12	SUR	PRJPT	I	MGM	MG	3.4		2	3
8-A	474	13	SUR	PRJPT	I	MH	MH	3.3		2	3
8-A	474	14	SUR	PRJPT	I	MH	MH	2.5		2	3
8-A	474	62A	CSC	DBTG	I	MGM/MH	I	3.6		2	3
8-A	474	62B	CSC	DBTG	I	MH	MH	3.4		2	3
8-A	474	62C	CSC	DBTG	I	MGM	MG	DH		2	3
8-A	474	62D	CSC	DBTG	I	TQ	TQ	3.5		2	3
8-A	474	62E	CSC	DBTG	I	CD	CD	7.5		2	3
8-A	474	62F	CSC	DBTG	I	CD	CD	12.7		2	3
8-A	474	62G	CSC	DBTG	I	TQ	TQ			2	3
8-A	474	62H	CSC	DBTG	I	MGM	MG	12.6	7.4	2	3
8-A	474	62I	CSC	DBTG	I	TQ	TQ			2	3
8-A	474	62J	CSC	DBTG	I	CD	CD			2	3
8-A	474	62K	CSC	DBTG	CD	-	CD			2	3
8-A	474	62L	CSC	DBTG	TQ	-	TQ	5.4		2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
8-A	474	62M	CSC	DBTG	TQ	-	TQ			2	3
8-A	474	62N	CSC	DBTG	TQ	-	TQ			2	3
8-A	474	62O	CSC	DBTG	TQ	-	TQ			2	3
8B-11	ENF	1	SUR	FLKTL	I	MGM	MG			2	3
8B-11	ENF	3	SUR	PRJPT	I	MC	MC	10.6		2	3
8B-11	ENF	4	SUR	FLKTL	CD	-	CD			2	3
8B-15	ENF	1	SUR	PRJPT	TQ	-	TQ	7.2		2	3
8B-15	ENF	2	SUR	PRJPT	I	TQ	TQ			2	3
8B-15	ENF	3	SUR	BIFACE	I	CD	CD			2	3
8B-15	ENF	4	SUR	FLKTL	I	MGM	MG			2	3
8B-15	ENF	5	SUR	FLKTL	TQ	-	TQ			2	3
8D-3	ENF	1	SUR	BIFACE	CD	-	CD	5.3		3	2
8D-3	ENF	10	SUR	FLKTL	TQ	-	TQ			3	2
8D-3	ENF	11	SUR	FLKTL	CD	-	CD			3	2
8D-3	ENF	12	SUR	FLKTL	CD	-	CD			3	2
8D-3	ENF	13	SUR	FLKTL	I	MC	MC			3	2
8D-3	ENF	14	SUR	FLKTL	I	MGM	MG			3	2
8D-3	ENF	15	SUR	FLKTL	I	MGM	MG			3	2
8D-3	ENF	16	SUR	FLKTL	I	CD	CD			3	2
8D-3	ENF	17	SUR	FLKTL	FS	-	FS			3	2
8D-3	ENF	18	SUR	FLKTL	TQ	-	TQ			3	2
8D-3	ENF	19	SUR	FLKTL	TQ	-	TQ			3	2
8D-3	ENF	2	SUR	BIFACE	CD	-	CD			3	2
8D-3	ENF	20	SUR	FLKTL	I	CD	CD			3	2
8D-3	ENF	21	SUR	FLKTL	I	TQ/FS	I			3	2
8D-3	ENF	22	SUR	FLKTL	TQ	-	TQ			3	2
8D-3	ENF	23	SUR	FLKTL	CD	-	CD			3	2
8D-3	ENF	24	SUR	FLKTL	I	SV	SV			3	2
8D-3	ENF	25	SUR	FLKTL	I	SV	SV			3	2
8D-3	ENF	26	SUR	FLKTL	CD	-	CD			3	2
8D-3	ENF	27	SUR	FLKTL	I	MGM	MG			3	2
8D-3	ENF	28	SUR	FLKTL	I	CD/SV	I			3	2
8D-3	ENF	29	SUR	FRMFLKTL	I	SV	SV	4.7		3	2
8D-3	ENF	3	SUR	BIFACE	TQ	-	TQ			3	2
8D-3	ENF	30	SUR	FLKTL	I	SV	SV			3	2
8D-3	ENF	31	SUR	PTBLNK	I	SV	SV	3.3		3	2

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
8D-3	ENF	32	SUR	FLKTL	TQ	-	TQ			3	2
8D-3	ENF	33	SUR	FLKTL	I	MH	MH			3	2
8D-3	ENF	34	SUR	FLKTL	I	SV	SV			3	2
8D-3	ENF	35	SUR	FLKTL	I	MH	MH			3	2
8D-3	ENF	36	SUR	FLKTL	I	MH	MH			3	2
8D-3	ENF	37A	SUR	DBTG	I	MGM	MG	9.2		3	2
8D-3	ENF	37B	SUR	DBTG	I	MGM	MG	1.8		3	2
8D-3	ENF	37C	SUR	DBTG	I	CD	CD	4.7		3	2
8D-3	ENF	37D	SUR	DBTG	I	MGM	MG	3.1		3	2
8D-3	ENF	37E	SUR	DBTG	I	MGM	MG			3	2
8D-3	ENF	37F	SUR	DBTG	I	CO	CO	1.9		3	2
8D-3	ENF	37G	SUR	DBTG	I	CD	CD	11.8		3	2
8D-3	ENF	37H	SUR	DBTG	FS	-	FS	4.9		3	2
8D-3	ENF	37I	SUR	DBTG	FS	FS	FS			3	2
8D-3	ENF	37J	SUR	DBTG	FS	-	FS	2.8		3	2
8D-3	ENF	37K	SUR	DBTG	CD	-	CD			3	2
8D-3	ENF	37L	SUR	DBTG	FS	FS	FS			3	2
8D-3	ENF	37M	SUR	DBTG	CD	-	CD			3	2
8D-3	ENF	37N	SUR	DBTG	CD	-	CD			3	2
8D-3	ENF	37O	SUR	DBTG	TQ	-	TQ			3	2
8D-3	ENF	4	SUR	BIFACE	CD	CD/SV	I	8.2	2.0	3	2
8D-3	ENF	5	SUR	BIFACE	CD	-	CD			3	2
8D-3	ENF	6	SUR	BIFACE	CD	-	CD			3	2
8D-3	ENF	7	SUR	FRMFLKTL	I	MGM	MG	4.7		3	2
8D-3	ENF	8	SUR	FRMFLKTL	TQ	-	TQ	1.2		3	2
8D-3	ENF	9	SUR	FLKTL	CD	-	CD			3	2
8D-4	ENF	1	SUR	PRJPT	CD	-	CD	4.8		3	3
8D-4	ENF	10	SUR	BIFACE	CD	-	CD	3.3		3	3
8D-4	ENF	11	SUR	PTBLNK	I	MC/MGM	M	8.2		3	3
8D-4	ENF	12	SUR	PTBLNK	TQ	-	TQ	1.4		3	3
8D-4	ENF	13	SUR	FLKTL	I	TQ	TQ			3	3
8D-4	ENF	14	SUR	FLKTL	I	MH	MH			3	3
8D-4	ENF	15	SUR	FLKTL	TQ	-	TQ			3	3
8D-4	ENF	16	SUR	FLKTL	I	FS	FS			3	3
8D-4	ENF	17	SUR	FLKTL	TQ	-	TQ			3	3
8D-4	ENF	18	SUR	FLKTL	TQ	-	TQ			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
8D-4	ENF	19	SUR	FLKTL	TQ	-	TQ			3	3
8D-4	ENF	2	SUR	BIFACE	I	CD	CD	6.5	5.2	3	3
8D-4	ENF	20	SUR	FLKTL	I	MGM	MG			3	3
8D-4	ENF	21	SUR	FLKTL	TQ	-	TQ			3	3
8D-4	ENF	22	SUR	FLKTL	TQ	-	TQ			3	3
8D-4	ENF	23	SUR	FLKTL	TQ	-	TQ			3	3
8D-4	ENF	24	SUR	FLKTL	I	MC/MGM	M			3	3
8D-4	ENF	25	SUR	FLKTL	TQ	-	TQ			3	3
8D-4	ENF	27	SUR	FLKTL	CD	-	CD			3	3
8D-4	ENF	28	SUR	FLKTL	TQ	-	TQ			3	3
8D-4	ENF	29	SUR	FLKTL	TQ	-	TQ			3	3
8D-4	ENF	3	SUR	BIFACE	I	MC/MGM	M	10.6		3	3
8D-4	ENF	30	SUR	FLKTL	I	TQ	TQ			3	3
8D-4	ENF	31	SUR	FLKTL	TQ	-	TQ			3	3
8D-4	ENF	32	SUR	FLKTL	I	MGM/MC	M			3	3
8D-4	ENF	33	SUR	FLKTL	I	-	I			3	3
8D-4	ENF	34	SUR	FLKTL	CD	-	CD			3	3
8D-4	ENF	35	SUR	PTBLNK	TQ	-	TQ	6.7		3	3
8D-4	ENF	36	SUR	FLKTL	CD	-	CD			3	3
8D-4	ENF	37	SUR	FLKTL	TQ	-	TQ			3	3
8D-4	ENF	4	SUR	BIFACE	I	TQ	TQ	2.6		3	3
8D-4	ENF	43A	SUR	DBTG	I	MGM/MH	I			3	3
8D-4	ENF	43B	SUR	DBTG	I	FS	FS	9.4		3	3
8D-4	ENF	43C	SUR	DBTG	I	MH	MH	5.9		3	3
8D-4	ENF	43D	SUR	DBTG	I	MGM	MG	6.8		3	3
8D-4	ENF	43E	SUR	DBTG	CD	-	CD	9.2		3	3
8D-4	ENF	43F	SUR	DBTG	CD	-	CD	NMB		3	3
8D-4	ENF	43G	SUR	DBTG	TQ	-	TQ	1.8		3	3
8D-4	ENF	43H	SUR	DBTG	TQ	-	TQ	1.3		3	3
8D-4	ENF	43I	SUR	DBTG	TQ	-	TQ			3	3
8D-4	ENF	43J	SUR	DBTG	TQ	-	TQ	1.3		3	3
8D-4	ENF	43K	SUR	DBTG	TQ	-	TQ			3	3
8D-4	ENF	43L	SUR	DBTG	TQ	-	TQ			3	3
8D-4	ENF	43M	SUR	DBTG	TQ	-	TQ			3	3
8D-4	ENF	43N	SUR	DBTG	TQ	-	TQ			3	3
8D-4	ENF	43O	SUR	DBTG	TQ	-	TQ			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
8D-4	ENF	5	SUR	BIFACE	I	TQ	TQ			3	3
8D-4	ENF	7	SUR	BIFACE	TQ	-	TQ	DH		3	3
8D-4	ENF	8	SUR	BIFACE	I	MGM	MG			3	3
8D-4	ENF	9	SUR	BIFACE	TQ	-	TQ			3	3
8G-15	ENF	2	SUR	BIFACE	TQ	-	TQ	5.3		3	2
8G-15	ENF	3	SUR	BIFACE	CD	-	CD			3	2
8G-15	ENF	4	SUR	FLKTL	CD	-	CD			3	2
8G-15	ENF	5	SUR	FLKTL	I	-	I			3	2
8G-15	ENF	7	SUR	FLKTL	CD	-	CD			3	2
8H-11	ENF	1	SUR	PRJPT	I	-	I	9.0		4	2
8H-11	ENF	10	SUR	BIFACE	CD	CD	CD	5.7	4.1	4	2
8H-11	ENF	11	SUR	BIFACE	I	-	-			4	2
8H-11	ENF	12	SUR	BIFACE	TQ	-	TQ	5.0		4	2
8H-11	ENF	13	SUR	FLKTL	CD	-	CD			4	2
8H-11	ENF	14	SUR	FLKTL	I	-	I			4	2
8H-11	ENF	15	SUR	FLKTL	I	-	I			4	2
8H-11	ENF	16	SUR	FLKTL	I	-	I			4	2
8H-11	ENF	17	SUR	FLKTL	I	-	I			4	2
8H-11	ENF	18	SUR	FLKTL	I	-	I			4	2
8H-11	ENF	19	SUR	FLKTL	TQ	-	TQ			4	2
8H-11	ENF	2	SUR	BIFACE	I	-	-			4	2
8H-11	ENF	20	SUR	FLKTL	I	-	I			4	2
8H-11	ENF	21	SUR	FLKTL	I	-	I			4	2
8H-11	ENF	22	SUR	FLKTL	I	-	I			4	2
8H-11	ENF	23	SUR	FLKTL	I	MH/SV	I			4	2
8H-11	ENF	24	SUR	FLKTL	I	TQ	TQ			4	2
8H-11	ENF	25	SUR	FLKTL	TQ	-	TQ			4	2
8H-11	ENF	26	SUR	FLKTL	I	MH	MH			4	2
8H-11	ENF	27	SUR	FLKTL	I	MGM	MG			4	2
8H-11	ENF	28	SUR	FLKTL	I	MGM	MG			4	2
8H-11	ENF	29	SUR	FLKTL	I	MH	MH			4	2
8H-11	ENF	3	SUR	BIFACE	TQ	-	TQ			4	2
8H-11	ENF	30	SUR	FLKTL	I	MH	MH			4	2
8H-11	ENF	33A	SUR	DBTG	I	CD/SV	I			4	2
8H-11	ENF	33B	SUR	DBTG	I	MGM	MG	6.0		4	2
8H-11	ENF	33C	SUR	DBTG	I	CD	CD	5.5		4	2

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
8H-11	ENF	33D	SUR	DBTG	I	MGM/MC	M			4	2
8H-11	ENF	33E	SUR	DBTG	I	MGM	MG	6.0		4	2
8H-11	ENF	33F	SUR	DBTG	CD	-	CD	5.7		4	2
8H-11	ENF	33G	SUR	DBTG	CD	-	CD	5.8		4	2
8H-11	ENF	33H	SUR	DBTG	CD	-	CD	5.7		4	2
8H-11	ENF	33I	SUR	DBTG	TQ	-	TQ			4	2
8H-11	ENF	33J	SUR	DBTG	TQ	-	TQ			4	2
8H-11	ENF	33K	SUR	DBTG	TQ	-	TQ			4	2
8H-11	ENF	33L	SUR	DBTG	TQ	-	TQ			4	2
8H-11	ENF	33M	SUR	DBTG	CD	-	CD			4	2
8H-11	ENF	33N	SUR	DBTG	CD	-	CD	12.6		4	2
8H-11	ENF	33O	SUR	DBTG	TQ	-	TQ	8.4		4	2
8H-11	ENF	4	SUR	BIFACE	I	-	-			4	2
8H-11	ENF	5	SUR	BIFACE	I	-	-			4	2
8H-11	ENF	6	SUR	BIFACE	TQ	-	TQ	4.0		4	2
8H-11	ENF	7	SUR	BIFACE	TQ	-	TQ	3.9		4	2
8H-11	ENF	8	SUR	BIFACE	I	-	-			4	2
8H-11	ENF	9	SUR	BIFACE	TQ	-	TQ			4	2
9G-4	ENF	1	SUR	PRJPT	I	MGM	MG			4	3
9G-4	ENF	10	SUR	FRMFLKTL	CD	-	CD	4.0		4	3
9G-4	ENF	11	SUR	FLKTL	TQ	-	TQ			4	3
9G-4	ENF	12	SUR	FLKTL	TQ	-	TQ			4	3
9G-4	ENF	13	SUR	FLKTL	I	MGM	MG			4	3
9G-4	ENF	14	SUR	DRILL	CD	-	CD			4	3
9G-4	ENF	15	SUR	FLKTL	TQ	-	TQ			4	3
9G-4	ENF	16	SUR	FLKTL	CD	-	CD			4	3
9G-4	ENF	17	SUR	FLKTL	I	TQ	TQ			4	3
9G-4	ENF	18	SUR	FLKTL	TQ	-	TQ			4	3
9G-4	ENF	19	SUR	FLKTL	CD	-	CD			4	3
9G-4	ENF	2	SUR	PRJPT	I	MH	MH	3.2		4	3
9G-4	ENF	20	SUR	FLKTL	I	SV	SV			4	3
9G-4	ENF	21	SUR	FLKTL	I	MH/MGM	I			4	3
9G-4	ENF	22	SUR	FLKTL	I	CD	CD			4	3
9G-4	ENF	23	SUR	FLKTL	I	SV	SV			4	3
9G-4	ENF	24	SUR	FLKTL	I	SV	SV			4	3
9G-4	ENF	25	SUR	FLKTL	TQ	-	TQ			4	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
9G-4	ENF	26	SUR	FLKTL	CD	-	CD			4	3
9G-4	ENF	27	SUR	FLKTL	I	-	I			4	3
9G-4	ENF	28	SUR	FLKTL	I	TQ	TQ			4	3
9G-4	ENF	29A	SUR	DBTG	I	MGM	MG	3.3		4	3
9G-4	ENF	29B	SUR	DBTG	I	CD	CD	2.3		4	3
9G-4	ENF	29C	SUR	DBTG	I	CD	CD	12.7		4	3
9G-4	ENF	29D	SUR	DBTG	I	SV	SV			4	3
9G-4	ENF	29E	SUR	DBTG	I	MGM	MG			4	3
9G-4	ENF	29F	SUR	DBTG	I	CD	CD	10.2		4	3
9G-4	ENF	29G	SUR	DBTG	I	CD	CD	4.7		4	3
9G-4	ENF	29H	SUR	DBTG	I	CD	CD	4.9		4	3
9G-4	ENF	29I	SUR	DBTG	I	SV/CD	I			4	3
9G-4	ENF	29J	SUR	DBTG	CD	-	CD	3.0		4	3
9G-4	ENF	29K	SUR	DBTG	CD	-	CD			4	3
9G-4	ENF	29L	SUR	DBTG	CD	-	CD			4	3
9G-4	ENF	29M	SUR	DBTG	TQ	-	TQ			4	3
9G-4	ENF	29N	SUR	DBTG	CD	-	CD			4	3
9G-4	ENF	29O	SUR	DBTG	CD	-	CD			4	3
9G-4	ENF	3	SUR	PRJPT	CD	-	CD			4	3
9G-4	ENF	4	SUR	PRJPT	TQ	-	TQ			4	3
9G-4	ENF	5	SUR	BIFACE	I	CD/SV	I			4	3
9G-4	ENF	6	SUR	BIFACE	CD	CD	CD	4.1		4	3
9G-4	ENF	7	SUR	BIFACE	I	SV	SV	4.4		4	3
9G-4	ENF	8	SUR	BIFACE	CD	-	CD			4	3
9G-4	ENF	9	SUR	DRILL	I	MGM	MG			4	3
E-17	ENF	1	SUR	PRJPT	I	MGM	MG	5.5		2	3
E-17	ENF	10	SUR	FLKTL	TQ	-	TQ			2	3
E-17	ENF	11	SUR	FLKTL	I	CD	CD			2	3
E-17	ENF	12	SUR	FLKTL	TQ	-	TQ			2	3
E-17	ENF	13	SUR	FLKTL	TQ	-	TQ			2	3
E-17	ENF	14	SUR	FLKTL	CD	-	CD			2	3
E-17	ENF	15	SUR	PTBLNK	CD	-	CD	1.3		2	3
E-17	ENF	2	SUR	PRJPT	TQ	-	TQ	8.4		2	3
E-17	ENF	3	SUR	BIFACE	CD	-	CD	8.2		2	3
E-17	ENF	4	SUR	BIFACE	TQ	-	TQ	4.0		2	3
E-17	ENF	5	SUR	BIFACE	TQ	-	TQ	4.7		2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
E-17	ENF	6	SUR	BIFACE	CD	-	CD			2	3
E-17	ENF	7	SUR	FRMFLKTL	CD	-	CD	12.6		2	3
E-17	ENF	9	SUR	FLKTL	TQ	-	TQ			2	3
E-17A	ENF	10	SUR	BIFACE	TQ	-	TQ			2	3
E-17A	ENF	11	SUR	FLKTL	TQ	-	TQ			2	3
E-17A	ENF	12	SUR	FLKTL	TQ	-	TQ			2	3
E-17A	ENF	13	SUR	FLKTL	I	MGM	MG			2	3
E-17A	ENF	15	SUR	PRJPT	I	SV/CD	I			2	3
E-17A	ENF	16	SUR	PRJPT	I	MGM	MG			2	3
E-17A	ENF	3	SUR	FLKTL	I	MGM	MG			2	3
E-17A	ENF	4	SUR	FLKTL	I	TQ	TQ			2	3
E-17A	ENF	5	SUR	FLKTL	CD	-	CD			2	3
E-17A	ENF	6A	SUR	DBTG	I	MGM	MG	1.2		2	3
E-17A	ENF	6B	SUR	DBTG	I	CD	CD			2	3
E-17A	ENF	6C	SUR	DBTG	I	CD	CD			2	3
E-17A	ENF	6D	SUR	DBTG	I	CD	CD			2	3
E-17A	ENF	6E	SUR	DBTG	I	CD	CD	1.3		2	3
E-17A	ENF	6F	SUR	DBTG	I	CD	CD	1.2		2	3
E-17A	ENF	6G	SUR	DBTG	I	TQ	TQ	9.8		2	3
E-17A	ENF	6H	SUR	DBTG	I	MGM	MG	13.5		2	3
E-17A	ENF	6I	SUR	DBTG	I	SV/CD	I			2	3
E-17A	ENF	6J	SUR	DBTG	TQ	-	TQ	1.3		2	3
E-17A	ENF	6K	SUR	DBTG	TQ	-	TQ	6.4		2	3
E-17A	ENF	6L	SUR	DBTG	TQ	-	TQ			2	3
E-17A	ENF	6M	SUR	DBTG	TQ	-	TQ	10.1		2	3
E-17A	ENF	6N	SUR	DBTG	CD	-	CD			2	3
E-17A	ENF	6O	SUR	DBTG	CD	-	CD			2	3
E-17B	ENF	11	SUR	PRJPT	I	TQ	TQ	10.5		2	3
E-17B	ENF	12	SUR	FLKTL	CD	-	CD			2	3
E-17B	ENF	13	SUR	FLKTL	TQ	-	TQ			2	3
E-17B	ENF	14	SUR	FLKTL	TQ	-	TQ			2	3
E-17B	ENF	15	SUR	FLKTL	TQ	-	TQ			2	3
E-17B	ENF	16	SUR	FLKTL	CD	-	CD			2	3
E-17B	ENF	17	SUR	FLKTL	TQ	-	TQ			2	3
E-17B	ENF	18	SUR	FLKTL	I	TQ	TQ			2	3
E-17B	ENF	19	SUR	FLKTL	TQ	-	TQ			2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
E-17B	ENF	20	SUR	FLKTL	TQ	-	TQ			2	3
E-17B	ENF	21	SUR	FLKTL	TQ	-	TQ			2	3
E-17B	ENF	22A	SUR	DBTG	I	MGM	MG			2	3
E-17B	ENF	22B	SUR	DBTG	I	MGM	MG			2	3
E-17B	ENF	22C	SUR	DBTG	I	MH	MH	13.5		2	3
E-17B	ENF	22D	SUR	DBTG	I	CD	CD	4.5		2	3
E-17B	ENF	22E	SUR	DBTG	TQ	-	TQ	DH		2	3
E-17B	ENF	22F	SUR	DBTG	TQ	-	TQ	1.2		2	3
E-17B	ENF	22G	SUR	DBTG	TQ	-	TQ			2	3
E-17B	ENF	22H	SUR	DBTG	TQ	-	TQ	1.4		2	3
E-17B	ENF	22I	SUR	DBTG	TQ	-	TQ	1.4		2	3
E-17B	ENF	22J	SUR	DBTG	TQ	-	TQ			2	3
E-17B	ENF	22K	SUR	DBTG	TQ	-	TQ			2	3
E-17B	ENF	22L	SUR	DBTG	TQ	-	TQ			2	3
E-17B	ENF	22M	SUR	DBTG	TQ	-	TQ	1.4		2	3
E-17B	ENF	22N	SUR	DBTG	TQ	-	TQ	4.8		2	3
E-17B	ENF	22O	SUR	DBTG	TQ	-	TQ			2	3
E-17B	ENF	3	SUR	PTBLNK	TQ	-	TQ	1.5	6.1	2	3
E-17B	ENF	4	SUR	BIFACE	TQ	-	TQ	NVB		2	3
E-17B	ENF	5	SUR	FLKTL	TQ	-	TQ			2	3
E-17B	ENF	6	SUR	FLKTL	I	MGM/MC	M			2	3
E-17B	ENF	7	SUR	FLKTL	TQ	-	TQ			2	3
E-17B	ENF	8	SUR	FLKTL	TQ	-	TQ			2	3
G-25	ENF	1	SUR	PRJPT	I	MGM	MG			4	3
G-25	ENF	10	SUR	FLKTL	TQ	-	TQ			4	3
G-25	ENF	11	SUR	PTBLNK	I	MGM	MG	1.7	7.6	4	3
G-25	ENF	12	SUR	FLKTL	I	MH	MH			4	3
G-25	ENF	2	SUR	BIFACE	TQ	-	TQ			4	3
G-25	ENF	3	SUR	BIFACE	CD	-	CD			4	3
G-25	ENF	5	SUR	FLKTL	TQ	-	TQ			4	3
G-25	ENF	6	SUR	FLKTL	CD	-	CD			4	3
G-25	ENF	7	SUR	FLKTL	TQ	-	TQ			4	3
G-25	ENF	8	SUR	FLKTL	I	MC	MC			4	3
G-25	ENF	9	SUR	FLKTL	CD	-	CD			4	3
G-32	ENF	1	SUR	BIFACE	CD	-	CD			4	2
G-32	ENF	10	SUR	FLKTL	CD	-	CD			4	2

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
G-32	ENF	11	SUR	FLKTL	I	MGM	MG			4	2
G-32	ENF	12	SUR	FLKTL	CD	-	CD			4	2
G-32	ENF	13	SUR	FLKTL	CD	-	CD			4	2
G-32	ENF	14	SUR	FLKTL	I	MH	MH			4	2
G-32	ENF	15	SUR	FLKTL	CD	-	CD			4	2
G-32	ENF	16	SUR	FLKTL	CD	-	CD			4	2
G-32	ENF	17	SUR	FRMFLKTL	CD	-	CD	4.2		4	2
G-32	ENF	19A	SUR	DBTG	I	FS	FS	9.5		4	2
G-32	ENF	19B	SUR	DBTG	I	FS	FS	9.5		4	2
G-32	ENF	19C	SUR	DBTG	I	MGM	MG			4	2
G-32	ENF	19D	SUR	DBTG	I	FS	FS	3.4		4	2
G-32	ENF	19E	SUR	DBTG	I	MGM	MG	5.3		4	2
G-32	ENF	19F	SUR	DBTG	I	CD	CD	4.8		4	2
G-32	ENF	19G	SUR	DBTG	I	FS	FS	9.5		4	2
G-32	ENF	19H	SUR	DBTG	I	CD	CD			4	2
G-32	ENF	19I	SUR	DBTG	I	FS	FS			4	2
G-32	ENF	19J	SUR	DBTG	CD	-	CD	5.2		4	2
G-32	ENF	19K	SUR	DBTG	TQ	-	TQ			4	2
G-32	ENF	19L	SUR	DBTG	TQ	-	TQ			4	2
G-32	ENF	19M	SUR	DBTG	TQ	-	TQ			4	2
G-32	ENF	19N	SUR	DBTG	CD	-	CD			4	2
G-32	ENF	19O	SUR	DBTG	CD	-	CD			4	2
G-32	ENF	2	SUR	BIFACE	TQ	-	TQ			4	2
G-32	ENF	3	SUR	BIFACE	CD	-	CD	5.9		4	2
G-32	ENF	4	SUR	BIFACE	TQ	-	TQ	4.5		4	2
G-32	ENF	5	SUR	BIFACE	CD	-	CD			4	2
G-32	ENF	6	SUR	BIFACE	CD	-	CD			4	2
G-32	ENF	7	SUR	PRJPT	TQ	-	TQ			4	2
H-21	ENF	1	SUR	PRJPT	I	MGM	MG	DH		2	1
H-21	ENF	2	SUR	PRJPT	CD	-	CD	1.6	7.9	2	1
H-21	ENF	3	SUR	PRJPT	TQ	-	TQ	3.2		2	1
H-21	ENF	4	SUR	PRJPT	TQ	-	TQ			2	1
H-21	ENF	5	SUR	PRJPT	TQ	-	TQ	5.8		2	1
H-3	ENF	2	SUR	FLKTL	I	MGM	MG			3	3
H-3	ENF	3	SUR	FLKTL	I	MGM	MG			3	3
H-3B	ENF	1	SUR	PRJPT	TQ	-	TQ	13.2		3	5

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
H-3B	ENF	2	SUR	PRJPT	TQ	-	TQ			3	5
H-3B	ENF	3	SUR	BIFACE	CD	CD	CD	6.0		3	5
H-3B	ENF	4	SUR	BIFACE	CD	-	CD			3	5
H-3B	ENF	5	SUR	FLKTL	CD	-	CD			3	5
H-3B	ENF	6	SUR	FLKTL	TQ	-	TQ			3	5
H-3B	ENF	7	SUR	PRJPT	TQ	-	TQ			3	5
H-5	ENF	1	SUR	FLKTL	I	CD	CD			2	3
H-5	ENF	2	SUR	FLKTL	CD	-	CD			2	3
H-5	ENF	3	SUR	FLKTL	I	CD	CD			2	3
ISO	455	887	ISO	PRJPT	TQ	-	TQ	11.9		3	-
ISO	455	888	ISO	PRJPT	I	CD	CD	9.9		3	-
ISO	455	889	ISO	PRJPT	TQ	-	TQ	6.4	11.8	3	-
ISO	455	894	ISO	PRJPT	CD	-	CD			3	-
ISO	455	914	ISO	PRJPT	TQ	-	TQ	6.0		3	-
ISO	455	918	ISO	PRJPT	TQ	-	TQ	5.4		3	-
ISO	455	919	ISO	PRJPT	TQ	-	TQ	5.9		3	-
K-0	ENF	1	SUR	PRJPT	TQ	-	TQ	8.4		3	3
K-0	ENF	10	SUR	PRJPT	TQ	-	TQ	2.4		3	3
K-0	ENF	103	SUR	PRJPT	TQ	-	TQ	9.2		3	3
K-0	ENF	104	SUR	PRJPT	TQ	-	TQ	6.2		3	3
K-0	ENF	105	SUR	PRJPT	CD	-	CD			3	3
K-0	ENF	106	SUR	PRJPT	TQ	-	TQ			3	3
K-0	ENF	107	SUR	PRJPT	TQ	-	TQ			3	3
K-0	ENF	108	SUR	PRJPT	TQ	-	TQ			3	3
K-0	ENF	109	SUR	PTBLNK	I	MGM	MG	2.1	DH	3	3
K-0	ENF	11	SUR	PRJPT	I	SV	SV	4.0		3	3
K-0	ENF	110	SUR	PRJPT	I	TQ	TQ			3	3
K-0	ENF	111	SUR	PTBLNK	CD	-	CD	1.3	3.8	3	3
K-0	ENF	112	SUR	PRJPT	TQ	-	TQ			3	3
K-0	ENF	113	SUR	BIFACE	TQ	-	TQ			3	3
K-0	ENF	114	SUR	BIFACE	TQ	-	TQ	5.4		3	3
K-0	ENF	115	SUR	BIFACE	CD	-	CD			3	3
K-0	ENF	116	SUR	BIFACE	CD	-	CD			3	3
K-0	ENF	117	SUR	BIFACE	TQ	-	TQ			3	3
K-0	ENF	118	SUR	BIFACE	I	MGM	MG			3	3
K-0	ENF	119	SUR	BIFACE	CD	-	CD			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
K-0	ENF	120	SUR	BIFACE	CD	CD/SV	I	8.7		3	3
K-0	ENF	121	SUR	BIFACE	I	SV	SV			3	3
K-0	ENF	122	SUR	BIFACE	I	MH	MH			3	3
K-0	ENF	123	SUR	BIFACE	TQ	-	TQ	3.8		3	3
K-0	ENF	124	SUR	BIFACE	TQ	-	TQ			3	3
K-0	ENF	125	SUR	PRJPT	TQ	-	TQ	1.1	5.9	3	3
K-0	ENF	126	SUR	BIFACE	TQ	-	TQ			3	3
K-0	ENF	127	SUR	BIFACE	I	TQ/MH	I	8.2		3	3
K-0	ENF	128	SUR	BIFACE	I	MH	MH			3	3
K-0	ENF	129	SUR	BIFACE	I	MGM	MG	11.3		3	3
K-0	ENF	13	SUR	PRJPT	TQ	-	TQ	2.1		3	3
K-0	ENF	130	SUR	BIFACE	TQ	-	TQ			3	3
K-0	ENF	131	SUR	DRILL	I	MH	MH			3	3
K-0	ENF	132	SUR	BIFACE	CD	-	CD			3	3
K-0	ENF	133	SUR	BIFACE	TQ	-	TQ	DH		3	3
K-0	ENF	134	SUR	BIFACE	CD	-	CD	3.1		3	3
K-0	ENF	135	SUR	BIFACE	TQ	-	TQ			3	3
K-0	ENF	136	SUR	BIFACE	I	MGM/MH	I			3	3
K-0	ENF	137	SUR	BIFACE	TQ	-	TQ	5.4		3	3
K-0	ENF	138	SUR	BIFACE	TQ	-	TQ	4.1		3	3
K-0	ENF	139	SUR	BIFACE	TQ	-	TQ			3	3
K-0	ENF	14	SUR	PRJPT	I	SV	SV	2.3		3	3
K-0	ENF	140	SUR	BIFACE	I	MH	MH			3	3
K-0	ENF	141	SUR	BIFACE	TQ	-	TQ			3	3
K-0	ENF	142	SUR	BIFACE	I	MH	MH			3	3
K-0	ENF	143	SUR	DRILL	CD	-	CD			3	3
K-0	ENF	144	SUR	BIFACE	CD	-	CD			3	3
K-0	ENF	145	SUR	BIFACE	CD	-	CD	7.1		3	3
K-0	ENF	146	SUR	BIFACE	I	MGM	MG			3	3
K-0	ENF	147	SUR	BIFACE	TQ	-	TQ	5.3		3	3
K-0	ENF	148	SUR	BIFACE	I	MGM/MH	I			3	3
K-0	ENF	15	SUR	PRJPT	TQ	-	TQ			3	3
K-0	ENF	155	SUR	FRMFLKTL	CD	-	CD	2.8		3	3
K-0	ENF	156	SUR	FRMFLKTL	FS	FS	FS	9.7		3	3
K-0	ENF	157	SUR	FRMFLKTL	I	MH	MH	1.4		3	3
K-0	ENF	158	SUR	FRMFLKTL	CD	-	CD	9.7		3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
K-0	ENF	159	SUR	PTBLNK	I	SV	SV	2.9	3.8	3	3
K-0	ENF	16	SUR	PRJPT	TQ	-	TQ	1.3	6.2	3	3
K-0	ENF	160	SUR	BIFACE	I	TQ	TQ	10.6		3	3
K-0	ENF	161	SUR	FLKTL	I	MH/TQ	I			3	3
K-0	ENF	162	SUR	FLKTL	I	MH	MH			3	3
K-0	ENF	163	SUR	FLKTL	TQ	-	TQ			3	3
K-0	ENF	164	SUR	FLKTL	CD	-	CD			3	3
K-0	ENF	165	SUR	FLKTL	TQ	-	TQ			3	3
K-0	ENF	166	SUR	FLKTL	TQ	-	TQ			3	3
K-0	ENF	167	SUR	FLKTL	TQ	-	TQ			3	3
K-0	ENF	168	SUR	FLKTL	TQ	-	TQ			3	3
K-0	ENF	169	SUR	FLKTL	I	MGM/MH	I			3	3
K-0	ENF	17	SUR	PRJPT	CD	-	CD			3	3
K-0	ENF	170	SUR	FLKTL	TQ	-	TQ			3	3
K-0	ENF	171	SUR	FLKTL	CD	-	CD			3	3
K-0	ENF	172	SUR	FLKTL	I	MGM	MG			3	3
K-0	ENF	173	SUR	FLKTL	I	MH	MH			3	3
K-0	ENF	174	SUR	FLKTL	CD	-	CD			3	3
K-0	ENF	175	SUR	FLKTL	CD	-	CD			3	3
K-0	ENF	176	SUR	FLKTL	I	MGM	MG			3	3
K-0	ENF	177	SUR	FLKTL	TQ	-	TQ			3	3
K-0	ENF	178	SUR	FLKTL	I	CD	CD			3	3
K-0	ENF	179	SUR	FLKTL	TQ	-	TQ			3	3
K-0	ENF	180	SUR	FLKTL	TQ	-	TQ			3	3
K-0	ENF	181	SUR	FLKTL	TQ	-	TQ			3	3
K-0	ENF	182	SUR	FLKTL	TQ	-	TQ			3	3
K-0	ENF	183	SUR	FLKTL	TQ	-	TQ			3	3
K-0	ENF	184	SUR	FLKTL	CD	-	CD			3	3
K-0	ENF	185	SUR	FLKTL	CD	-	CD			3	3
K-0	ENF	186	SUR	FLKTL	CD	-	CD			3	3
K-0	ENF	187	SUR	FLKTL	TQ	-	TQ			3	3
K-0	ENF	188	SUR	FLKTL	I	MH	MH			3	3
K-0	ENF	189	SUR	FLKTL	I	SV	SV			3	3
K-0	ENF	19	SUR	PRJPT	TQ	-	TQ			3	3
K-0	ENF	190	SUR	FLKTL	TQ	-	TQ			3	3
K-0	ENF	191	SUR	FLKTL	TQ	-	TQ			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
K-0	ENF	192	SUR	FLKTL	TQ	-	TQ			3	3
K-0	ENF	193	SUR	FLKTL	TQ	-	TQ			3	3
K-0	ENF	194	SUR	FLKTL	I	FS	FS			3	3
K-0	ENF	195	SUR	FLKTL	CD	-	CD			3	3
K-0	ENF	196	SUR	FLKTL	TQ	-	TQ			3	3
K-0	ENF	197	SUR	FLKTL	I	MGM	MG			3	3
K-0	ENF	198	SUR	FLKTL	I	MGM	MG			3	3
K-0	ENF	199	SUR	FLKTL	CD	-	CD			3	3
K-0	ENF	2	SUR	PRJPT	TQ	-	TQ	8.4		3	3
K-0	ENF	20	SUR	PRJPT	TQ	-	TQ	1.6		3	3
K-0	ENF	200	SUR	FLKTL	CD	-	CD			3	3
K-0	ENF	201	SUR	FLKTL	TQ	-	TQ			3	3
K-0	ENF	202	SUR	FLKTL	CD	-	CD			3	3
K-0	ENF	203	SUR	FLKTL	I	MH/TQ	I			3	3
K-0	ENF	205	SUR	FLKTL	I	FS	FS			3	3
K-0	ENF	207	SUR	FLKTL	TQ	-	TQ			3	3
K-0	ENF	208	SUR	FLKTL	I	TQ	TQ			3	3
K-0	ENF	209	SUR	FLKTL	TQ	-	TQ			3	3
K-0	ENF	21	SUR	BIFACE	I	MH	MH			3	3
K-0	ENF	210	SUR	FLKTL	I	MGM	MG			3	3
K-0	ENF	211	SUR	FLKTL	TQ	-	TQ			3	3
K-0	ENF	212	SUR	FLKTL	I	TQ	TQ			3	3
K-0	ENF	213	SUR	FLKTL	TQ	-	TQ			3	3
K-0	ENF	215	SUR	FLKTL	I	MGM	MG			3	3
K-0	ENF	216	SUR	FLKTL	TQ	-	TQ			3	3
K-0	ENF	217	SUR	FLKTL	I	MH	MH			3	3
K-0	ENF	218	SUR	FLKTL	I	SV	SV			3	3
K-0	ENF	219	SUR	FLKTL	I	MGM/QI	I			3	3
K-0	ENF	22	SUR	BIFACE	I	CD	CD			3	3
K-0	ENF	220	SUR	FLKTL	TQ	-	TQ			3	3
K-0	ENF	221	SUR	FLKTL	I	MH	MH			3	3
K-0	ENF	222	SUR	PTBLNK	TQ	-	TQ	5.0		3	3
K-0	ENF	23	SUR	PRJPT	TQ	-	TQ			3	3
K-0	ENF	236A	SUR	DBTG	I	FS	FS	9.5		3	3
K-0	ENF	236B	SUR	DBTG	I	MGM	MG	4.6		3	3
K-0	ENF	236C	SUR	DBTG	I	FS	FS	2.5		3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
K-0	ENF	236D	SUR	DBTG	I	MGM/MC	M			3	3
K-0	ENF	236E	SUR	DBTG	I	TQ	TQ	3.8		3	3
K-0	ENF	236F	SUR	DBTG	I	MGM/MC	M			3	3
K-0	ENF	236G	SUR	DBTG	I	MGM	MG	1.5		3	3
K-0	ENF	236H	SUR	DBTG	I	TQ	TQ			3	3
K-0	ENF	236I	SUR	DBTG	I	MH	MH	3.6		3	3
K-0	ENF	236J	SUR	DBTG	I	TQ	TQ	5.4		3	3
K-0	ENF	236K	SUR	DBTG	TQ	-	TQ	12.4		3	3
K-0	ENF	236L	SUR	DBTG	TQ	-	TQ			3	3
K-0	ENF	236M	SUR	DBTG	TQ	-	TQ			3	3
K-0	ENF	236N	SUR	DBTG	TQ	-	TQ			3	3
K-0	ENF	236O	SUR	DBTG	CD	-	CD			3	3
K-0	ENF	24	SUR	BIFACE	TQ	-	TQ			3	3
K-0	ENF	25	SUR	BIFACE	TQ	-	TQ			3	3
K-0	ENF	26	SUR	PRJPT	CD	-	CD			3	3
K-0	ENF	27	SUR	BIFACE	I	MH	MH	4.1	1.8	3	3
K-0	ENF	28	SUR	BIFACE	CD	CD	CD	5.4		3	3
K-0	ENF	29	SUR	FLKTL	CD	-	CD			3	3
K-0	ENF	3	SUR	PRJPT	TQ	-	TQ	5.1		3	3
K-0	ENF	30	SUR	FLKTL	I	MGM	MG			3	3
K-0	ENF	31	SUR	FLKTL	TQ	-	TQ			3	3
K-0	ENF	32	SUR	FLKTL	I	TQ	TQ			3	3
K-0	ENF	33	SUR	FLKTL	TQ	-	TQ			3	3
K-0	ENF	34	SUR	FLKTL	TQ	-	TQ			3	3
K-0	ENF	35	SUR	FLKTL	I	MGM	MG			3	3
K-0	ENF	36	SUR	FLKTL	TQ	-	TQ			3	3
K-0	ENF	37	SUR	FLKTL	TQ	-	TQ			3	3
K-0	ENF	38	SUR	FLKTL	I	MH/MGM	I			3	3
K-0	ENF	39	SUR	FLKTL	I	MGM	MG			3	3
K-0	ENF	4	SUR	PRJPT	I	FS	FS	NVB		3	3
K-0	ENF	40	SUR	FLKTL	I	MGM	MG			3	3
K-0	ENF	41	SUR	FLKTL	CD	-	CD			3	3
K-0	ENF	44	SUR	FLKTL	I	SV	SV			3	3
K-0	ENF	45	SUR	FLKTL	I	MH	MH			3	3
K-0	ENF	46	SUR	FLKTL	I	SV	SV			3	3
K-0	ENF	47	SUR	FLKTL	I	MH/TQ	I			3	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
K-0	ENF	48	SUR	FLKTL	I	MH	MH			3	3
K-0	ENF	49	SUR	FLKTL	I	MH/MGM	I			3	3
K-0	ENF	5	SUR	PRJPT	TQ	-	TQ	5.9		3	3
K-0	ENF	6	SUR	PRJPT	CD	-	CD	5.6		3	3
K-0	ENF	7	SUR	PRJPT	CD	-	CD			3	3
K-0	ENF	8	SUR	PRJPT	CD	-	CD			3	3
K-0	ENF	9	SUR	PRJPT	I	FS	FS			3	3
K-0B	ENF	1	SUR	PRJPT	TQ	-	TQ			3	3
L-14	ENF	1	SUR	BIFACE	TQ	-	TQ	3.5		2	3
L-14	ENF	10	SUR	BIFACE	I	FS	FS			2	3
L-14	ENF	11	SUR	FRMFLKTL	CD	-	CD	3.2		2	3
L-14	ENF	12	SUR	FRMFLKTL	TQ	-	TQ	8.1		2	3
L-14	ENF	13	SUR	FLKTL	TQ	-	TQ			2	3
L-14	ENF	14	SUR	FLKTL	I	TQ	TQ			2	3
L-14	ENF	15	SUR	FLKTL	TQ	-	TQ			2	3
L-14	ENF	16	SUR	FLKTL	I	QI	QI			2	3
L-14	ENF	17	SUR	FLKTL	I	TQ	TQ			2	3
L-14	ENF	18	SUR	FLKTL	TQ	-	TQ			2	3
L-14	ENF	19	SUR	FLKTL	TQ	-	TQ			2	3
L-14	ENF	2	SUR	BIFACE	TQ	-	TQ	3.5		2	3
L-14	ENF	20	SUR	FLKTL	TQ	-	TQ			2	3
L-14	ENF	21	SUR	FLKTL	CD	-	CD			2	3
L-14	ENF	22	SUR	FLKTL	TQ	-	TQ			2	3
L-14	ENF	23	SUR	FLKTL	TQ	-	TQ			2	3
L-14	ENF	24	SUR	FLKTL	TQ	-	TQ			2	3
L-14	ENF	3	SUR	BIFACE	I	TQ	TQ	3.5		2	3
L-14	ENF	4	SUR	BIFACE	TQ	-	TQ	4.4		2	3
L-14	ENF	5	SUR	BIFACE	TQ	-	TQ	3.4		2	3
L-14	ENF	6	SUR	BIFACE	TQ	-	TQ	3.4		2	3
L-14	ENF	7	SUR	BIFACE	I	QI	QI	3.1		2	3
L-14	ENF	8	SUR	BIFACE	TQ	-	TQ	4.7		2	3
L-14	ENF	9	SUR	BIFACE	TQ	-	TQ	3.0		2	3
L-14C	ENF	1	SUR	PRJPT	I	TQ	TQ	1.9	3.8	2	1
L-14C	ENF	2	SUR	BIFACE	TQ	-	TQ	6.3		2	1
L-14C	ENF	3	SUR	PRJPT	I	MH	MH			2	1
L-14C	ENF	4	SUR	FLKTL	CD	-	CD			2	1

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
L-14C	ENF	5	SUR	FLKTL	TQ	-	TQ			2	1
L-14C	ENF	6	SUR	FLKTL	I	MGM	MG			2	1
L-14C	ENF	7	SUR	FLKTL	TQ	-	TQ			2	1
L-14C	ENF	8	SUR	FLKTL	TQ	-	TQ			2	1
NON	474	1	ISO	PRJPT	I	FS	FS	6.4		1	-
NON	474	10	ISO	PRJPT	I	TQ	TQ			2	-
NON	474	2	ISO	PRJPT	I	TQ	TQ	9.6		1	-
NON	474	23	ISO	PRJPT	CD	-	CD	6.6		4	-
NON	474	25	ISO	PRJPT	CD	-	CD			1	-
NON	474	26	ISO	PRJPT	CD	-	CD	8.9		4	-
NON	474	3	ISO	PRJPT	I	TQ/QI	I	10.2		4	-
NON	474	31	ISO	PRJPT	TQ	-	TQ	2.7		3	-
NON	474	37	ISO	PRJPT	TQ	-	TQ			2	-
NON	474	38	ISO	PRJPT	TQ	-	TQ			4	-
NON	474	4	ISO	PRJPT	I	MGM	MG	8.3		4	-
NON	474	43	ISO	PRJPT	TQ	-	TQ	8.2		1	-
NON	474	5	ISO	PRJPT	I	SV/CD	I	11.5		4	-
NON	474	6	ISO	PRJPT	I	TQ	TQ	5.4		4	-
NON	474	7	ISO	PRJPT	FS	FS	FS	3.2		3	-
NON	474	8	ISO	PRJPT	I	MC	MC	10.0		4	-
NON	474	9	ISO	PRJPT	I	FS	FS	4.4		3	-
Y-1	ENF	10	SUR	FLKTL	I	TQ	TQ			2	3
Y-1	ENF	11	SUR	FLKTL	TQ	-	TQ			2	3
Y-1	ENF	12	SUR	FLKTL	CD	-	CD			2	3
Y-1	ENF	13	SUR	FLKTL	I	MGM	MG			2	3
Y-1	ENF	14	SUR	FLKTL	TQ	-	TQ			2	3
Y-1	ENF	15	SUR	FLKTL	I	TQ	TQ			2	3
Y-1	ENF	16	SUR	FLKTL	I	FS	FS			2	3
Y-1	ENF	17	SUR	FLKTL	I	SV	SV			2	3
Y-1	ENF	18	SUR	FLKTL	CD	-	CD			2	3
Y-1	ENF	19	SUR	FLKTL	TQ	-	TQ			2	3
Y-1	ENF	2	SUR	BIFACE	CD	-	CD			2	3
Y-1	ENF	20	SUR	FLKTL	CD	-	CD			2	3
Y-1	ENF	21	SUR	FLKTL	I	MGM/MC	M			2	3
Y-1	ENF	22	SUR	FLKTL	I	MGM	MG			2	3
Y-1	ENF	23	SUR	FLKTL	CD	-	CD			2	3

Appendix C - Obsidian Source and Hydration Data

Site	Acc	Cat #	Unit Type	Artifact	Visual	XRF	Source	H1M	H2M	Quad	Site Type
Y-1	ENF	24	SUR	FLKTL	TQ	-	TQ			2	3
Y-1	ENF	25	SUR	FLKTL	I	MH	MH			2	3
Y-1	ENF	27A	SUR	DBTG	I	MGM/MC	M			2	3
Y-1	ENF	27B	SUR	DBTG	I	MGM	MG	1.6		2	3
Y-1	ENF	27C	SUR	DBTG	I	MGM	MG	1.5		2	3
Y-1	ENF	27D	SUR	DBTG	I	MGM	MG	1.8		2	3
Y-1	ENF	27E	SUR	DBTG	I	CD	CD	3.3		2	3
Y-1	ENF	27F	SUR	DBTG	I	SV	SV			2	3
Y-1	ENF	27G	SUR	DBTG	I	SV	SV			2	3
Y-1	ENF	27H	SUR	DBTG	I	MGM	MG	3.0		2	3
Y-1	ENF	27I	SUR	DBTG	I	CD	CD			2	3
Y-1	ENF	27J	SUR	DBTG	I	FS	FS	3.2		2	3
Y-1	ENF	27K	SUR	DBTG	I	MGM	MG			2	3
Y-1	ENF	27L	SUR	DBTG	TQ	-	TQ	6.6		2	3
Y-1	ENF	27M	SUR	DBTG	TQ	-	TQ	4.8		2	3
Y-1	ENF	27N	SUR	DBTG	FS	-	FS			2	3
Y-1	ENF	27O	SUR	DBTG	FS	-	FS			2	3
Y-1	ENF	3	SUR	PRJPT	I	SV	SV			2	3
Y-1	ENF	4	SUR	BIFACE	CD	-	CD			2	3
Y-1	ENF	5	SUR	BIFACE	CD	-	CD	3.8		2	3
Y-1	ENF	6	SUR	BIFACE	I	MH	MH			2	3
Y-1	ENF	9	SUR	FLKTL	I	TQ	TQ			2	3