AN EXAMINATION OF THE ETHNOGRAPHIC BOUNDARY SHARED BY GUMBATWAS AND KOKIWAS MODOC TRIBELETS, NORTHEASTERN CALIFORNIA.

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Glennda Gene Luhnow

Signed by:

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There have been many times in the past six years that I despaired of ever finishing what I had started; and thus it is with a happy heart that I address those individuals that have contributed to this work within this Acknowledgement. Without all of you this would not have been possible! I thank the generosity of spirit of each and every one of you which led you to share your knowledge, time and energy with me on this very long journey towards the completion of this thesis. This thesis is as much your work as it is mine; and I hope that you recognize the spirit of your ideas within these pages.

* * * * *

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* * * * *

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* * * * *

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* * *

I would like to dedicate this thesis to the memory of my father, Glenn Eugene Luhnow, who was killed in Vietnam on October 14, 1967. The price paid for this education was much too high. I would trade it all to see you smile.

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ABSTRACT

The topic of investigation defined here is the ethnographic boundary shared by the Gumbatwas and Kokiwas tribelets of the aboriginal Modoc. As currently defined, the placement of this boundary is based upon the ethnographic description recorded by Ray (1963). The validity of this boundary has been recently called into question on the basis of archaeological evidence recovered from the study area. This paper proposes to test these field observations by establishing cultural indices which characterize Gumbatwas and Kokiwas Late Archaic and Terminal Prehistoric period (1800 B.P.-historic era) obsidian assemblage components in terms of source and form. These indices will then be applied to archaeological manifestations in the boundary corridor to identify the parameters of cultural activity which occurred there in the late prehistoric past.

INTRODUCTION

This paper is an investigation of the ethnographic boundary shared by the Gumbatwas and Kokiwas tribelets of the Modoc. As currently recognized, this boundary is defined in the ethnographic literature by Spier (1930) and Ray (1963). The accuracy of the placement of this boundary has recently been called into question on the basis of archaeological data collected in the region through extensive surface survey supplemented by excavation, obsidian hydration and x-ray fluorescence analysis (see Roedeffer and Galm 1985; Jermann 1987; Moratto, et. al. 1995). It is the objective of this paper to assess and potentially redefine this boundary based on the archaeological evidence available for review at this time.

The major assumptions guiding the proposed study are that a discrete obsidian use strategy can be identified for each group; and that each use strategy will be reliant upon a specific source locality. Strategies based on similar assumptions have been demonstrated effectively in a wide variety of archaeological and geographical contexts (Fredrickson 1989; Bettinger 1982). It is assumed that the dominant obsidian source utilized by the Kokiwas will be Blue Mountain, a source of good quality obsidian located squarely in the heart of their core area; while Gumbatwas assemblages should be seen to exhibit a preference toward locally available East Medicine Lake Highlands sources.

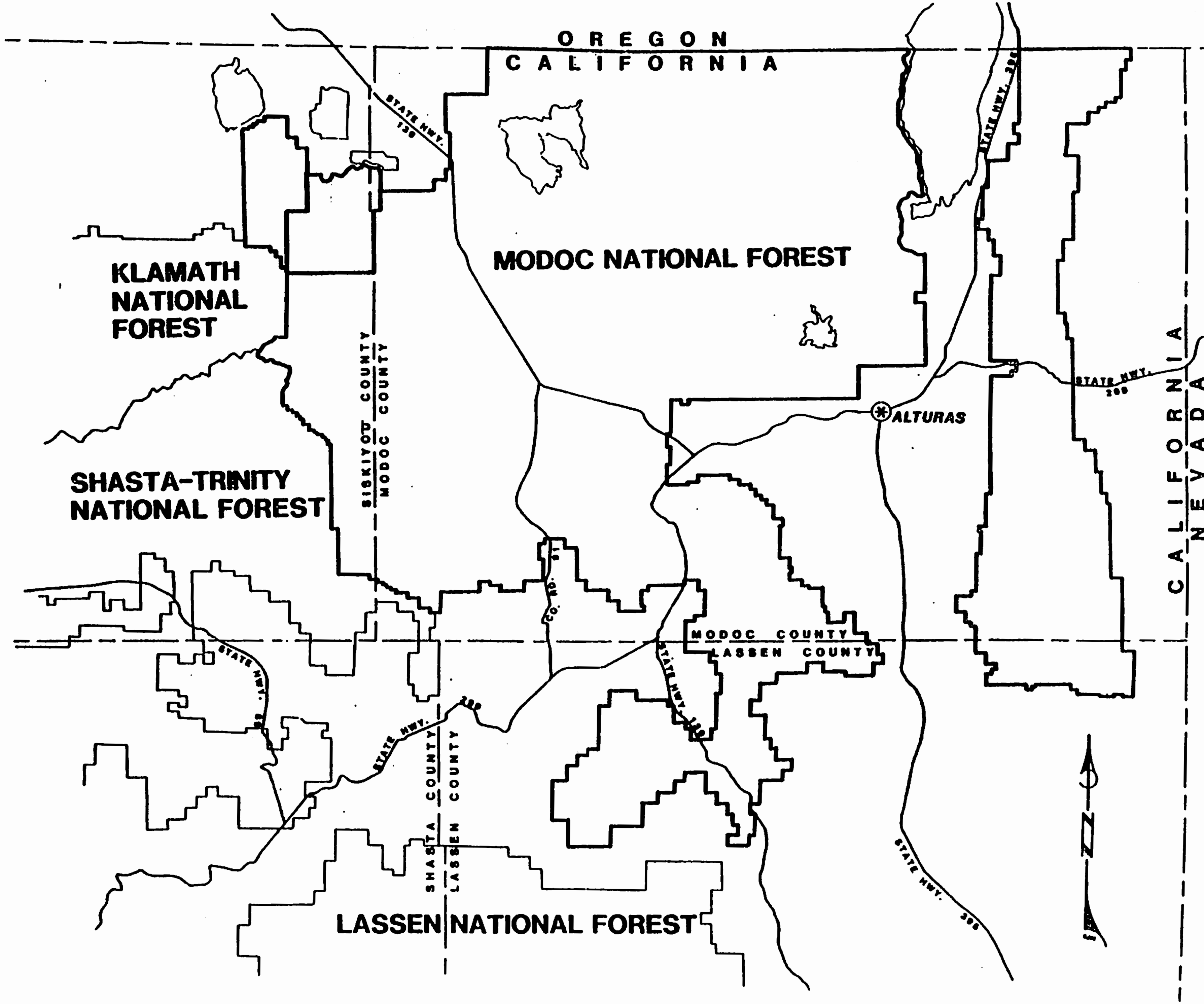
The testing parameters of the study area are defined by the interface occurring between the major Gumbatwas and Kokiwas population centers at Tule and Clear Lakes. For the purposes of this paper a sampling corridor has been established in that section of the Modoc Plateau. This corridor is roughly fifteen miles wide (E-W), and twenty miles in length (N-S). It skirts the eastern flanks of the Lava Beds National Monument and Medicine Lake Highlands in the west and extends eastward into the Devil's Garden Lava Platform in the east.

Late Archaic (1800-600 B.P.) and Terminal Prehistoric (600 B.P.-historic era) assemblages within the sampling corridor are the units of analysis for this study. A total of twenty-two archaeological sites were observed and sampled. Data recovered from twelve of these sites have been analyzed with regards to the established core area obsidian procurement-use strategies characteristic of both the Gumbatwas and Kokiwas groups. It is held that by establishing the distribution of different obsidian assemblage patterns across the boundary corridor the actual physical boundary shared by these two groups can be defined.

The body of this paper has been subdivided into five organizational subcategories: Section I (Background); Section II (Methods and Theory); Section III (Analytical Tools); Section IV (Core Area Data); Section V (Boundary Analysis); and Section VI (Concluding Remarks). Section I consists of Chapters One through Three and provides an overview of the physical environment of the study area and its available resources; cultural traditions of the Modoc people and the sequence of historic contact for the region.

Section II consists of Chapters Four through Seven and provides discussion of the theoretical and methodological constructs governing the structure of inquiry; an overview of prior archaeological investigations in the study area, and the sampling design developed for this project.

Section III consists of Chapters Eight through Twelve and provides for a general overview of the major analytical procedures employed by this study; obsidian hydration analysis, x-ray fluorescence and lithic analysis; as well as definition of chronological controls and obsidian resources available in the study area. Sections IV and V present core area indices and field data; while concluding remarks and directions for future research are found in Section VI. Raw sample data for sites tested by this study is included in Appendix A; and results from selected sites from the OTH-B Radar, Tuscarora and PGT-PG&E pipeline projects as supplementary data sets are presented in Appendix B.



MAP 1: THE STUDY AREA
(from Gates 1983)

SECTION I: BACKGROUND

CHAPTER 1:

Environmental Overview

Prehistoric settlement and subsistence patterns represent adaptive responses to dictates imposed by the physical environment. The location of critical resources and their seasonal availability acted as restraints on human use and occupation of particular regions. Environmental limiting factors such as these carried with them implications for almost every aspect of human life. Examination of the environmental context of prehistoric societies is crucial then to the understanding and reconstruction of their past lifeways.

There is universal agreement in the ethnographic literature as to the general territory and environmental zones associated with both the Gumbatwas and Kokiwas. Both groups occupied great swaths of land; much of which was probably only marginally exploited as routes for travel between resource patches during the summer. When viewed as a contiguous Modoc tract of land, the total expanse encompasses the northeastern corner of California westward nearly halfway across the state. The southern border traversed the Devil's Garden and Medicine Lake Highlands regions from Mt. Shasta in the west to Goose Lake in the east; extending northward into Oregon to a line which roughly followed the current Oregon-California state line. The whole of this area falls within two major geomorphic provinces of California, the Modoc Plateau and the Cascade Range. They will each be discussed in more detail below.

The Cascade Range

The Cascade Range runs from British Columbia into Northern California. It is a volcanic region that is characterized by large, active volcanic cones. It is commonly classified as two sections; the Western Cascades and the High

Cascades. The Western Cascades are located north of the California-Oregon border outside of the study area. They were formed by the layering of Miocene volcanic material atop the sedimentary rocks of the Klamath Range.

The High Cascades extend roughly from the California-Oregon border south to Lassen Park. They are younger than the Western Cascades, and were formed by Plio-Pleistocene volcanic activity. Basalt and basaltic andesite are common, and were used as lithic tool-making materials by the aboriginal population. Winters in this region are severe, with temperatures in the crest region below freezing from November into early June. The summers are short, hot and dry.

The region is fed by drainages which run from the crest to the valley floors; as well as by springs. There are numerous ecotones in this region. Their occurrence is dependent upon elevation. Rich meadows occur in valleys and wetlands, exhibiting sedges (Carex spp.), rushes (Juncusspp.), tufted hair-grass (Deschampsia caespitosa), epos (Perideridia gairdneri), camas (Camassia quamash), and wokas (Nuphar polysepalum). Juniper woodland is the vegetation type most common in the foothills, supporting western juniper (Juniperus occidentalis), sage (Artemisia spp.), bitterbrush (Purshia tridentata), and mountain mahogany (Cercocarpus ledifolius). The range of oak (Quercus spp.) and other hardwoods, such as willow (Salix spp.) and white alder (Aldus rhombifolia), is limited to these two ecozones (Nilsson 1985: 15). Higher elevations are generally of the mixed coniferous forest vegetation type, exhibiting Douglas fir (Pseudotosuga menziesii), Ponderosa pine (Pinus ponderosa), and incense cedar (Calcocedrus decurrans).

Fauna of the region include black-tailed deer (Odocoileus hemionus columbianus), mule deer (Odocoileus hemionus hemionus), and black bear (Ursus americanus). There are a number of game birds present, such as

California quail (Lophortyx californicus), blue grouse (Dendragapos obscuruss), and chukar (Alectoris chukar). Anadromous fisheries are limited to the Klamath River, on the western side of the crest, but trout species (Salmo spp.) are present.

The Medicine Lake Highlands

The Medicine Lake Highlands are considered to be an eastern expresion of the Cascade Range. This region is the result of tremendous volcanic upheaval, most of which dates to the Pleistocene period. It consists of a number of domes, jagged glass and lava flows and remnant cinder cones surrounding a collapsed caldera; the site of Medicine Lake. Elevations in the Highlands range from 4600' to 8000' above sea level. Winters are very cold and snowy, with warm dry summers. Water is limited largely to Medicine, Bullseye and Blanche Lakes. The region is generally less diverse than the rest of the Cascades in both flora and fauna. There are no anadromous fisheries native to the region; and both riparian and brush species are less varied. There are also no lowland oak species native to the area.

This region is located in the study area within Gumbatwas territory, but is recognized to be a peripheral area whose use was perhaps seasonally shared by a number of cultural groups. Medicine Lake itself was a place of reputed power for the Pit River people and the site of Lani'shwi, a Modoc summer village (Kniffen 1928; Ray 1963).

Hughes (1983) has identified ten obsidian source localities occurring in the Highlands. Overall quality of the materials from these localities is excellent, and exploitation of these resources by aboriginal peoples for tool-making purposes can be documented as early as 7500 B.C. (Hughes 1982:173).

Competition for access to such a desirable resource resulted in battles between the Modoc and both Shasta and Pit River factions (Merriam 1926; Kniffen 1928).

Recent volcanic activity in the region has occurred within the last 500 years at Glass Mountain. This flow has been dated to 885 +/- 40 (Donelley-Nolan, et. al. 1990); and has produced what some experts have termed to be the best-quality obsidian in the world. The recent date of this eruption has had the result of making this a very sensitive time-marker useful for dating archaeological contexts.

The Modoc Plateau

The Modoc Plateau is located between the Cascade Range in the west and the Warner Mountains in the east. It is considered to be the southernmost extension of the Columbia Plateau. Volcanic and tectonic activity in the region produced a broad highland plain that is crosscut by volcanic rifts and lava flows. Elevations range from an average of 4500' on the plateau floor to peaks of over 6000'. Rain and snow in the region are relatively light. There are a number of large lake basins on the Plateau; including Lower Klamath, Tule, Clear, and Goose Lakes, all of which are located in or are marginal to the study area. The basins in turn feed and are fed by the four large river systems, the Pit, McCloud, Fall, and Lost, which crosscut the northern and southern portions of the Plateau.

The landscape supports a number of diverse ecozones such as Great Basin shrub-grass, juniper woodland, coniferous forest, lacustrine and meadow/marshland. The location of these ecozones across the landscape is dependent on elevation for the first four communities; and upon the occurrence of water for the latter two.

The Great Basin shrub-grass community is found at elevations generally less than 5000' and supports sage (Artemisia spp.), rabbitbrush (Chrysothamus spp.), and native bunchgrasses. This is replaced by juniper woodland (see above description) in the foothills. The coniferous forest of the higher elevations was dominated by western yellow pine (Pinus ponderosa and P. jeffreyi), white fir (Abies concolor), and some red fir (Abies magnifica) prior to logging. There are few stands of pristine timber left standing on the Plateau today.

Lacustrine areas supported common tule (Scirpus acutus), sego lily (Calochortus spp.), cattail (Typha latifola), epos, wokas and camas roots. Meadow/marsh vegetation occurred throughout the region (see above description).

The location of the large lakes of the region on the Pacific Flyway led to an abundance of waterfowl. There appears to have been few deer during aboriginal times, although antelope (Antiliocapra americana) were found in shrub-grass vegetation and bighorn sheep (Ovis canadensis californiana) ranged through the lava country around Tule Lake. Grizzly bear (Ursus horribilis), canadian elk (Cervus canadensis) and bison (Bison bison) may also have been found in the study area in the prehistoric past (Gates 1983:25).

There are three basic landforms found on the Modoc Plateau (Pease 1960:12). These are identified as mountains, lava platforms, and modern basins. Mountains on the Plateau are largely block-faulted (Pease 1965:23). The two major formations in the region are the Warner and Adin mountains. Mountains in the region provide for both natural boundary systems and points of reference on the landscape. Many are also the sites of valuable lithic source localities.

Lava platforms are varied in form, and range from ancient, well-weathered materials to more recent deposits. They range in size as well, from a few acres to over hundreds of sections. The Devils Garden Lava Platform is the largest, encompassing over fifty linear miles between Goose Lake and the Medicine Lake Highlands (Gates 1983:17).

The Devil's Garden region makes up a large part of the study area. The Kokiwas were its primary occupants in prehistoric times; a small western portion also extended into Gumbatwas territory. In its pristine state the dominant vegetation community was Great Basin shrub-grass. The ecotones noted by a botanist for an early railroad survey party were grassy plains, sage plains and yellow pine forests (Newberry 1857: 15-16).

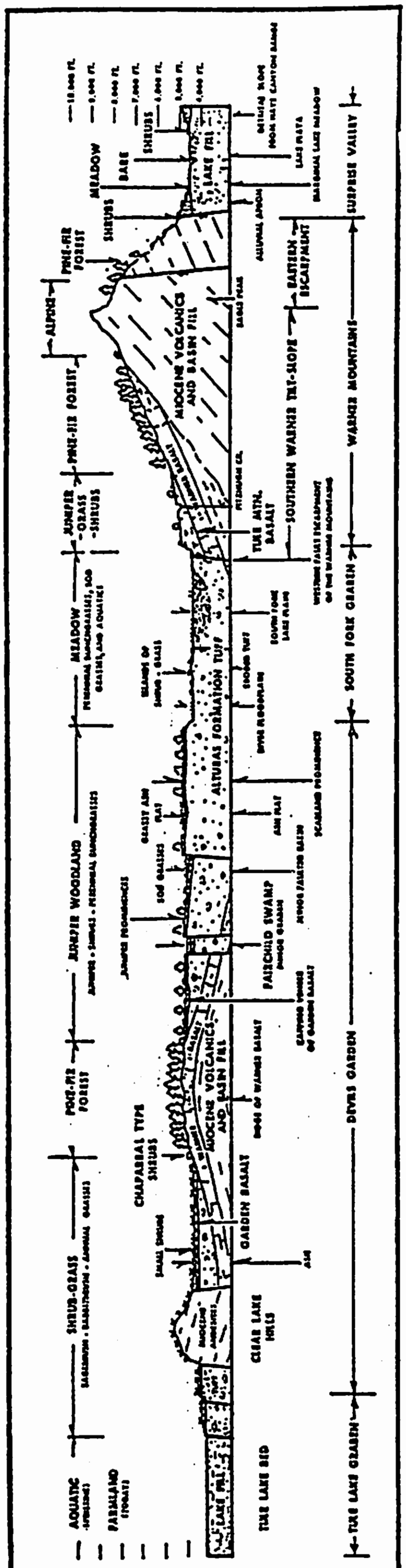
Small sheltered wetland biozones supported by incipient drainages, seeps, and springs were once scattered across the Garden landscape; gathering places for the roots that were a staple of the Modoc diet. Today, activities such as logging, mining and ranching have severely decimated these resources, resulting in the encroachment of juniper woodland vegetation types.

Blue Mountain, a remnant shield cone of Mio-Pliocene origin located on the Garden between Clear and Goose lakes, is also the location of a good-quality obsidian source. The use of this source has been well-documented archaeologically in ancient contexts, and is believed to have been controlled exclusively by the Kokiwas in the late prehistoric period.

Three major lake basins which constitute central resource bases occur on the Plateau in the study area. These are: Lower Klamath Lake, Tule Lake and Clear Lake. Pease (1965:26) notes that these basins exhibit fault delineation. This could be of some importance to the consideration of boundaries, especially when considered in light of the fact that cultural boundaries tend to follow naturally defined features.

MAP 2: CROSS-SECTION OF LANDFORM TO VEGETATION

(from Pease 1965)



CHAPTER 2:

Ethnographic Overview

Modoc cultural traditions reflect a long-standing practice of cultural "borrowing" of selected traits from numerous sources; the result of which is the fusion of various traits from the greater California, Columbia Plateau and Great Basin culture areas. Although "borrowing" of desired cultural elements from external sources for the purpose of their incorporation into the home culture is by no means uncommon, the unique geographic position of the Modoc at a cultural interface between distinct long-standing traditions provided them more of an opportunity to pick and choose elements of each than was the norm. The Modoc and their neighbors to the north, the Klamath, represent two extreme examples of this practice; cultural traditions that were *built* upon elements borrowed from outgroup affiliations. Their culturally anomalistic nature has made them impossible to classify according to a conventional taxonomy of native culture, in which affiliation is assigned on the basis of shared traits that define the culture area at large. Gates (1983:97) suggests that the Modoc and their northern neighbors, the Klamath, should be classified as "transition cultures with definite ties to all three culture areas".

There is little ethnographic literature available for the Modoc. Actual ethnographic research is limited to the work of Gatschet (1890), Barrett (1910), Spier (1930), Voegelin (1942) and Ray (1963); with a short ethnographic sketch to be found in Powers (1877).

Additional information can also be gleaned from ethnographies of the Achomawi by Merriam (1926), and Kniffen (1928); and from Stern's (1964) overview of Klamath reservation life. General overviews such as those found in Kroeber (1925) and Heizer and Elsasser (1980) merely provide synopses of these primary sources. Journals by early explorers and trappers of the region such as Fremont (1845, 1846) and Ogden (1961) contain references to their contacts with the Modoc but offer little in the way of ethnographic description. Two accounts of life among the Modoc by Miller (1874) and Riddle (1973) also exist, but the accuracy of their information cannot be confirmed and remains sketchy at best. There is an extensive amount of material dealing with the Modoc War, but most of this has been written by military historians and contains few references to Modoc culture and traditional life.

The name "Modoc" was derived from the Klamath descriptive names moadok ("southern people") and moadokkni ("southerners"). The Modoc and the Klamath are language affiliates that were closely related in the prehistoric past. Their language has been classified today as the Klamath-Modoc isolate of the Penutian phylum. Other Penutian speakers are found along the Columbia River and throughout western Oregon (Gates 1983:112).

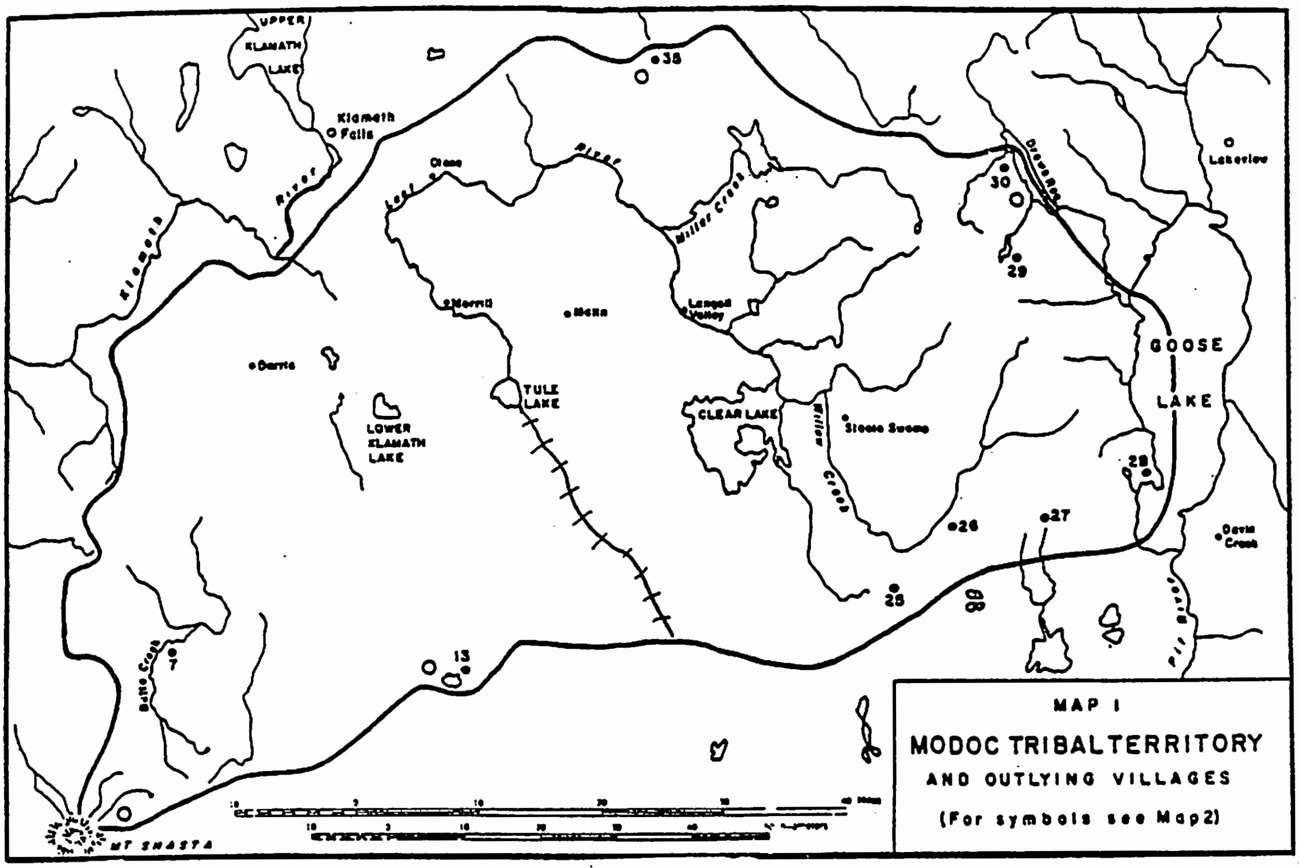
The Modoc people occupied the northeastern corner of the state of California and a small portion of south-central Oregon. This is a region of volcanic origin, and encompasses a large part of the geomorphic province of California known as the Modoc Plateau. This is a rugged environment, characterized by remnant shield volcanoes, basaltic lava flows and numerous fault rifts which cross-cut the terrain (Moratto, et. al.1995:2.8).

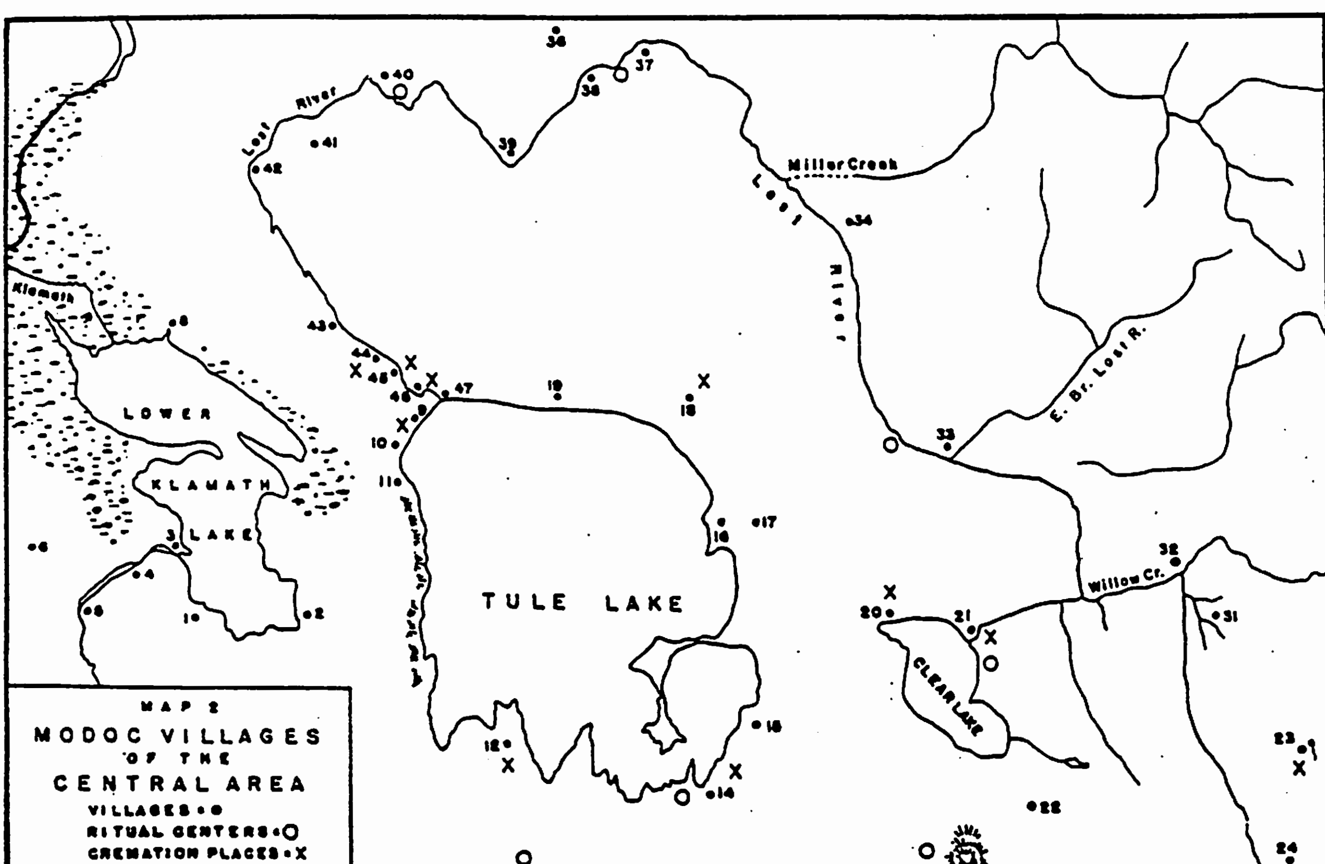
The boundaries of Modoc territory have been defined most specifically by Ray (1963). The western boundary which separated the Modoc from the Shasta followed the line of the Cascade Divide from Mt. Shasta northward to the present California-Oregon border, while the boundary shared by the Klamath and the Modoc extended in a northeasterly direction from this point across to Yainax Butte and Hildebrand.

From Yainax Butte, the line extended east to the south of Quartz Mountain, and then southeasterly across Goose Lake, the use of which was

MAPS 3 and 4: MODOC ETHNOGRAPHIC BOUNDARY and VILLAGES

(from Ray 1963)





KEY TO RAY'S VILLAGE SITES

All descriptive information which follows below is from Ray (1963). Only sites which are judged to be relevant to the present study are included.

Gumbatwas Sites

12. Gu'mbat: a large permanent village located on the southern shore of Tule Lake particularly populous during the winter months.

Kokiwas Sites:

14. E'uslis: a permanent village site on the southeastern shore of Tule Lake with associated cremation area.
15. Keshla'kchuish: important summer village associated with epos gathering.
20. Ste'okas: large permanent village on the north shore of Clear Lake. Winter population aggregate with associated cremation area and important summer resource patches.
22. Chala'ks: summer village northeast of Doublehead Mountain which served as a base for hunting and epos gathering.

shared by the Kokiwas Modoc with the Yahuskin (Northern) Paiute and the Achomawi. This line extended southwesterly back to Mt. Shasta from the extreme southern point of Goose Lake, defining the border between the Modoc and the Achomawi. The boundary area shared with the Achomawi is disputed on the basis of information contained in Achomawi ethnographies by Merriam (1928) and Kniffen (1929), which extend Achomawi territory much farther north through the Devil's Garden region to Glass Mountain. However, an isoplethic model of the distributional pattern of Blue Mountain obsidian, a source controlled by the Kokiwas Modoc, appears to support Ray's southern boundary position (Van de Hoek: 1990).

Relationships between the Modoc and their neighbors appear to be fixed traditions based on warfare and raiding. Mounted Sahaptin raiders armed with guns are reported to have raided the Klamath in the early years of the 1800's for the purpose of taking slaves (Minor, et. al. 1979: 116; Ray, et. al. 1938). By midcentury, the Klamath-Modoc were also mounted and raiding their traditional enemies to the south and west; the Achomawi and the Shasta.

The Northern Paiute were also the victims of these raiding parties, although likely to a much lesser degree. Slaves taken on these raids were often taken to the trading station at The Dalles, Oregon to be sold. The Klamath acted as middlemen in this trade network due to their proximity and contact with the tribes of the Columbia Plateau.

Items that were commonly traded by the Klamath-Modoc included not only slaves but also Pit River bows, wokas seeds and beads. These were exchanged for horses, blankets, buffalo skins, parfleches, dentalium, dried salmon and lamprey eels (Spier and Sapir 1930). The active participation of the Klamath-Modoc in The Dalles trade network led to a greater integration of Plateau culture traits and corresponding shifts within the structure of traditional society. Most notably these included a greater emphasis on the acquisition of wealth, greater degree of social stratification, a decrease in the authority of the position of shaman and an associated increase in the authority of figures such as the village headman and war chief.

The phenomena of slave raiding and the associated shift in Klamath-Modoc cultural affiliation deserves to be discussed in greater detail in terms of the implied state of native populations at the time of contact. These were cultures in transition; existing not in a "traditional" form but in a state of regional upheaval. With the acquisition of the horse (post -1800) and its subsequent adoption as a status item, slave raiding by the Klamath-Modoc on their weaker neighbors almost certainly increased. However, the actual extent of Modoc slave raiding is not agreed upon. Kroeber (1925:319) calls it an "overstated" phenomena, while others in the ethnographic literature view it as being particularly devastating, especially on the Achomawi. Contradictory accounts can be found in Bulletin Nos. 30 (1907) and 78 (1925) of the Bureau of American Ethnology. Bulletin 30 states that slave raiding by the Modoc and Klamath seems to have been an institution of long standing. Bulletin 78 questions the actual extent that it was practiced. It goes on to use the (then) current strength and numbers of the Achomawi tribes as a rebuttal to the postulates outlined by the earlier Bulletin 30 (Palmberg 1982:4-5).

The Modoc recognized three tribelets, or subgroups, within the larger tribe. The territories of these groups were determined by the presence of different lacustrine resource patches and the geographic location of winter settlements. The basis of membership in these individual tribelet units appears to be based on geography, rather than any linguistic or cultural differences between them (Stern 1966). Affiliation was based predominately with family and kinship ties, and allegiance was more likely to be based on village membership than on tribelet affiliation. Gates (1983:115) states that intertribelet feuds occurred with some frequency; and raids between the tribelet factions resulted in the taking of slaves and destruction of property. In the face of any external threat, however, all three tribelets put aside any differences and banded together for mutual aid.

The tribelet subdivisions are as follows: the Gumbatwas, or "people of the west", who occupied the area around Lower Klamath Lake and Tule Lake; the Kokiwas, or "people of the far-out country", who lived around Clear Lake; and the Paskanwas, or "river people", who were found in the Lost River Valley. The Gumbatwas and the Kokiwas, as the groups under consideration, are the only two who will be discussed in any detail here.

Ray (1963:202), defines the territory of the Gumbatwas as encompassing all that area west of a line following a ridge running between Lower Klamath Lake and Lost River Valley, through Tule Lake from its northwest to southeastern corner and then southwesterly to the southern tribal boundary. This area encompassed both the Lava Beds National Monument and the Medicine Lake Highlands, including Glass Mountain and other sources of high-quality obsidian.

Although Modoc tribelets were homogenous in language and culture, Stern (1966:19), reports that the villages of the Gumbatwas were composite in membership, with a population that included not only Modoc people, but Klamath, Shasta and Pit River as well. Winter villages were located on Lower Klamath Lake and its tributaries, as well as the western and southern shores of Tule Lake (Masten 1985).

Ray (1963:202-203), defines the boundary of the Kokiwas as all that area lying to the east of the line described above, extending to the western shore of Goose Lake. This region included the Clear Lake Basin, the upper reaches of the Lost River and a major portion of the Devil's Garden lava platform. The location of the Kokiwas as lying apart from the major population centers of Tule Lake and the Lost River Valley gave rise to their name, "people of the far-out country".

The permanent villages of the Kokiwas were located along Clear Lake and in the area around Blue Mountain (Ray 1963). The Blue Mountain locality is also home to an important source of good quality obsidian. It is a premise of this paper that the Blue Mountain locality was the primary source of obsidian utilized by the Kokiwas.

The semi-sedentary lifestyle of the Modoc can be described as per Binford's (1980:10) definition of a "collector" subsistence strategy. The logistical organization of labor resources is the central element of a collector subsistence strategy. Binford (1980:10) lists the two characteristics of the collector strategy as follows:

> "... collectors are characterized by (1) the storage of food for at least part of the year and (2) logistically organized food-procurement parties."

The subsistence adaptation of the Modoc was predominately lacustrine-based. The Modoc were tule specializers, who used tule in the manufacture of homes, baskets, and various utensils (Barrett 1908:258). They followed a highly formalized round of seasonal subsistence activities, with sites being regularly revisited at different times of the year. During the summer months, the population dispersed over the landscape to procure seasonally available resources, and gathered again in the late fall at winter settlements located along Lower Klamath Lake, Tule Lake, Clear Lake and Lost River. Winter sedentism was supported by stored foods, which were cached by each family near the winter villages in secret locations.

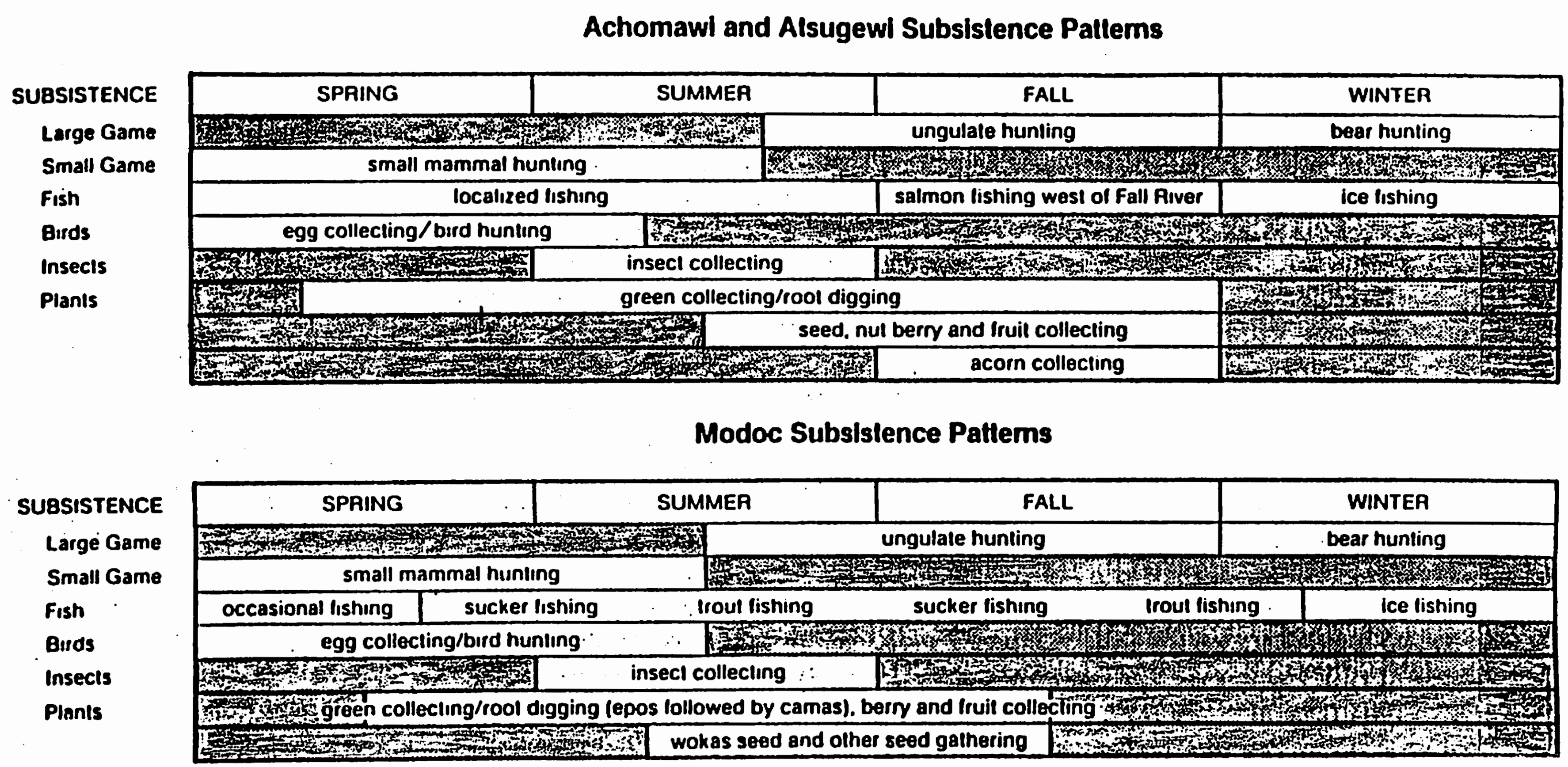


FIGURE 1: MODOC SEASONAL SUBSISTENCE ROUND
(from Roedeffer and Masten 1985)

Once the snow had melted, the homes at the winter villages were dismantled and the people began their subsistence round. In the early spring, whole villages moved to fishing sites for the exploitation of suckers. These runs lasted about three to four weeks, and the sites were often annually reused. From there, the people moved into the open grasslands for the exploitation of the epos root. This was one of the most important resources for the people because large amounts could be gathered and stored.

In the early summer, groups moved into meadow and wetland areas to collect camas. This was not an abundant resource in Modoc territory, so the groups became widely dispersed. In late summer, another genus of camas, the white camas, ripened, and antelope were hunted on the plains, and mountain sheep were hunted in the lava beds. Wild grasses were collected from a wide variety of locations, while wokas was collected in the wetlands.

Through late August and September the people exploited the second sucker run of the year and the harvesting and drying of upland berry crops took place. The men hunted deer and elk from these upland camps, and visited the obsidian quarries of the East Medicine Lake Highlands. In October, the population began to converge on the winter villages once again. After resettling in the winter villages, the population was reliant upon stored foods, occasionally supplemented by solitary hunting, ice fishing and the December trout run. Each family was responsible for the gathering of their own winter resources (Moratto, et. al. 1995:3.27) .

CHAPTER 3:

Historical Context

The earliest recorded contact between the Modoc people and European newcomers took place on December 26, 1826, when Hudson Bay Company trappers under the lead of Peter Skene Ogden reached the Modoc interior and the winter settlements of Tule Lake. This was one of the Hudson's Bay Company's "Snake Country Expeditions"; long-term trapping ventures geared towards the intensive exploitation of the fur resources along the watersheds of the Snake and Columbia Rivers and their surrounding areas (Gates 1983:151). Expeditions of this type eventually reached the wilderness of eastern Idaho, northern Utah, western Montana and northeastern California in their quest for fur. The British interests of the Hudson's Bay Company in the Pacific Northwest realized that they were slowly losing ground in the face of American westward expansionism, and it was their intent to "eliminate the beaver entirely in the areas east and south of the Columbia District...including the unexplored Klamath region" (Thompson 1979: 68).

These "fur brigades" were sporadic visitors to the Modoc Plateau until the 1840's. Many of them left their mark on the landscape by naming natural features, such as Pit River, Goose Lake and Mt. Shasta; and their reports of the natural landscape encountered during these forays into the wilderness provided valuable information to the wagon trains and homesteaders that came later. It is indeed unfortunate that their records did not provide the same amount of detail in regards to the native inhabitants of the region

The journal of Peter Skene Ogden (1826-1827) is the earliest written record of the Modoc and Pit River peoples. Although the details of native culture it provides are sketchy at best, it provides one of the few eyewitness accounts of pre-contact traditions of settlement and subsistence.

Although there are no reports of any hostilities between the early trappers and the native inhabitants, contact between the two groups introduced the native people of the area to European diseases such as smallpox, malaria, measles and venereal disease (Cross 1982: 48). The exact impact of these diseases upon the native populations is unknown, and researchers disagree on the extent of that impact to this day. A lack of records and conflicting reports from this period makes it impossible to determine accurately either aboriginal population numbers or the demographics of disease.

It is certain, however, that these outbreaks severely weakened the native population even before the first white settlers appeared in the region. Cook (1976: 237) puts forth a forty percent fatality rate figure for the Pit River tribelets. As staggering a percentage as this is, in terms of the overall figures of the California native epidemic at large it was actually a low number. Joaquin Miller, in his account of life among the Modoc, refers often to the presence of disease but provides no concrete statistical figures. His descriptions, however, imply that the loss of life due to disease was devastating indeed. Powers (1976: 254) states that in 1847 alone the Modoc lost one hundred and fifty people to smallpox. This was quite a blow to the population in light of the fact that its size at any given point prior to contact has been estimated to have been not more than two thousand individuals.

The earliest direct contact between the Modoc and Americans took place in 1842, when John C. Fremont led an exploring expedition through northern California and southern Oregon in December of that year (Murray 1959:12). He was followed by more Americans shortly thereafter. In 1843, the first overland party crossed the Modoc Plateau on horseback enroute from Fort Boise to Sutter's Fort (Gates 1983: 188).

The earliest road cut through the Modoc region was blazed by the Scott-Applegate Party of 1846, a group of Willamette Valley pioneers seeking a southern route to the Oregon Trail. The search for "cut-offs" and other alternative routes across the Cascade and Sierra Nevada ranges was a very common practice at that time, a response to the ardurous two-thousand mile length of the Overland Trail. The trail that the Scott-Applegate party established on this trek became known as the "Applegate Road". It followed the northern edge of the volcanic tableland along the edges of Modoc country and opened up the virgin wilderness of the region for the many more wagon trains which were soon to follow. The 1850's found the Modoc Plateau a major route for travelers on their way to Oregon and the California gold fields; and by 1857 it was criss-crossed by several incipient overland routes.

Unknown to the Modoc and other native groups attempting to adjust to the sudden encroachment of white activity upon their ancestral lands, during this same period Congress was busily undertaking steps to clear Indian title to Western lands through the Indian Treaty Acts (1850). In that same year, Congress also passed the Donation Land Law. This would set the stage for the Homestead Act of 1862. It is interesting to note here that the Homestead Act, which awarded 160 acre plots with few restrictions to white male citizens of the United States, was passed and went into effect a full two years before the Modoc and Klamath were presented with the lands of the Klamath Reservation under the provisions of the Treaty of 1864.

As the stream of settlers into Modoc territory steadily increased, native people began to take action against the steady tide of encroachment on their land. In 1852 Modoc under the command of Chief Schonchin attacked and massacred an emigrant train camped on Tule Lake at Bloody Point. Close to forty emigrants were killed; including women and children. Public outrage against this crime was widespread in the local mining camps; and the call to justice was swift. A vigilante force led by one Ben Wright was dispatched from Yreka, and in the weeks that followed this group hunted and killed all of the natives they could find for retribution of the Bloody Point incident. Finally, they encountered a village group of Modoc on Tule Lake and proposed a treaty parlay under a white flag of truce. The Modoc agreed, and a group of forty-eight warriors met with the Yreka men. They were unarmed when Wright and his men opened fire on them at close range, killing all but some five or six who managed to escape (Murray 1959: 20).

After this incident, the Modoc kept to their peace and avoided any further contact with the emigrants. The military, on the other hand, seized the opportunity to assert itself more visibly in the region. In 1857 Fort Crook was built in Fall River Mills, and settlement of the region was officially sanctioned by its presence.

In 1864, the Modoc signed the Treaty of Round Valley, and agreed to live on the Klamath Reservation in Oregon on land shared with their former northern neighbors and "cousins", the Klamath. This treaty never extinguished native land rights to aboriginal territory, but the removal of the native population to the reservation gave settlers the freedom to assert their rights to claim the land as public domain under the provisions of the Homestead Act (Pease 1963: 80). It was not until 1959 that the courts determined that the land had been obtained illegally, and that the Native Americans were entitled to restitution. This particular ruling pertained specifically to the upriver Pit River lands, but the Modoc were also the victims of illegal homestead acquisitions of land. Prior to their removal to the Klamath Reservation, there had been no white settlements along the shores of Tule Lake or Lower Klamath Lake. For the three years they resided at the reservation, however, settlement in these two fertile alluvial basins flourished and towns such as Klamath Falls grew up overnight (Pease 1963: 74).

The Klamath Reservation had been established on the traditional tribal lands of the Klamath; and competition for resources between the two groups was fierce. When the Klamath began to demand tribute from the Modoc for the use of timber and other reservation resources, the Modoc subchief Kientpoos (Captain Jack) attempted first to relocate his band. When this failed to rectify the situation, he next attempted to petition the agent in charge of the reservation for help. When this endeavor also failed to relieve the situation, Captain Jack led his band back to their ancestral home on the Lost River north of Tule Lake in 1865; remaining there for four years without incident.

In December of 1869, Jack and his people were persuaded once again to go back to the reservation, but their tenure lasted only four months. In April of 1870, they left the reservation once again for their homeland. Settlers that had made claims on Modoc land for homesteading had other plans. In November of 1872, the Modoc were ordered back to the reservation: by means of force, if necessary. Jack and his people refused, and took refuge from the American military forces in the region within the lava tube labrynth of what is today the Lava Beds National Monument.

Thus began the Modoc War, in which a small band consisting of only fifty-seven warriors, some women, children and elders managed to keep the army at bay for an incredible six months from the fortress of the lava tubes. For some time, public support weighed heavily in their favor. Then, under a white flag of truce, Jack and a group of his warriors gunned down General E.R.S. Canby and several peace commissioners.

This incident served only to turn the tide of war against the Modoc. Shortly thereafter the group disbanded and went separate ways. Jack led one small group east into the upper Willow Creek drainage near Langell Valley, Oregon. The other group headed west and surrendered peacefully on May 20, 1873 at Fairchilds Ranch on Hot Creek (Murray 1959: 136).

Four of the warriors who had participated in the ambush on Canby (indeed, the same four that had originally instigated that action, according to some of the later chroniclers of this event) surrendered to the Army a few days later. These four were put on the Army payroll and granted clemency for their complicity in the murder of General Canby in exchange for the capture of Jack and the his band.

Upon his discovery on Willow Creek east of Clear Lake, Jack gave himself up without incident on June 1, 1873. After a brief military trial, he and three of his compatriots were sentenced to death by hanging. After this sentence was carried out, their heads were removed and sent to the Smithsonian for study. These skulls were returned to the Klamath Tribe in the late 1980's for reburial. They were interred upon the lands of the Klamath Reservation.

The rest of Jack's band, which consisted of thirty-nine men , fifty-four women and sixty children, were banished to the Quapaw Agency in Oklahoma in early October, 1873 (Riddle 1973: 42). It was not until thirty-six years later that Congress at last passed the bill that allowed them to return to the Klamath Reservation one final time. After such a long period of time, it was only to be expected that the elder people who knew and loved the land of home the best did not live to set eyes on it again. The majority of people that remained were largely unfamiliar with their ancestral lands and had lost the continuity of their ties to it. Many of them now had stronger ties to the Oklahoma reservation where they had spent most (or all) of their lives, and chose to remain there.

With the removal of the Modoc as a threat, the settlement of the Modoc region went on uninterrupted. It is today an economy that is based predominately on ranching and other agricultural pursuits associated with large privately-owned land bases. Local Federal lands in the Modoc region are also used for these same purposes as "free range" lands. The Tule Lake Basin, which Captain Jack and his people once knew so well, has been radically changed beyond recognition. In 1910, the lake, which once covered 150 square miles, was reduced to a controlled sump of perhaps 25 square miles. Lands reclaimed by this action were converted to agriculture (Eidsness et al. 1992: 8).

The tradition of Modoc ties to the land have carried on. According to local Modoc consultants, offerings are still left at prayer cairns in the Lava Beds and the Stronghold is the site of spiritual training for members of the tribe (Eidsness et al 1992:28). Also, since 1990, the "Return to the Stronghold Gathering" has been held at Lava Beds National Monument in conjunction with members of the Confederated Modoc and Yahooskin Tribes and the Modoc Tribe of Oklahoma.

SECTION II: METHODS AND THEORY

CHAPTER 4:

Theoretical Orientation

Boundaries are abstract constructs which operate within the cultural landscape as divisions of the physical environment. Due to their characteristic nature as interfaces of social interaction, archaeological research into their dynamics has implications for the identification of regional patterns of interaction, mobility and trade.

The structure of inquiry guiding archaeological investigation of boundary systems must both define the boundary at an abstract level as well as model its manifestation in terms of the physical world. The research question defined by this paper is framed by ethnographic reference to phenomena of a late prehistoric nature, and lends itself well to the blending of theory and models gleaned from both the historic and prehistoric domains of archaeology.

Direct Historical Approach

Research questions dealing with late prehistoric, protohistoric or historic phenomena are by nature inherently framed by the *direct historical approach.* First defined by Strong (1935); this theoretical construct is based in the assumption that knowledge of the prehistoric past can be gained through the study of native texts and oral traditions, linguistics, ethnography and/or ethnohistorical documents which exhibit cultural, geographical and/or temporal associations with a specific archaeological context. Direct historical data used in association with archaeological contexts are used to establish comparative units of analysis which may aid in the resolution of alternative models for the explanation of archaeological data (Trigger 1991: 377). By acting as a supplement to the archaeological record, direct historical data has the potential to provide greater depth to the overall cultural picture; and has been used in that fashion as a stepping-stone toward the formation of both culture history and chronology in a variety of contexts (Stahl 1994).

The direct historical model proposed by Lightfoot et al. (1991: 8) holds that the greatest utility of ethnographic documentation is to provide a temporal footnote for the diachronic application of archaeological data. In this context, Ray's (1963) definition of the ethnographic boundary shared by the Gumbatwas and Kokiwas is viewed as an indicator of the final florescence of boundary dynamics occurring in the prehistoric past and a Late Period (1200 B.P. to historic times) footnote to which archaeological investigation can be applied.

Boundary Theory

There are a number of theoretical constructs that have been developed to provide internal structure to studies of boundary systems. Marquardt and Crumley (1987:1) have defined the *cultural landscape* as the spatial manifestation of the relations between humans and their environment. The premise of this construct is that the manner in which people adjust to the physical landscape of an area is a reflection of their history, organization and values. Sociohistorical structures, physical structures, and their interpretations are held to be determinative and mutually definitive of the cultural landscape as a whole. In keeping with this, boundaries are defined as abstract constructs which operate within the cultural landscape as divisions of the physical environment. They are defined by both the internally established administrative priorities of a society, and its external social and physical relationships.

Because they are based upon socially defined variables, boundaries are by nature flexible and subject to change through both space and time. The spatial and temporal fluidity reflected within boundary systems provides insight into regional contexts of culture continuity and change. Shifts in boundary areas are a reflection of shifts in the priorities central to the maintenance of the cultural system itself; and are often related to political and economic variables.

Boundary Models

Other theoretical constructs govern the analysis of spatial and temporal patterning of obsidian as it occurs along boundary areas. The first of these is the Law of Monotonic Decrement (or distance-to-K). Quite simply, this states that, all other things being equal, the closest source for a given material should be the one utilized. As distance from the source increases, the amount of material from that source used should be seen to decrease. Overriding factors associated with the distance-to-K concept are: quality of the material available; abundance of the source; availability of the source; purpose of utilization and geography; as well as intangible social factors (Ericson and Earle 1977:72). In accordance with the basic premise of the distance-to-K model, it is assumed that the Gumbatwas tribelet of the Modoc will be seen to utilize material from East Medicine Lake obsidian sources; and that the Kokiwas will be seen to utilize material from Blue Mountain. Associated with this concept is Bettinger's (1982:113) model to examine territoriality in the Owens Valley. Using obsidian hydration and x-ray fluorescence sourcing techniques, Bettinger postulated that if inhabitants of Owens Valley were territorial, then it would be expected that material from a specific source (in this case Fish Springs) would occur in high frequencies within the territory where the source was located and where procurement would have been by direct access; low frequencies would occur in territories where it would have been procured by trade; and that a sharp truncation of frequency would occur to mark the boundary between these areas. This is the model for analysis employed by the present study.

Core-Periphery Model

The *core-periphery* model of interaction defines the unequal trade relationship that exists between a highly developed core area and populations of lesser complexity which occur in its surrounding buffer zone and in the outlying periphery. As defined by this system, raw materials, such as slaves, are supplied by peripheral groups to meet core area demand in exchange for manufactured or luxury products, such as horses. Over time, peripheral groups take on core culture traits.

The nature of the boundary recorded at the time of contact is assumed to have been a direct result of the core-periphery relationship existing between the Klamath-Modoc and the trans-Plateau trade network at that time. This relationship is thought to have been based on the introduction of the horse into the Plateau region circa 1750 (Spier 1930; Stern 1963), an event leading to the expansion of The Dalles trans-Plateau trade network in association with an economic emphasis on slave raiding. The Klamath-Modoc acquired the horse in the early 1800's and quickly became involved in the slave trade. Marked shifts in Modoc traditional culture reflecting Plateau influence are thought to be a result of this; and are perhaps mirrored in the spatial demographics of the region. Within a limited temporal frame, this core-periphery interaction may have utility in providing a baseline for the definition of spatial parameters associated with social transition.

CHAPTER 5:

Archaeological Investigations in the Study Area

The focus of early archaeological investigations in the study area was the establishment of a regional chronology for the Klamath Lake Basin (Cressman 1942; Hansen 1942: Heizer 1942; and Swartz 1961, 1964). Several major excavations have been carried out in the Tule Lake and Lower Klamath Lake areas, targeting deeply stratified sites such as rockshelters and villages. Some of these sites were occupied for several thousands of years, and many of them exhibit late-period assemblages.

Cressman (1940, 1942) produced the first cultural sequence for the region based on excavation data recovered from the Kawumkan Springs site on Lower Klamath Lake. The three-phase chronology he constructed based upon the observed stratigraphic sequence chronicled 8000 years of local prehistory and successfully demonstrated the cultural affiliations between the Klamath Lake Basin and the northern Great Basin.

Cressman's earliest horizon, the Narrows phase, was dated between 8000-4000 B.P. and characterized by large leaf-shaped and side-notched projectile points, grinding stones, beveled edged knives and fossilized bone foreshafts; while a middle horizon dating to 4000-2000 B.P. (Laird's Bay), was identified in association with peat bog deposits and characterized by large and medium sized leaf-shaped, side-notched and corner-notched obsidian points, manos and stone awls. Cressman's final, or Historic, horizon was dated to 1500 B.P., and characterized by small obsidian projectile points, tubular pipes and shell beads from the Pacific Coast (Eidsness and King 1992: 20).

This sequence was further refined by the work of later researchers in the Tule Lake Basin, notably Squier (1956) and Swartz (1961, 1963). The 1952

FIGURE 2: MAJOR EXCAVATIONS IN NORTHEASTERN CALIFORNIA

(from Gates 1983)

Author Publication Date	Site Name	Region	Excavation Date	Dates	CRM *	C-14 **	Fauna	Flora/ Pollen	Chronology	Typology	Culture Change	Ethno. Affinity	Settlement/ Subs. Mode	Trade	Reg. Approach Survey	Burials	Comments
Weide 1968, 1974		Warner Valley		3150-1350 B.P.					X	X			X		X		Survey
O'Connel and Haywood 1972; O'Connell 1975	King's Dog, Menlo Baths, Rodriguez Site	Surprise Valley	1966-1969	6000-0 B.P.		X	X		X	X	X		X		X		
Riddell 1960	Karlo Site	Eagle Lake	1965			X	X		X	X		X		X		X	
Baumhoff and Olmsted 1964	Lorenzen Site	Little Hot Springs Valley		1450-450 B.P.		X			X	X	X	X				X	
Wohlgemuth 1978	CA-LAS-345	Eagle Lake	1978	1450-? B.P.	X					X							Test
Pippen et al. 1979	Pike's Point Site	Eagle Lake	1978	4500-100 B.P.	X	X			X	X	X	X	X				
Hughes 1977	Burrell Site	Goose Lake	1972	(6000) 2000-300 B.P.		X			X	X	X	X	X	X	X		
Hughes 1976	Johnson Slough	Goose Lake	1976	?		X				X				X			
Manuel 1977	4 Mod-439/440	Ft. Bidwell Indian Reservation	1976	2500 B.P. - Historic	X					X							Intermitte
Johnson 1977	Core Site	Warm Springs Valley-Canby Area	1975	(1450) 560-150 B.P.	X					X							Systemat excavati
Hughes 1973	Cuppy Cave	Pit River Canyon-Canby Area	1972	1450-100 B.P.	X				X	X	X	X					
Fenenga and Riddell 1948	Tommy Tucker Cave	Honey Lake	1947	c. 500 B.P. Historic			X	X	X	X	X						Rock Art
Grayson 1976	Nightfire Island (avifauna)	Lower Klamath Lake	1967	6000-550 B.P.		X			X		X						

FIGURE 2 (con't)

Author Publication Date	Site Name	Region	Excavation Date	Dates	CRM *	C-14 **	Fauna	Flora/ Pollen	Chronology	Typology	Culture Change	Ethno. Affinity	Settlement Subs Mode	Trade	Reg. Approach Survey	Burials	Comments
Hansen 1942	Narrows and Lairds Bay	Lower Klamath Lake	1940	c. 6000 B.P. - Historic				X	X		X						
Cressman et al. 1942	Cove, Narrows, Lairds Bay, and others	Lower Klamath Lake	1940	c. 8000 B.P. - Historic			X	X	X	X	X	X	X		X		
Heizer 1942	Massacre Lake Cave, Tule Lake Cave, and others	Massacre and Tule Lakes	1940													X	
Squier and Grosscup 1954	Sis-223, Sis-239, and others	Lower Klamath Lake	1952	Protohistoric-Early Historic					X	X					X	X	
Canfield and Crouch 1939	Fern C.	Lava Beds National Monument	1935						X	X					X		Pictographs
Swartz 1961, 1964	Sis-101	Tule Lake	1960	c. 3500 B.P. - Historic	X		X	X	X	X	X	X			X	X	

* An X indicates work was carried out to mitigate adverse effects of a development project. No mark indicates a purely research oriented project.
** An X indicates C-14 dates are published.

archaeological survey of the Lava Beds National Monument by Squier and Grosscup recorded 163 sites. These were categorized as cave/ rockshelter sites, petroglyph sites, surface sites or burial/cremation sites. Shortly thereafter the primary Gumbatwas village of *Gumbat* was excavated by Swartz (1961, 1963). This site, known as the "Peninsula Bay" site, was occupied for some 2500 years.

On the basis of these projects, Cressman's Historic horizon was subdivided into three distinct phases. The latest of these, the Tule Lake phase, was associated with small triangular or Desert Side-Notched projectile points, obsidian blades, stone awls, bone and antler flakes, bird and animal bone, bead ornaments, Pacific shell beads, pine nut beads and some non-native artifacts (Squier 1956:2). This phase was dated to 500 B.P. The middle, or Gillem's Bluff, phase assemblage was charcterized by crevice burials, bone awls, thin grinding slabs, medium to large projectile points and large obsidian blades; while the earliest phase, Indian Bank, was dated to 1500 B.P. and consisted of large projectile points, flexed burials, antler wedges, bone pins and pendants and mortars (Squier 1956: 34-35).

The greatest contribution of chronologies such as the one discussed above is the identification of assemblage patterns characteristic of specific temporal phases. Temporally diagnostic artifacts provide a baseline for making inferences about data sets at the most general level and can be used successfully to frame data prior to extensive technical analysis. Diagnostic artifacts can thus be viewed as data sets in and of themselves as well as valuable indices for general temporal control over unknown quantities as they occur archaeologically.

Surface collections are variable in nature in terms of context and do not exhibit identifiable components like those associated with stratified deposits.

This makes it difficult to frame surface collections in terms of a chronological framework based on stratigraphically-defined assemblage profiles. Current regional investigations employ a more standardized chronological model than that outlined above. Although the temporal categories modeled by this approach are looser and more general than those identified by the earlier chronological sequence, it incorporates the same regional temporal assemblage characteristics. The temporal strata as currently defined are: Paleoindian (pre-8500 B.P.), Early Archaic (6500-3500 B.P.), Middle Archaic (3500-1800 B.P.), Late Archaic (1800-600 B.P.) and Terminal Prehistoric (600 B.P.-historic era).

REGIONAL INVESTIGATIONS: Gumbatwas Core

Gumbatwas territory, which encompasses both the Tule and Lower Klamath Lake basins, has been well-documented archaeologically both in terms of excavation and survey. Excavations at three large, highly-stratified village sites are especially noteworthy: Peninsula Bay, Kawumkan Springs, and Nightfire Island. Sampson's (1985) investigation of Nightfire Island, located on Lower Klamath Lake, revealed a stratigraphic sequence dating back 6000 years from a terminal date of occupation estimated as 500 B.P. This deposit provides some well-established evidence for a marked shift in obsidian use preference associated with the transition from Elko to Gunther point styles (1650 B.P.); demonstrating an 18% increase in the frequency of Medicine Lake obsidian over a previous reliance on obsidian from northern sources such as Spodue Mountain (Sampson 1985).

In terms of surface survey, the Gumbatwas region has been addressed by a number of large-scale investigations; most notably a survey of the Medicine Lake Highlands by Fox and Hardesty (1974). This survey identified

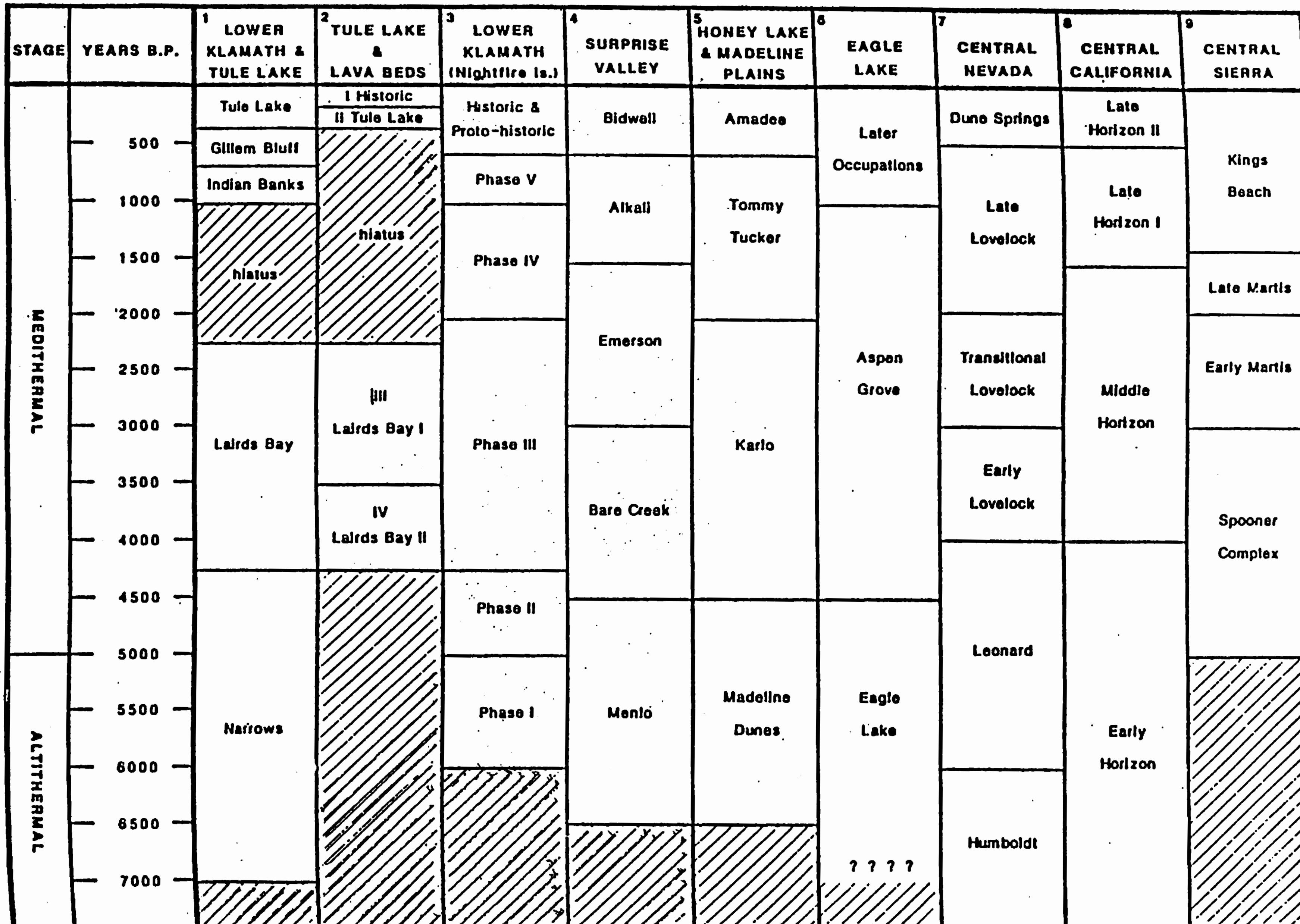


FIGURE 3: REGIONAL CHRONOLOGY
(from Gates 1983; Roedeffer and Masten 1985)

some 768 archaeological sites; all rather sketchily recorded, with sites generally "split" rather than "lumped" together. This project yielded 73 whole and partial projectile points which represented all temporal periods. The types observed were: Cottonwood Triangular and Bipointed, Rose Spring Corner-Notched and Side-Notched, Gunther Barbed, Elko Eared and Corner-Notched, and Northern Side-Notched.

Additional survey work has been conducted by Friedman (1977) in the Mt. Dome area southwest of Tule Lake. Thirty-four archaeological sites were identified during the course of that survey; all of which were classified as lithic scatters. Archaeological evidence recovered from these sites consisted of Cottonwood, Rose Spring and Desert Side-notched series projectile points, indicating late period occupation of the area.

Archaeological resources occurring on the Lava Beds National Monument on the southern shore of Tule Lake have also recently been assessed by surface investigation (Eidsness and King 1992). The specific research goals guiding this project included the evaluation of past archaeological investigations, assessment of site integrity and the updating of the existing data base (Eidness and King 1992: vi). This has resulted in a comprehensive overview of the current state of all existing Monument resources.

REGIONAL INVESTIGATIONS: Kokiwas Core

This area is lacking in the excavation history characteristic of the Gumbatwas core area. A notable exception to this is Hughes' (1972a; 1972b; 1972c; 1973; 1974 a; 1974b; 1974c; 1977) work in the Goose Lake Basin. Hughes' excavations at CA-MOD-293, CA-MOD-305 and CA-MOD-301 assessed late prehistoric subsistance strategies and group boundaries associated with Modoc, Achomawi and Northern Paiute use of the area.

Surface surveys of the Devil's Garden region associated with various Modoc National Forest management activities have been numerous. An inventory of 17,000 acres associated with the Triangle Ranch Wetlands Land Exchange is located at the heart of Kokiwas territory; and includes such archaeologically sensitive areas as Antelope Plains, Fairchild Swamp and Boles Meadows. Two ethnographic Modoc villages, Ka'umpwis and Tanka'i, were included in this study area.

Surveys in the upper Clear Lake/ Willow Creek drainage region have documented a number of extensive village site complexes, many in association with structural remains such as rock rings, rock alignments and prayer seats. One example of this is thought to represent the Kokiwas ethnographic village Ste'okas. This site was surveyed in 1995 by members of the Modoc National Forest archaeology crew, who reported burials, cremation areas, house pits and extensive lithic remains (George and Vickie Kline; personal communication, 1996).

A number of Master's theses have addressed the aboriginal use of the Devil's Garden (Cross 1980; Masten 1985; Nilssen 1985; Van de Hoek 1991). Especially relevant to this study is Van de Hoek's (1991) analysis of the spatial and temporal patterning of Blue Mountain obsidian as it occurs on the Garden. This study resulted in the establishment of patterned frequency isopleths of Blue Mountain source distribution across the Garden landscape. This project will be discussed in more detail in association with the Kokiwas core area data in Section 5.

REGIONAL INVESTIGATIONS: Boundary Area

The boundary area as defined by this study encompasses a large portion of the western Devil's Garden. This area has been subjected to numerous small-scale archaeological survey investigations undertaken by both the Modoc

National Forest and private contractors. Sites sampled by this thesis are associated with a number of these projects, most notable of which is the OTH-B Radar Project. Survey coverage associated with this project included archaeologically sensitive areas in the vicinity of Doublehead Mountain which identified several large and extensive lithic scatters, some in association with structural remains and midden. Four sites originally identified and recorded by the OTH-B Radar project have been field evaluated and tested as part of the sample for analysis selected by this project.

Recent archaeological investigations associated with utility corridors have resulted in the survey coverage of a large portion of the boundary corridor as well as the subsequent mitigation of NHRP-eligible resources through excavation (Wirth Associates 1981; Roedeffer and Galm 1985; Moratto, et al 1995; Delacorte and Hildebrandt 1994). The data recovered from these projects has been supported by obsidian hydration and x-ray fluorescence analysis.

CHAPTER 6:

Sampling Design

The sampling design proposed for the study of this ethnographic boundary system is guided by historic archaeology on a theoretical level while drawing upon methodology from the prehistoric domain. Marquardt and Crumley's (1987) theoretical conceptualization of boundary structure provide the framework of this sampling design, while advancements toward "hard" archaeological science in obsidian studies and debitage analysis provide the technical edge.

SAMPLING THEORY

In order to address questions of boundary dynamics, it is necessary to first provide the concept of a boundary with structural definition in terms of form and function. It is this definition that gives the abstract notion a basis in reality. It becomes evident that the boundary cannot be defined in terms of itself, it is the forces which operate to maintain it that are the true units of analysis. Boundaries operate as the interface between cultural groups and are by nature defined by the dynamics of social interaction between the groups which share them. For this reason the analysis of boundary systems is dependent upon understanding the groups which hold them in common. In terms of extinct boundary systems, this entails the identification of patterns in the archaeological record that can be recognized as characteristic of each cultural group and provides for distinction between them. By establishing such material indices for the identification of individual cultural strategies it is then possible to make inferences regarding boundary dynamics based on the archaeological record.

Due to the incomplete nature of the archaeological record, lithic materials provide the most enduring unit of analysis by which to isolate past technological strategies. The examination of lithic materials in terms of both source and form in order to define culturally-specific procurement patterns and use strategies has been used successfully to demonstrate bounded systems in a number of studies (Bettinger 1982; Fredrickson 1989). Obsidian source distribution represents the material most accessible to each cultural group; differential accessibility to sources produce distinctive patterns which distinguish between them.

SAMPLING STRATEGY/ SAMPLING UNIVERSE

The sampling strategy followed by this paper can be roughly described as a probability strategy, in which all sites have the same opportunity for inclusion into the final sample for analysis. The sampling universe defined here is defined by the establishment of the boundary corridor as a discrete unit of analysis. The general population of sites located within this boundary corridor will follow established guidelines for random sample selection.

The boundary corridor defined for sampling purposes by this paper is located on the Modoc Plateau at the interface of the Medicine Lake Highlands and Devil's Garden environmental zones at a mean elevation of 4500 feet. It is of generally level topography, climbing gently from 4100 feet along the western boundary to 5000 feet along the crest of the hills which form its eastern limits. Environmentally, this region corresponds to the vegetation community commonly known as Great Basin Shrub-Grass (Pease 1960).

The western boundary of this corridor follows the line defined by Ray's (1963) ethnographic description. It extends from a point north of Timber Mountain in the south along a northwesterly course to the south central shore of Tule Lake in the vicinity of Captain Jack's Stronghold. To the east, the corridor boundary extends to the northeast from the same southern point at Timber Mountain along the flanks of the Devil's Garden to the southwestern tip of Clear

Lake. The northern extent of the boundary corridor is defined by an arbitrary line drawn between the southernmost extremes of Tule and Clear Lakes.

SITE SELECTION CRITERIA

Sites were considered eligible for inclusion into the sampling universe if the following criteria were met:

1.) Exhibit temporal relevance.

The Glass Mountain obsidian source located in the East Medicine Lake Highlands within Gumbatwas territory stands as the definitive indicator of Late Period chronology. Chesterman (1955) set an original date for the eruption of Glass Mountain of 1360+/-240 B.P. This date has now been further refined to approximately 850 B.P. on the basis of more recent work (Donnelly-Nolan et al 1990). Due to the inherent temporal control afforded by this particular source material, sites associated with it have been included into the sampling universe. It must be noted, however, that use of this material is not as common as once thought. Glass Mountain materials from the PG&E-PGT pipeline project in the study area were surprisingly limited in both count and distribution (Skinner, personal communication 1997).

Projectile points are another valuable tool used to assign chronological control to prehistoric archaeological sites. Projectile points types that are associated with Late Archaic and Terminal Prehistoric occupations are described in Section IV. Sites associated with these forms were included in the sampling universe.

Late Period artifact types such as hopper mortars and European trade goods are also recognized to be temporally sensitive but are defined here as secondary chronological indicators due to their lack of additional research value relevant to this analysis.

2.) Chronological indicators must be part of a curated collection that is readily accessible and available for analysis.

3.) Multi-component sites must exhibit a comparable balance in terms of the overall assemblage and use strategy. The Late Period component must be strong (exhibiting multiple chronological indicators) and well-defined.

Sites in the sampling universe which have already been subjected to hydration analysis and assigned to a Late Period time frame will be given special consideration and included into the final sample as autonomous analytical units enhancing our understanding of the overall picture. It is the position of this paper that their inclusion in the final analysis as units independent of the selected universe serves to enhance, rather than bias, the representability of the overall sample.

There has been considerable debate over the rate of hydration for the East Medicine Lake chemical group, which has led to the development of competing rates for its hydration. This study will follow the rate advocated by the PGT-PG&E pipeline project analysis (Moratto, et al. 1998). Application of this hydration rate to the relevant data will remain consistent through analysis. Sites entered into analysis on the basis of prior obsidian hydration results will be assessed and converted to the equivalent rate as followed by this study before their results will be held to be comparable and conclusive to the final analysis.

Site records from the Tulelake, Clear Lake Reservoir, Steele Swamp, Hackamore and Timber Mtn. 7.5" USGS topographic quadrangles were reviewed at both the Modoc National Forest Supervisor's Office in Alturas, CA., and the Northeast Information Center of the California Archaeological Inventory at Chico State University on the basis of this criteria for the purpose of defining the sampling universe as a whole. Approximately five hundred site records were reviewed before the parameters of this project were scaled down. Eighty-five sites located within the sampling corridor were eventually judged to be eligible for inclusion into the sampling universe.

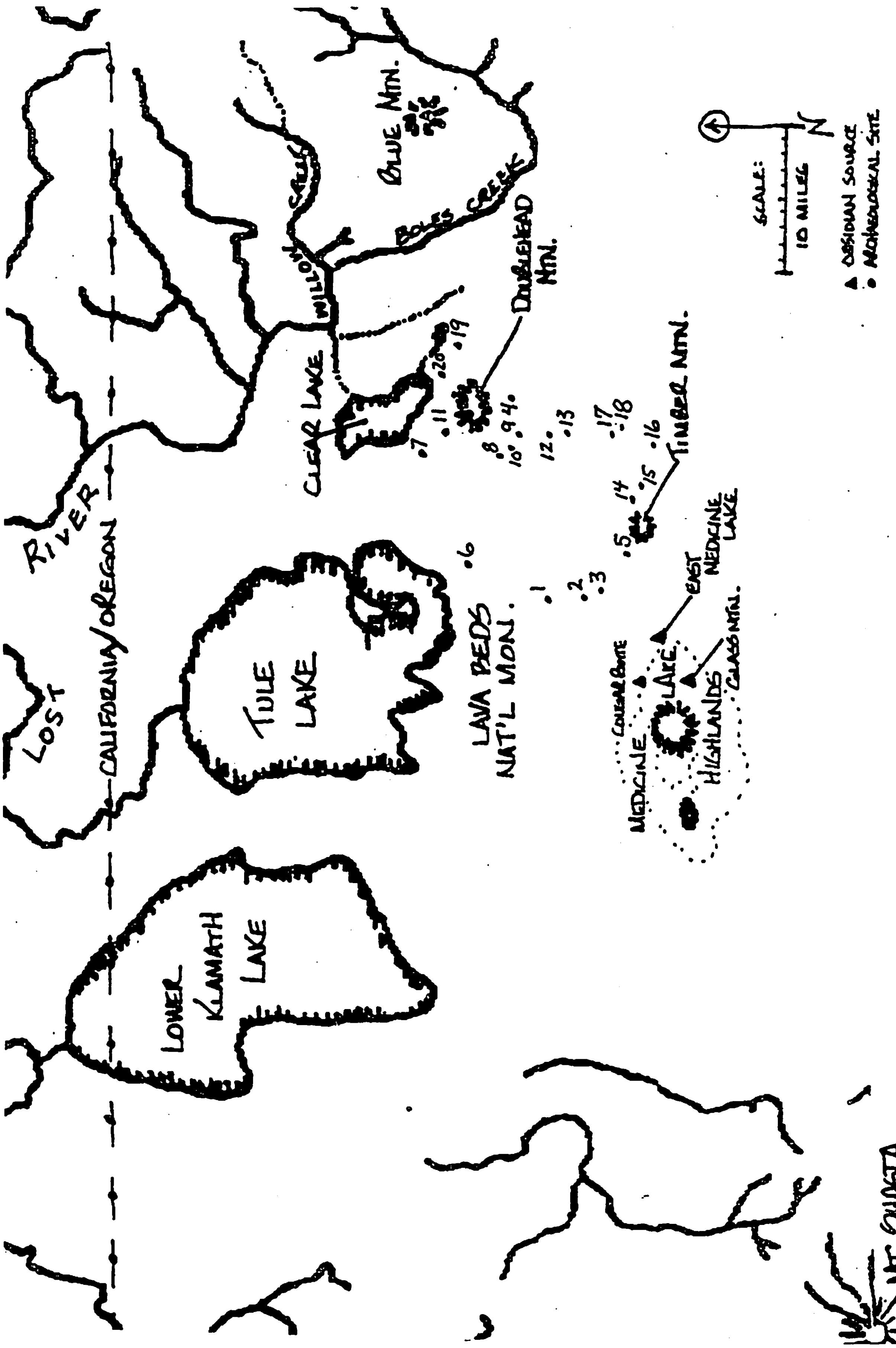
FINAL SAMPLE

The boundary corridor was subdivided into ten sampling strata, each measuring one mile E-W and fifteen miles N-S. Two sites were chosen from each strata with the use of a random numbers table. These sites were then visited in the field, where a number of problems occurred. Two of the sites chosen by this sample were naturally occurring phenomena and not cultural in nature; while two others could not be relocated. This led to two of the sampling strata without representation in the sample. This bias was eliminated when six of the eight temporally relevant sites from the PG&E-PGT and Tuscarora pipeline projects were found to be located within this area.

At final count, twenty sites in the boundary corridor were field sampled; the results from thirteen of these sites were submitted for obsidian hydration and XRF testing. This number, coupled with the existing data from the PG&E-PGT and Tuscarora projects, is held to provide an adequate sample of the late period assemblage units currently identified within the region.

In addition, two sites from the Kokiwas core area located within the Clear Lake catchment area were sampled and tested in order to provide archaeological indices for the use of Blue Mountain obsidian. No sampling was done within the Gumbatwas core area, obsidian indices have been established with existing data.

MAP 5: SITES SAMPLED



KEY TO SITE LOCATION MAP

1.) 56-1414 (Mod-2339)
2.) 56-1660 (Mod-2618)
3.) 56-0928 (Mod-1374)
4.) 56-1226 (Mod-2078)
5.) 56-1978 (Mod-2983)
6.) 56-1756 (Mod-2668/H)
7.) 56-1012 (Mod-1478)
8.) 56-1538
9.) 56-1561
10.) 56-1544
11.) 56-1208 (Mod-2236)
12.) 56-1172 (Mod-1918)
13.) 56-1397 (Mod-2318)
14.) 56-1837
15.) 56-1838
16.) 56-1952
17.) 56-1316 (Mod-2326)
18.) 56-1311 (Mod-2296)
19.) 56-1037 (Mod-1925)*
20.) 56-1285 (Mod-1932)*
21.) 56-1476 (Mod-2481)
22.) 56-1471 (Mod-2482)

* outlier

CHAPTER 7:

Field and Lab Methods

This study established twenty-two sites that were field-checked and sampled. Twenty of these sites were located within the boundary corridor; while two others were located within the core area of the Kokiwas near the southeastern margin of Clear Lake. These sites were chosen from the records of the Modoc National Forest and the Northeastern Information Center of the California Archaeological Inventory. Further site selection criteria has been discussed in the previous chapter on sampling design.

Sites were relocated in the field using information noted in the site records. Datum tags associated with each site were located in order to insure that the site was indeed the one targeted for study. The sites were then surveyed with five meter transects in order to establish site boundaries and examine the lithic assemblage. Each site was mapped and field recorded using monitoring forms provided by the Modoc National Forest.

Obsidian material observed at each site was examined and assigned to a lithic reduction stage sequence as developed by Bieling (1991) for the analysis of lithic materials at Bridgeport. Flakes were classified according to observed physical and morphological characteristics. The lithic analysis is presented in more detail in Section III.

The quantification of lithic material in terms of percentages was figured using general rules of thumb. The use of 5-meter survey transects to observe the total lithic assemblage occurring at each site provided initial indices which were then checked against the existing data base observations as outlined in previous site records and project reports.

Collection was limited to ten flakes from each site. These flakes were collected from arbitrary 1 x 1 meter sampling units placed in the area of greatest flake density within the site. Multiple sampling units were established for several low-density sites. All diagnostic artifacts observed were collected, but only Late Period point types were subjected to further analysis. Several Elko series points were recovered during the course of this project; these were collected and turned over to the Modoc National Forest for curation. The resulting sample consisted of 208 flakes and several diagnostic artifacts.

Samples collected were washed, individually bagged and assigned a catalog number according to site. Each flake or artifact was then sketched, weighed and measured, and described according to physical and morphological charateristics. A sample of nearly 200 flakes and artifacts collected from fifteen sites were then submitted to Craig Skinner of the Northwestern Anthropological Research Facility in Corvallis, Oregon for obsidian hydration and XRF sourcing analysis. A sample of 65 diagnostic artifacts previously collected from these sites was also submitted by Gerry Gates of the Modoc National Forest.

SECTION III: ANALYTICAL TOOLS

CHAPTER 8:

Chronological Controls

As defined by Hughes (1986: 83), the term "time-marker" denotes an artifact type or style that is a "morphologically distinctive form fashioned during a restricted period of prehistory". In the California and Great Basin culture areas these generally take the form of projectile point styles which demonstrate consistant association with specific temporal components as defined by stratigraphy, radiocarbon dating and obsidian hydration analysis. The occurrence of these forms within a specific archaeological context can be taken to provide a baseline for the chronological control of archaeological materials prior to the application of more technical levels of analysis. A brief overview of the temporal units held to be relevant to the scope of analysis identified by the present study and diagnostic marker forms associated with each follows below.

Middle-to-Late Transition (1250-850 B.P.)

Late Archaic Period (1300-600 B.P.)

These two periods mark the transition from the atlatl traditions of the Middle Archaic into the bow-and-arrow technology of the Late Archaic period. This transition is characteristically associated with the adoption of smaller projectile point styles better suited to the demands of the new technology. These are generally observed to be morphologically distinct from earlier dart-sized projectile forms.

Gunther Series

Gunther series projectile points are currently dated as occurring from 1650 B.P. through the historic period based on dates obtained from obsidian hydration analysis and carbon-dated stratigraphic deposits. The appearance of the Gunther style on the Modoc Plateau is documented by data collected at Nightfire Island. The mean hydration rim for projectiles of this type as established by the PGT-PG&E database was 2.4 microns (sd=0.8 microns).

Classic Gunther Barbed projectile points are characterized by barbs which extend beyond the base of the point and are often serrated. First described in the literature by Treganza (1958: 13-16), Gunther series projectile points are ambiguous by definition and variable in form, ranging from small triangular projectiles with exaggerated barbs and contracting stems to specimens which exhibit less pronounced barbs and stems which vary from contracting to straight and expanding. Hughes (1986: 86) provides discussion of the variability inherent within the Gunther category and notes that the original definition has been expanded upon to incorporate a wide range of small, barbed corner-notched projectile points found in the greater Northern California region.

As defined by PGT-PG&E project guidelines, Gunther series projectiles are characterized by contracting stems, proximal shoulder angles less than 90 degrees and expanding barbs. Under this definition, Gunther series projectile forms exhibit morphological features similar to those associated with Rosegate series points; thus creating an area of overlap in the classification of these two styles. Specimens which cannot be definitely assigned to one or the other of these two groups are defined as "small corner-notched" forms (Moratto, et. al. 1995: I-50).

<u>Rosegate Series</u>

This data category incorporates the point styles identified individually as Rose Spring, Eastgate Expanding Stem and Surprise Valley Split-stem under one general heading. These three types occur in different geographic contexts throughout the greater region but exhibit a high degree of morphological similarity and are temporally contemporaneous.

Rosegate points are considered to represent the earliest arrow-point forms occurring in the Great Basin and northern California. They are currently held to occur between 1350 and 650 B.P. Hughes (1986: 84) postulates that Rosegate forms may have been developed by the adaptation of Elko series dart points to emerging bow-and-arrow technology.

Rosegate series projectiles are small, triangular corner-notched forms that exhibit a lenticular cross-section. Stems vary from straight to slightly expanding and notches tend to extend from the corner of the stem diagonally toward the midline of the blade. As defined by the PGT-PG&E pipeline project guidelines, Rosegate series points are characterized by a neck width less than 6.5 mm., an expanding stem with proximal shoulder angles greater than 90 degrees and no extending barbs.

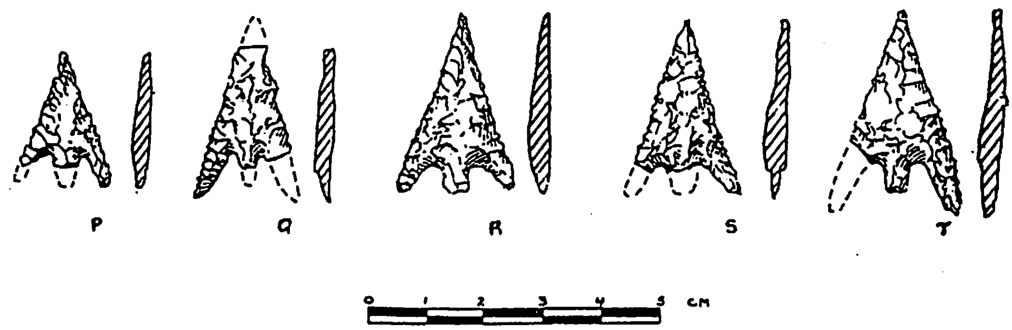
While they are common on the Modoc Plateau and throughout the Great Basin, the distribution of this point style does not appear to have extended westward beyond the southern Cascade Range. Data from the PGT-PG&E pipeline assigns a mean hydration value of 2.6 microns (sd=0.8 microns) to Rosegate forms observed on the Modoc Plateau.

<u>Terminal Prehistoric Period (600 B.P.-historic period)</u>

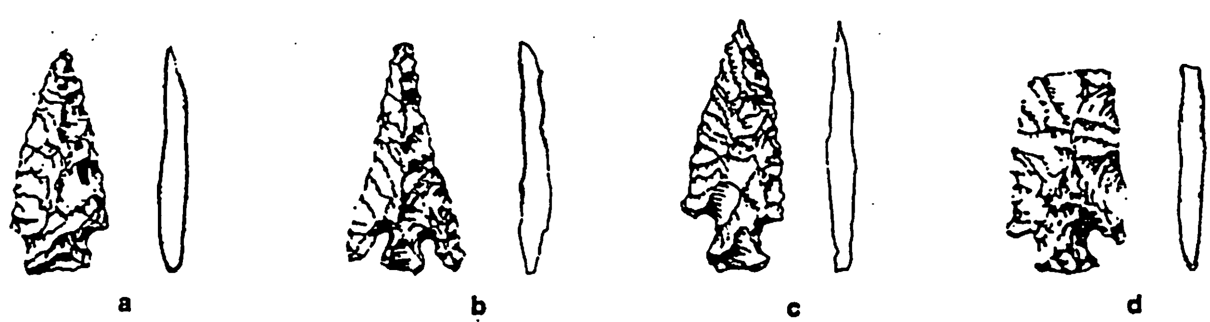
This temporal phase represents the final phase of pre-contact native culture as well as the protohistoric contact period. The restricted temporal span represented by the Terminal Prehistoric is difficult to delineate archaeologically, and is traditionally defined by the occurrence of Desert Side-notched projectile points. This definition has been expanded to include the Cottonwood Triangular and Small Stemmed point types as well. Other diagnostic elements

FIGURE 4: LATE ARCHAIC POINT STYLES

GUNTHER SERIES (from Hughes 1986)



ROSEGATE SERIES (from Delacorte, et. al. 1997)



indicative of Terminal Prehistoric occupations are: marine shell, chokecherry, pine nut and glass beads; brown-ware ceramics and items reflecting European trade (Delacorte, et. al. 1995: 71).

Desert Side-notched

This projectile form was first described in the archaeological literature by Baumhoff and Byrne (1959). It is characteristically small, thin and triangular in shape with notches cut high on the sides of the blade; typical weight is 1.5 gms. or less. Four subtypes, defined on the basis of basal configuration, have been identified within the larger category; these are distinguished on the basis of basal configuration. The Sierra subtype is characterized by central basal notching and diamond-shaped ears; the General subtype exhibits a convex to slightly concave base; Delta types are marked by deep V-shaped basal concavities; and Redding is associated with bell-shaped bases and curved notches (Delacorte, et. al. 1995: 68). The variability of form exhibited by these subtypes is not reflected temporally or culturally to any measurable degree.

The time frame associated with Desert Side-notched projectile points is 600 B.P. Hydration readings for this point style are consistently lower than those recorded for Rosegate series points; the mean rim value assigned to points of this type by the PGT-PG&E pipeline database is 1.3 microns (sd=0.2 microns). These points are scarce overall archaeologically possibly due to the limited temporal span of their duration.

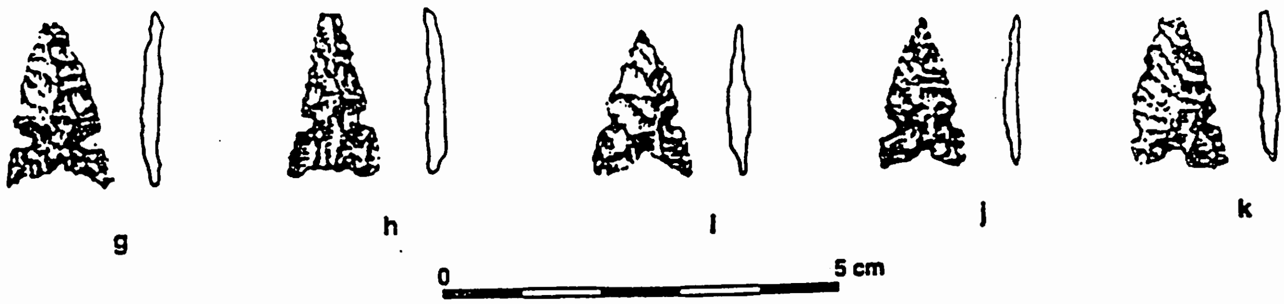
Cottonwood Triangular

This point style was first defined in the archaeological literature by H. Riddell (1957). Points of this type are small and triangular with unshouldered straight margins. Basal configuration of this type ranges from straight to concave bases. It is similar in size to the Desert Side-notched form; weighing less than 1.5 grams and under 3.6 mm. in thickness (Moratto, et. al. 1995: I-46).

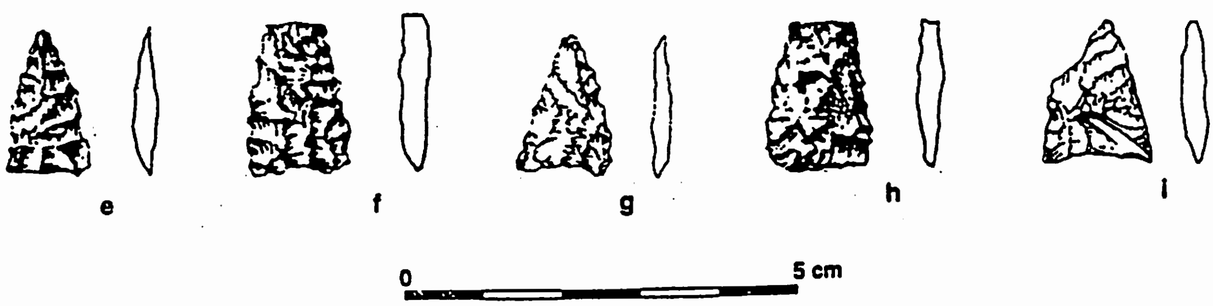
FIGURE 5: TERMINAL PREHISTORIC POINT STYLES

(from Delacorte, et. al 1997)

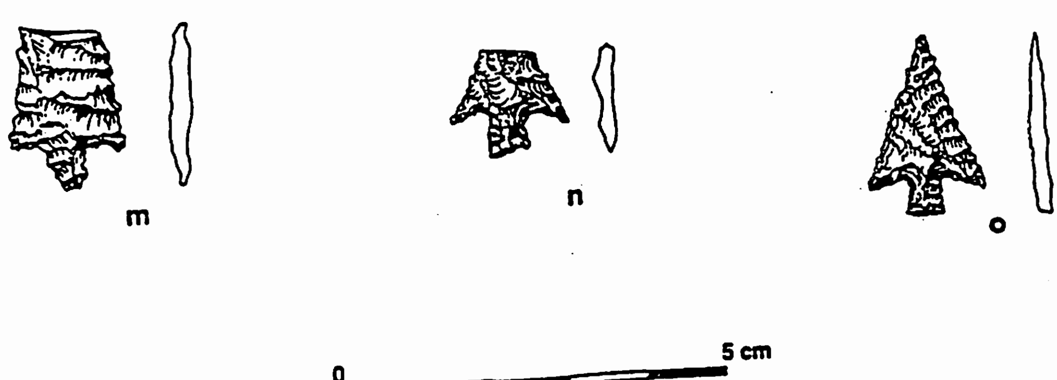
DESERT SIDE-NOTCHED



COTTONWOOD TRIANGULAR



SMALL STEMMED



Cottonwood Triangular points are often found in association with Desert Side-notched forms archaeologically. The two types exhibit nearly identical hydration readings and are commonly recognized as occurring contemporaneously. PGT-PG&E pipeline data assigns a mean rim value of 1.3 microns (sd=0.3 microns) to points of this type.

Small Stemmed

This category is defined by Delacorte, et. al. (1995: 70) as small corner-notched points which exhibit unusually deep and wide notches and slightly contracting stems. While it is noted that this style is quite similar to both Rosegate and Gunther series points, distinction can be made from them on the basis of the ratio of stem length to medial width (Delacorte, et. al. 1995: 70). Small Stemmed points are observed to be quite long in relation to their width, exhibiting a ratio greater than 1.25, while Rosegate points characteristically exhibit ratios less than 1.25. Further distinction can be made based on the tendency of Small Stemmed points to terminate in an unworked basal fracture, indicating that notching took place prior to the final modification of the tool margin. In comparison, Rosegate series projectiles exhibit more refined basal terminations and were completely edged prior to the setting of notches.

Following the lead established by Delacorte, et. al. (1995: 70) the Alkali Stemmed point style has been included into this category by the present study. This position is supported by both stratigraphic associations with Terminal Prehistoric assemblages as well as limited hydration data. The age associated with Small Stemmed points from the Tuscarora Pipeline project is post-600 B.P. based on hydration readings from thirty-three samples which ranged between 1.0-2.9 microns (mean 1.78). A more detailed chronological index of the overall series has yet to be established.

CHAPTER 9:

Obsidian Hydration Analysis

The geologic process known as obsidian hydration was first introduced into the scientific literature in 1958 as an offshoot of research into the hydration of natural glasses and the formation of perlite (Moratto, et. al. 1995: 5-7). The process of obsidian hydration refers to an observable phenomena by which water slowly diffuses from a newly-exposed surface of obsidian toward the interior of its mass. This diffusion of water creates a measurable band, also known as a hydration rim, which represents the passage of time since the exposure of the hydrating surface to the environment. This band can be observed and measured when observed by microscope as a thin section on a prepared slide. Hydration rims noted in relation with archaeological contexts range from no observable rim to rims of nearly 30 microns found in association with early sites in Africa (Skinner, et. al. 1997: 5).

The utility of this concept as a means of dating archaeological contexts was first demonstrated in 1960 in the work of Friedman and Smith. It was recognized that the measurable rim of hydration of an obsidian artifact possessed potential for providing a relative date of its modification. Unlike carbon-14 and other dating tools used in archaeology, obsidian hydration could be used to provide a date for the cultural activity which produced the tool; rather than simply providing a date for the material utilized.

Of primary concern to the development of relative dates for archaeological contexts is the establishment of source-specific rates of hydration. These rates are established either through the correlation of hydrated data with carbon-14 dates or through controlled laboratory experimentation. The rate of hydration as established for a specific source provides for the conversion of hydration measurements to an estimated calendar date when applied to a mathematical model of hydration. In terms of the present study, such a hydration rate has been established for East Medicine Lake and Grasshopper Flat/ Lost Iron Well/ Red Switchback material by Moratto, et. al. (1995). The model for the Modoc Plateau is as follows:

$$\text{Log } y = 1.844 \ (\text{Log } x) + 2.403$$

x= hydration rim width (microns)

y= Year B.P. (present= 1950)

The use of obsidian hydration as an effective dating tool of prehistoric contexts is not without limitations, however. It is recognized that a number of environmental factors such as ground temperature, chemical composition of the parent material, depth of deposit and soil alkalinity affect the rate of hydration and the development of the hydration band. These factors and others provide for a great deal of inter- and intra-source chronological variability and remain imperfectly understood. Discussion of these variables are beyond the scope of the present study, and are presented in greater detail in Ridings (1991); and Skinner and Tremaine (1993).

CHAPTER 10:

X-Ray Fluorescence Analysis

Obsidian from Blue Mountain, located on the Devil's Garden east of Clear Lake, is a type that is easy to identify visually on the basis of its physical properties. However, obsidian from different sources often display general physical characteristics which make them visibly indistinguishable from each other. This is true in the case of the seven discrete source types located in the Medicine Lake Highlands.

X-ray fluorescence is a method by which obsidian sources can be "fingerprinted" in terms of their diagnostic trace element concentrations. Trace elements are those rare-earth values which are part of the geochemical composition of specific sources or chemical families of affiliated sources. Diagnostic trace elements, as defined in Skinner, et. al. (1997: 4), are those elements which exhibit little intersource variability and provide for the greatest observable distinction between source types. These most often occur at values less than 1000 ppm in the sample.

The occurrence and distribution of trace elements within the sample is determined by the scanning of the artifact by a x-ray fluorescence spectrometer. This is a non-destructive method; unlike early characterization studies, which involved the powdering and pelletization of the sample. The occurrence of trace elements occurring within the sample is then directly compared to known trace element profiles held to be characteristic of distinct parent sources. These profiles are established by the analysis of material collected from the parent source itself.

It has been noted (Hughes 1986; Moratto, et. al. 1995) that obsidian from the Grasshopper Flat/ Lost Iron Wells/ Red Switchback chemical group is often virtually indistinguishable from obsidian from the East Medicine Lake chemical group on the basis of trace element analysis. Research has shown that while the two source groups can often be successfully distinguished from one another on the basis of their zirconium (Zr) content; an area of overlap does exist. To counter this ambiguity, an umbrella category, the "Grasshopper Group", has been established. Materials which contain less than or equal to 190 ppm zirconium are characterized to the Grasshopper Flat/ Lost Iron Well/ Red Switchback chemical group; while those that contain greater than or equal to 205 ppm zirconium are identified as belonging to the East Medicine Lake chemical group. Those materials which exhibit zirconium readings within the 191-204 ppm range are classified as Grasshopper Group (Skinner 1997: 9).

CHAPTER 11:

Lithic Analysis

Lithic material is the dominant data set existing for archaeological investigations into prehistoric lifeways as they occurred in California. Flaked stone assemblages provide valuable insight into past systems of procurement, exchange and social organization. Lithic analysis is used by archaeologists to identify the manufacturing sequence associated with the production of flaked stone tools. The priniciples of lithic analysis are based upon observable attributes associated with specific stages of tool manufacture. Discussion of lithic materials, production systems, manufacturing sequences and the model for analysis followed by this paper follows below.

Quality of Parent Material

Whittaker (1994) provides an excellent overview of the qualities inherent to the parent material utilized in the manufacture of stone tools. He notes that for a stone to be knappable, it must be homogenous in structure, brittle enough to flake easily, and elastic enough to bend under pressure yet retain its original shape (Whittaker 1994: 13-14). Stones that can be successfully knapped are either amorphous (internally homogenous) like obsidian; or are cryptocrystalline (internally structured) like chert, flint or basalt (Whittaker 1994: 13). The internal structure of a stone determines the degree of malleability it exhibits; and this can be loosely corresponded to the amount of silica (Si02) it contains.

Obsidian is a volcanic glass that is chemically related to both rhyolite and granite. Although it contains high amounts of non-silicate minerals, the homogeneity of the stone is born from the rapid cooling of the rock at a rate that inhibited the development of internal crystalline structure (Whittaker 1994: 69). Obsidian exhibits particular qualities in flaking that make it the most desirable material available for tool-making activity. It ranges in texture from glassy to crystalline; texture attributes are an excellent indicator of the quality of the material itself.

Lithic Production Systems

While early archaeologists placed a premium upon formed artifacts, today it is recognized that formed artifacts represent only the final stage of a lithic production system. Ericson (1982) defines a lithic production system as:

> "...the total of synchronous activities and locations involved in the utilization and modification of a single source-specific lithic material for stone-tool manufacture and use in a larger social system."

In order to reconstruct prehistoric lithic production systems it is first necessary to identify patterned behavior reflected in the lithic production sequence associated with a particular system. Experimentation with flintknapping techniques by today's archaeologists and other interested parties have led to the identification of manufacturing attributes characteristic of specific stages of tool production. These attributes are identified in archaeological contexts through examination of the debitage and tools generated by production activity. Debitage is the waste product generated by the production of stone tools. This material is discarded to become part of the archaeological record and reflects the production activity that created it. By examining both debitage and formed tools patterns of production activity as it occurs in a specific archaeological context can be identified. Discussion of the stages of lithic reduction as held by this study follows below.

Lithic Production Sequence

Stage 1 of the reduction sequence refers to the production or acquisition of a flake of sufficient size to reduce to a desired shape, or blank. Direct access to source material produces a core from which large primary flakes can be developed for future tool making; while materials obtained through secondary access such as trade often take a more refined form for ease of transportation. Cores, primary flakes and flake blanks make up the Stage 1 reduction assemblage; and are associated with percussion flaking techniques. These materials are generally large in mass, exhibit thick cross-sections and little surface complexity, and often exhibit remnant cortex.

Stage 2 is classified with Stage 1 as early stage reduction activity, but at this level the objective is the initial edging of the blank in order to strengthen the edges and establish striking platforms for thinning in later stages. Edge angles tend to fall between 55 and 75 degrees at this stage in order to facilitate further reduction, and modification of the blank is generally associated with percussion flaking techniques. Bieling (1991: 319) notes that most flake scars on Stage 2 forms do not extend beyond midline; and that average width-to-thickness ratios fall between 2.0 and 3.0.

Stage 3 is the transitional phase in the process of tool manufacture in which the process of refining the blank in terms of a finished product is begun. The objective of this stage is to thin the blank in such a manner that a lenticular cross-section is defined (Bieling 1991: 319). This is achieved by removing flakes from edge to midline across the face of the blank. Between six to twelve flake removals are associated with this stage, and frequently these can be seen to overlap earlier flake scars. It is noted that during this stage width-to-thickness ratios generally can be seen to increase to range between 3.0 and 4.0 while edge angles decrease to between 40 and 60 degrees (Callahan 1979).

Stage 4 reduction refers to the secondary thinning process in which edge angles of the original blank are established to their final form, between 25 and

45 degrees. Width-to-thickness ratios of the piece increase to final form as well, and range between 4.0 and 5.0 (Bieling 1991: 320). Surface irregularities produced by earlier stages of reduction are erased and an estimated 12-14 flakes are removed from the piece during this stage (Callahan 1979). Stage 4 forms are generally bifacial and exhibit pressure flake scars.

Stage 5 refers to the artifact in its final form. Further refining of the proximal end of the artifact for the purpose of including details such as notching also takes place at this stage. In Stage 6 these details are incorporated into the design. Stage 7 refers to the rejuvenation of tools through repair and maintenance.

Model for Lithic Analysis

The model for analysis of lithic remains followed by this study was developed by Bieling (1991) for the study of archaeological materials from Bridgeport, Mono County. In the first stage of analysis as outlined by this model each flake is examined and identified as either a complete flake, a flake fragment, or indeterminate shatter. This initial assessment is then further refined on the basis of key morphological attributes defined by this model as sensitive indicators of flake type in terms of production sequence. These are: amount of dorsal complexity, presence of cortex, flake size, flake weight and flake shape (Bieling 1991: 277).

The amount of dorsal complexity exhibited by a specific flake has long been held as a sensitive indicator of production stage. Medium and large flakes that have little complexity are thought to represent early-stage core reduction activity; while small, thin flakes of the same type are held to be indicative of late-stage activities such as pressure thinning. Flakes that exhibit a high amount of complexity are often associated with the reduction of late-stage forms such as bifaces, unifaces and other tools.

The presence of cortex on a particular flake is generally indicative of early stage reduction activity. Because it is assumed that the amount of cortex present in a particular lithic assemblage will be seen to decrease as distance from the source increases, this attribute can be used as an indice for correlation with expectations associated with distance-to-K projections (Bieling 1991: 278). Morphological definition of flake size, weight and shape follow the same principles of categorization as established for formal tool types in terms of indices of their expectations. Flakes that exhibit mass in terms of weight and thickness are generally held to be indicative of early stage processes; while flakes that are thin and fine are often categorized as later stage forms. However, it must be noted that these particular attributes were explored here only in their most basic sense due to the high number of flake fragments that occurred in the sample.

CHAPTER 12:

Obsidian Resources

There are over ninety obsidian source localities to be found in the southern Oregon, northeastern California and northwestern Nevada interface. Many of these sources are geochemically distinct, and can be identified and differentiated only by use of trace and rare earth concentration values. Source clusters located in the Medicine Lake Highlands, southern Oregon and the Warner Mountains are those most commonly associated with the Modoc Plateau obsidian assemblage.

The Medicine Lake Highlands and Blue Mountain, as the dominant localities under investigation, will be highlighted below in descriptive form; while discussion of the Warner Mountain and Oregon sources will be limited to more generalized information. Hughes (1986) provides a comprehensive overview of these and other localities, from which much of the information below is derived.

MEDICINE LAKE HIGHLANDS

Obsidian source localities within this region dominate the collected sample. Seven geochemically distinct groups of obsidian are currently identified as occurring in the Medicine Lake Highlands; although Hughes notes that the probability is high that other localities as yet unknown exist within the region. These seven source groups are associated with eleven discrete obsidian flows. Discussion of the source groups and their associated flows follow below.

Grasshopper Group

This chemical group consists of three distinct occurrences: Grasshopper Flat, Lost Iron Wells, and Red Switchback. The Grasshopper Flat and Lost

Iron Wells flows are located in the southwestern Highlands; while Red Switchback occurs in the northwest some distance away. Extensive use of these sources occurred throughout prehistory, and analysis by Mertzman (1982: 7) has established a K-Ar date of 0.33 +/- 0.02 million years for the Grasshopper Flat flow; and a K-Ar date of 0.61 +/- 0.03 million years for Red Switchback.

Visual characteristics associated with each source flow are defined by Hughes (1986: 300-301). Obsidian from the Grasshopper Flat flow tends to be milky grey in color and is often banded; while obsidian from the Lost Iron Wells flow is either grey or black in color and exhibits streaking and broad banding both. Both of these sources exhibit ample evidence of prehistoric quarrying activity. Obsidian from the Red Switchback is both red and black in color. Hughes (1986: 317) notes that this is a small outcrop 3.5 m. in diameter exposed by an uprooted tree; and that there is no evidence of prehistoric quarrying as at the Grasshopper and Lost Iron Wells localities.

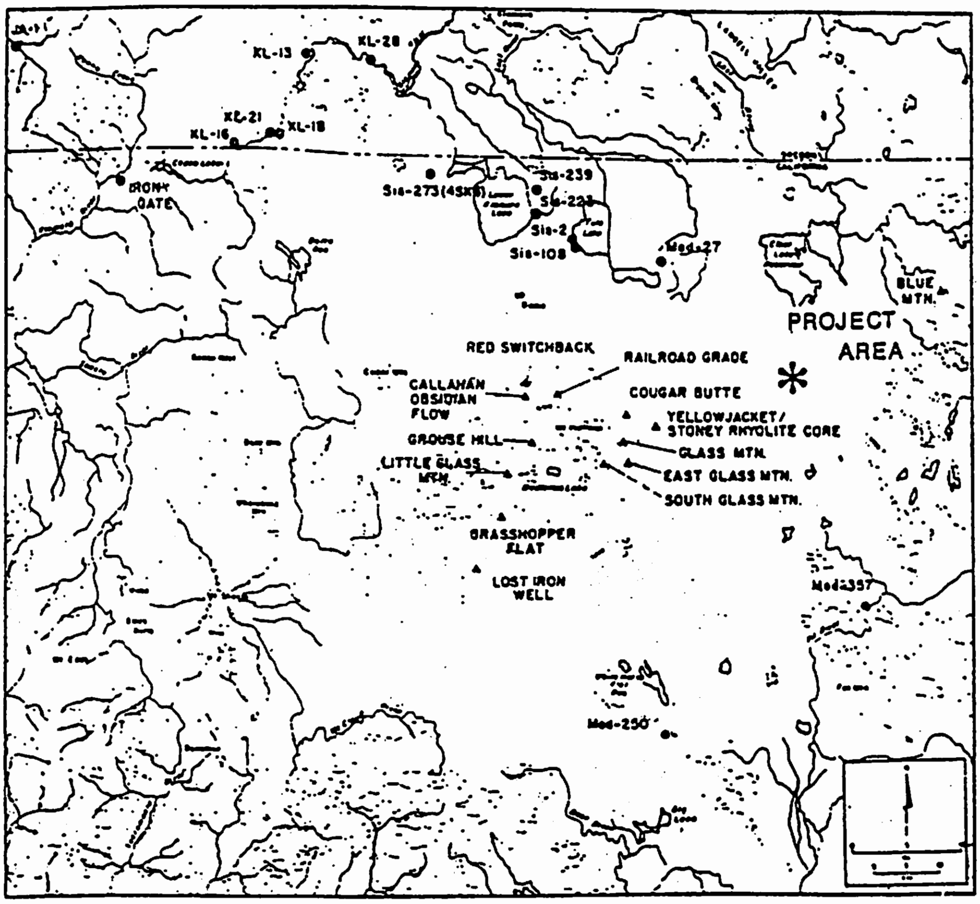
East Medicine Lake Chemical Group

Yellowjacket and Stoney Rhyolite Core are the two source localities associated with this chemical group. These sources are located only two miles apart on the extreme eastern portion of the Highlands. Mertzman (1982) has established a K-Ar date of 0.24 +/- 0.03 million years for the Stoney Rhyolite Core source. Current data derived from geologic mapping suggests that these are separate exposures of the same parent material (Hughes 1986:318); a position which is supported by trace element analysis.

Hughes (1986: 318) notes that while there is no evidence of prehistoric quarrying at Yellowjacket, the obsidian flow at Stoney Rhyolite Core is associated with numerous broken bifaces. These obsidians are visually indistinguishable; both are grey-black in color with clear blotches and banding.

MAP 6: OBSIDIAN SOURCES (Medicine Lake Highlands)

(from Hughes 1986)



<u>Glass Mountain Chemical Group</u>

The Glass Mountain obsidian source is located in the eastern Highlands and is an obsidian of superior quality that experts rank as one of the best in the world. It is also extremely valuable as a dating tool due to its late eruption date of 850+/- 40 B.P. (Donnelly-Nolan, et. al. 1990). The flow is enormous; covering an area of approximately five square miles, and there is ample evidence for prehistoric quarrying in the form of large broken bifaces, tips and midsections.

Hughes (1986: 319) distinguishes between the Glass Mountain flow proper and its sister flow; South Glass Mountain. Unlike the Glass Mountain flow, prehistoric quarrying evidence is limited at South Glass Mountain. Obsidian from both localities is physically indistinguishable, however, and is visually characterized by a rich, glassy appearance which ranges from black to grey in color with banding evident on some pieces.

<u>East Glass Mountain Chemical Group</u>

Located slightly east and roughly equidistant between the two Glass Mountain flows, stratigraphic relationships suggest that this obsidian source flow pre-dates them. Obsidian from this flow is visually indistinguishable from that found at Glass Mountain; but the two types can be separated on the basis of trace-element analysis.

<u>Cougar Butte Chemical Group</u>

This source is represented by a single locality in the eastern Highlands and provides abundant evidence of prehistoric quarrying in the form of broken bifaces, roughouts and biface reduction debris. Mertzman (1982) has established a K-Ar date of 0.43 +/- 0.04 million years for the source itself.
This obsidian occurs as nodules up to 20 cm. in length, convenient for the manufacture of bifaces (Hughes 1986: 320). The material is milky-grey in color lightly tinged with a blotchy pink-purple cast.

Callahan Chemical Group

This is a small outcrop of obsidian located on the northwestern slope of the Highlands, not far from the Red Switchback locality discussed above. It is a frequent component of prehistoric assemblages, and quarrying evidence at the source locality consists of debitage and biface and roughout fragments (Hughes 1986: 320). Obsidian from this locality ranges from black to bluish-grey-black in color with an even complexion. No banding is evident.

Railroad Grade Chemical Group

This is a small exposure of obsidian located in the northern Highlands near both the Red Switchback and Callahan localities. Hughes (1986: 304) describes it as a lesser-grade obsidian; resinous, vitreous and brittle in texture. It occurs in nodules up to 30 cm. in size. There is no evidence for quarrying at the source locality itself, but this obsidian has been noted in prehistoric contexts.

BLUE MOUNTAIN

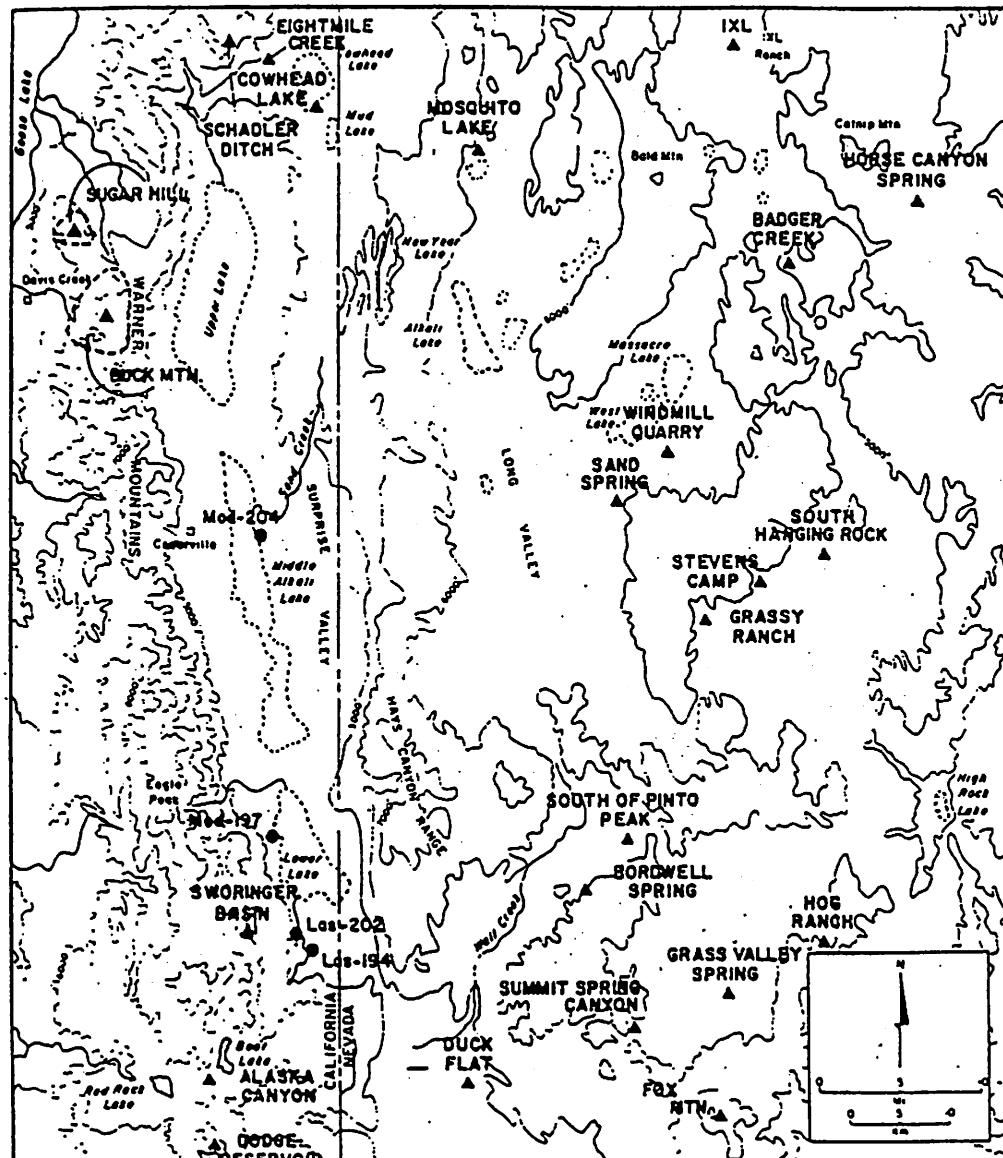
This source is located on the Devil's Garden approximately ten miles southeast of Clear Lake. The use of this obsidian throughout prehistory is well-documented in archaeological contexts. Its use is most often associated with the Kokiwas during the late prehistoric period. It is a visually distinct obsidian; slightly grainy in complexion with a uniform greenish-black hue. Although it lacks the glassy finish of other obsidian types, it is of good-quality and easily worked.

WARNER MOUNTAINS

These sources are located about thirty miles to the east of the Highlands along the California-Nevada border. Hughes (1986: 299) identifies twenty

MAP 7: OBSIDIAN SOURCES (Warner Mountains)

(from Hughes 1986)



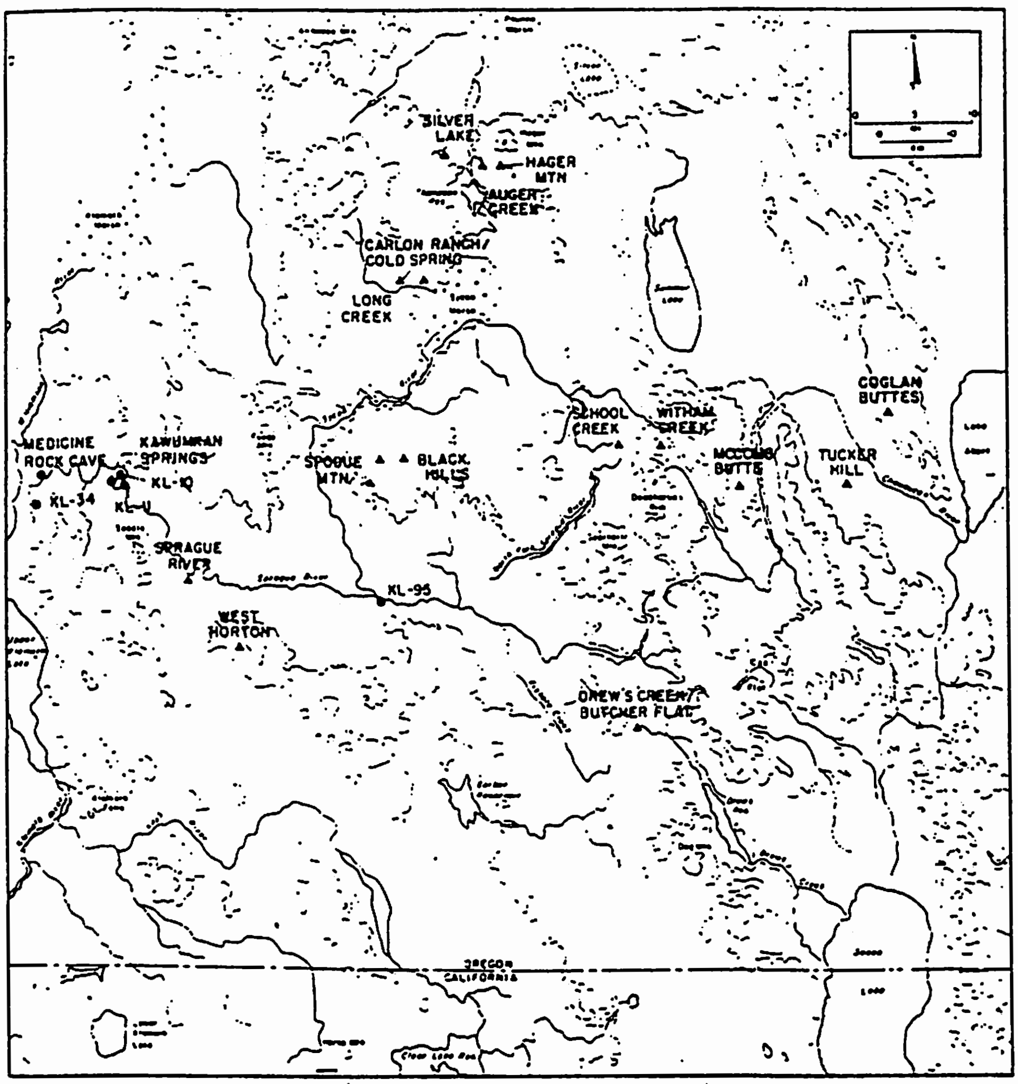
discrete source occurrences that can be grouped in association with seven distinct geochemical varieties within this region. Once again, the wealth of sources identified within this geographical area makes it highly probable that other sources exist as yet outside of known parameters. The quality of this material is comparable to that found on the Highlands; and its value as a trade item in the prehistoric past is well-documented by a widespread distribution. It is often found in a ceremonial context; in contrast to the more utilitarian use of Highlands sources.

SOUTHERN OREGON

Hughes (1986: 311-322) identifies sixteen geochemically distinct obsidian groups consisting of twenty-two source localities in the southern Oregon region. These sources are farther in distance from the study area than the Warner Mountains. Most of them are located along an east-west tending belt approximately twenty-five miles north of the present California-Oregon border. These sources were distributed widely across the landscape during the Middle Period, but in following with regional patterns this distribution was restricted and localized later in time. Material from a number of these sources, especially Sycan Marsh; Silver Lake; Spodue Mountain; Kawumkan Springs; and Drews Creek/ Butcher Flat, appear in the late-period Modoc assemblage.

MAP 8: OBSIDIAN RESOURCES (Southern Oregon)

(from Hughes 1986)



SECTION IV: CORE AREA INDICES

CHAPTER 13:

Kokiwas Core Area

A major premise of this thesis is that a discrete obsidian procurement-use strategy can be determined for both the Kokiwas and Gumbatwas groups by examining the core area of each. This discussion of the Kokiwas core draws heavily from the work of Van de Hoek (1991). This thesis established an isoplethic fall-off model for the distribution of Blue Mountain obsidian as it occurs on the Devil's Garden. Twenty-six sites were field investigated by this study and samples from nine sites were submitted for hydration analysis.

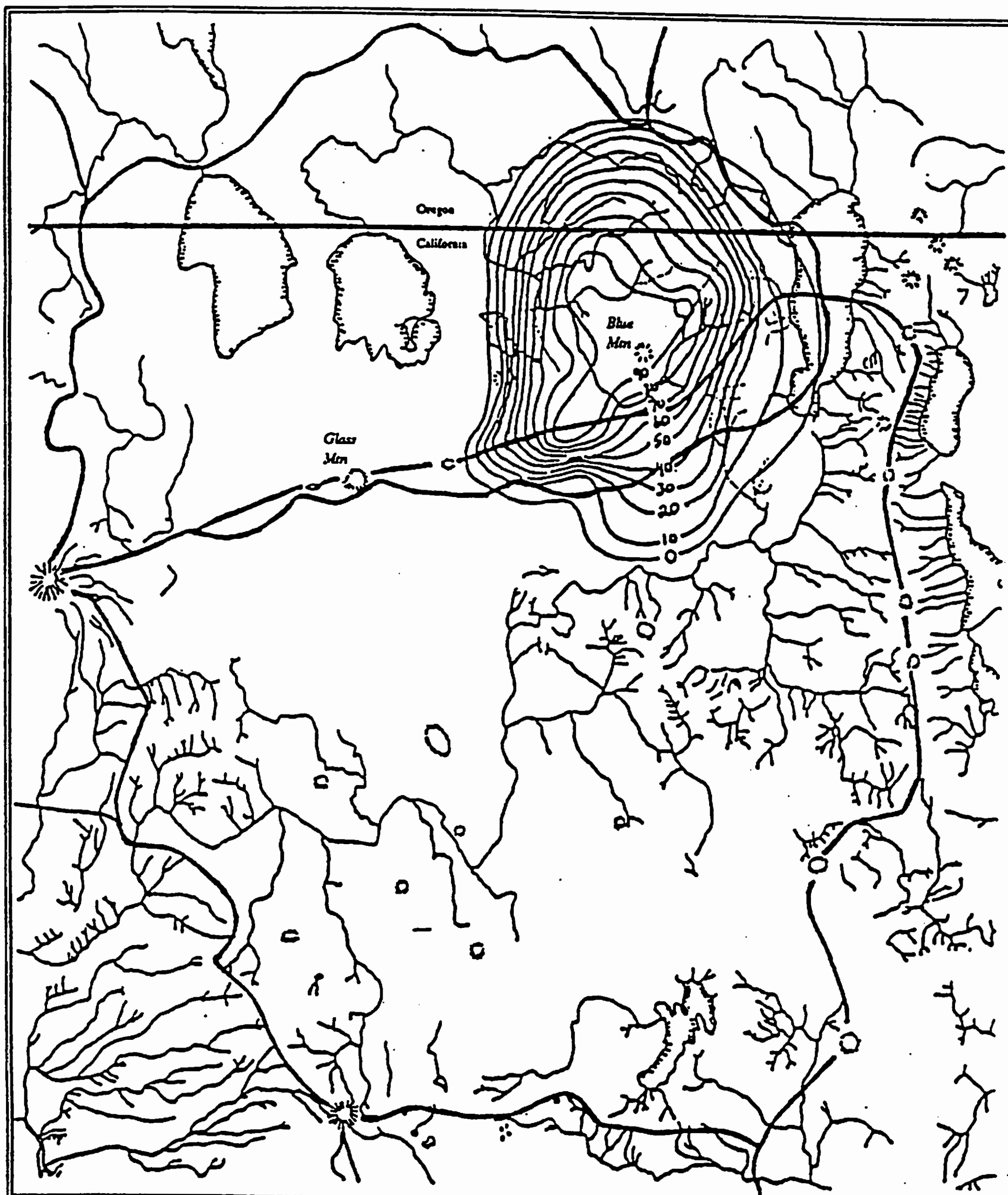
While only Blue Mountain material was tested by this study, percentages of that material to other lithics present provide information about the general nature of the lithic assemblage observed in the area. Hydration rates associated with this project range from 1.0 to 2.2 microns, which indicates a Late Period occupation and thus makes this data relevant to the study at hand.

In this model, the isoplethic distribution of Blue Mountain obsidian can be seen to drop off sharply in the western and southwestern portions of the Garden. At CA-MOD-1925, located 8.5 miles west of Blue Mountain, material from that source makes up 74% of the total lithic material observed at the site. At site number 05-09-1190, located 17 miles from Blue Mountain on the same southwestern transect as MOD-1925, material from that source makes up only 0.5% of the total lithic assemblage. While it is noted that the influence of Medicine Lake Highlands obsidian was probably strongly asserting itself (Glass Mountain is located approximately 15 miles to the southwest), the rate of falloff is greater than that of a normal distance-to-K model.

The distribution of Blue Mountain material is also compressed to the east of the source, dropping off approximately five miles from the western shore of

MAP 9: ISOPLETHIC DISTRIBUTION OF BLUE MOUNTAIN OBSIDIAN

(from Van de Hoek 1991)



Goose Lake. However, this falloff rate is not as pronounced as that noted above. Blue Mountain material lingers in the eastern assemblages appreciably longer and is probably influenced by southern Oregon and Warner Mountain sources. (Van de Hoek 1991: 68).

To the north and south of Blue Mountain the isoplethic range of its distribution is much further than expected. Van de Hoek provides some evidence for a high-percentage distribution of Blue Mountain material in assemblages located north of the Oregon border (1991: 73). This is interesting due to the proximity of southern Oregon sources such as Drews Creek/ Butcher Flat. She also notes that the distribution of the Blue Mountain source extends into the south to the extreme southern limits of the Devil's Garden (1991: 71).

Four sites are included in the discussion here of the Kokiwas core area. Two of these are sites field tested by this study (sites 19 and 20); while two others were analyzed by Van de Hoek (1991). Site 19, the ethnographic village site Chala'ks, was tested by both of these projects.

SITE NO. 19: CA-MOD-1925 (05-09-56-1037)

CA-MOD-1925 is the site of Chala'ks, an ethnographically described named summer village of the Kokiwas. It is located to the east of Doublehead Mountain on the margin of Red Lake, approximately two miles to the south and east of Clear Lake. This site is approximately 8.5 miles to the southwest of the Blue Mountain obsidian source. One bedrock mortar, one bedrock metate and groundstone implements have been observed at the site, indicating that the processing of foodstuffs was of some importance there.

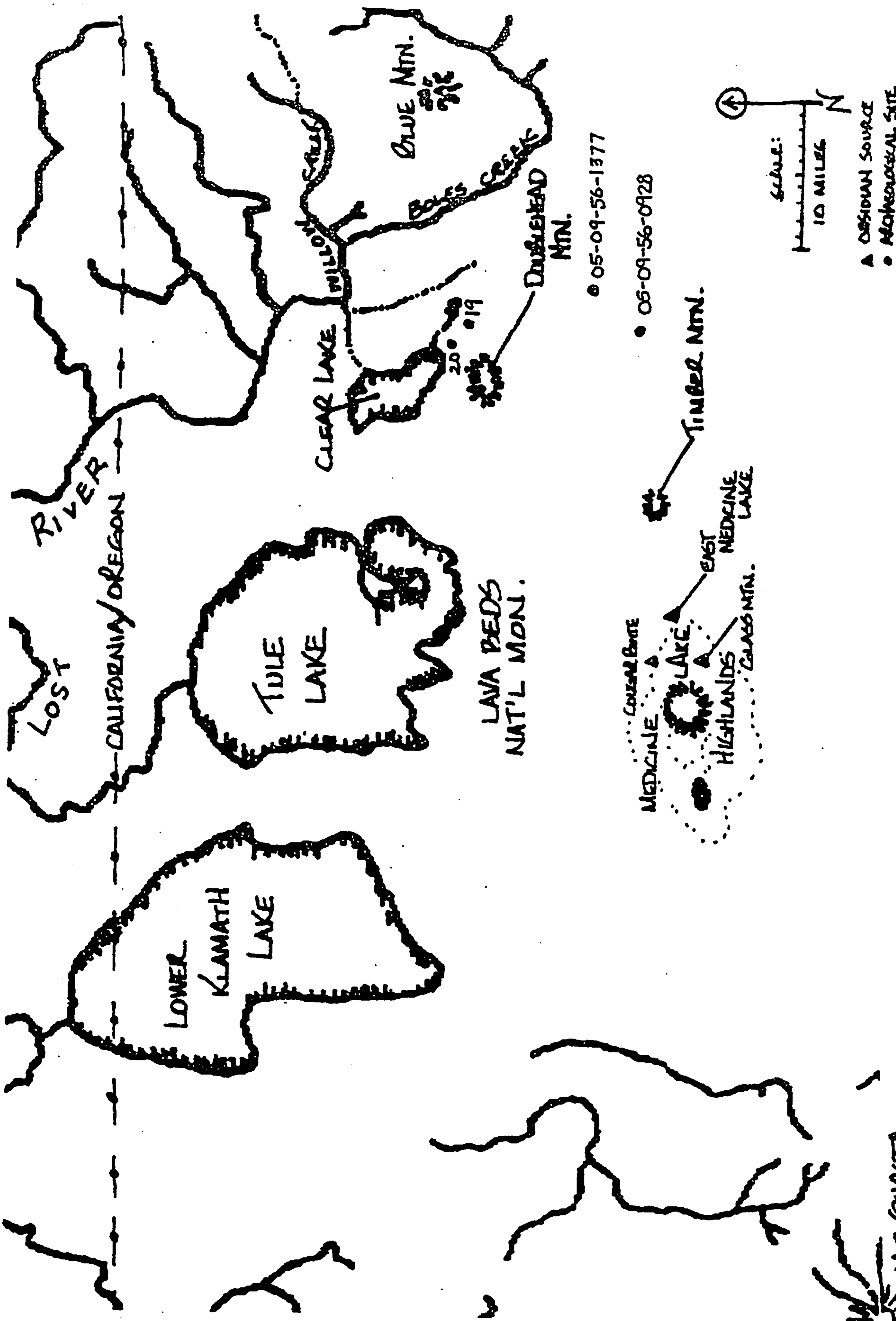
The site is classified as a light-to-moderate lithic scatter. At least 70 % of the surface lithic assemblage observed in 1997 is of Blue Mountain obsidian. A full suite of reduction activity was represented by this material; which ranged in form from large-sized flakes to microflakes. Numerous large flakes and chunks of angular shatter exhibited cortex. Several varieties of translucent glass made up another 20% of the total lithic assemblage; with fine-grained basalts, mahogany Warner Mountain obsidian and chert making up the remaining 10%. Flakes associated with these obsidians tended to be small, thin and fine while basalt flakes were larger and chunkier. These observations tally closely with Van de Hoek's 1991 estimates. Her figures place the percentage of Blue Mountain to other obsidian observed on site at 74%. While other obsidian source types are not identified in the sample, a 2% occurrence of other lithics such as basalt and cryptocrystalline is noted.

Thirteen previously collected projectile points and tools as well as ten flakes and one Rose Spring projectile point collected during 1997 field investigation were submitted for source and hydration analysis. Hydration results for an additional ten Blue Mountain flakes is provided by Van de Hoek (1991: 92).

An interesting pattern emerged in the analysis of this material. The East Medicine Lake sample (n=2 flakes, 5 projectile points) exhibited a range of 4.1 to 5.3 microns, with a mean of 4.8 microns, while Blue Mountain material (n=7 flakes, 5 projectile points) exhibited a range of 2.2 to 3.3 microns with a mean of 2.7 microns.

The projectile points submitted for analysis by this study included a variety of temporal forms which correspond to both the Middle and Late Archaic periods. Temporal affiliation was confirmed by hydration for both tool groups. Middle period forms (n=8) are: three Humboldt series, two leaf-shaped, one

MAP 10: KOKIWAS CORE AREA SITES



concave base, one base and one Rose Spring Corner-notched. These points returned a hydration range of 4.5- 5.9 microns (mean=5.2 microns) and XRF identified East Medicine Lake (n=5), Harris Flat (n=1), and South Warners (n=1) as the source localities from which they were derived.

The Late Archaic tool assemblage consisted largely of parts: two projectile tips; two projectile bases and one complete Rose Spring point. The hydration range for these items is 2.3- 3.3 microns (mean=2.8 microns). The projectile fragments were sourced to Blue Mountain; while the point was identified as Cougar Butte obsidian.

The debitage sample of ten flakes was dominated by Blue Mountain material (n=7). East Medicine Lake (n=2) and Harris Flat (n=1) were also represented. The overall range of the debitage sample is 2.2-4.9 microns (mean=3.0 microns); however, the range for the Blue Mountain subsample is 2.2- 3.0 microns (mean=2.5 microns). In support of this, the ten Blue Mountain flakes analyzed by Van de Hoek can be seen to exhibit a comparable range of hydration; clustering between 1.7- 2.5 microns (mean=2.1 microns).

Like the pattern observed with the tools above, Blue Mountain material is consistently associated with low hydration readings at this site; while East Medicine Lake and non-local sources are associated with both higher rim values and earlier tool styles. This seems to suggest a shift in the obsidian use-procurement strategy at the site in the Middle to Late Period transition.

SITE NO. 20: CA-MOD-1932 (05-09-56-1285)

CA-MOD-1932 has been recorded as a temporary camp or possble seasonal base camp. It is located two miles east of Clear Lake along Mowitz Creek, a fairly permanent water source in years of average rainfall. Three rock rings, three basket hopper mortars and other groundstone implements have been observed at this site, indicating some degree of occupational permanence.

This site is classified as a light density lithic scatter. It is located approximately ten miles west of the Blue Mountain obsidian source. 80% of the surface obsidian assemblage observed at this site was of Blue Mountain material, while black-banded translucent, grey opaque, grey translucent, grey-banded translucent and mahogany Warners obsidian, fine-grained basalt and chert made up the remaining 20%.

Eleven flakes and one projectile point were collected during the 1997 field season and submitted for obsidian hydration and characterization analysis. The single projectile point was a Desert Side-notched which was sourced to Cougar Butte. This point had a hydration reading of 2.5 microns.

The debitage sample did not reflect the obsidian source distribution as observed at the site in terms of relative quantity: six of the flakes sourced to East Medicine Lake; two others sourced to the Grasshopper Group; and three Blue Mountain flakes completed the sample. Overall hydration range of the debitage sample was 1.8- 4.9 microns (mean=4.2).

A pattern which emerged in further analysis of the data mirrored that observed at MOD-1925. East Medicine Lake/ Grasshopper Group materials exhibited a hydration range of 4.4- 4.9 microns (mean=4.4 microns); while the three Blue Mountain flakes included in the overall sample returned a hydration range of 1.8- 2.6 microns (mean=2.2 microns). Once again, Blue Mountain materials are associated with appreciably lower hydration rim values than those recorded for East Medicine Lake and non-local sources.

Two sites, 05-09-56-1377 and 05-09-56-928, have been chosen from Van de Hoek (1991) to profile along with data collected by the present study.

SITE NO. 19: CA- MOD-1925 (05-09-56-1037)
OHA/ XRF SAMPLES

CATALOG NO.	PROVENIENCE	DESCRIPTION	LENGTH	WIDTH	THICK.	WEIGHT
09-0863-02	50 m. @ 302 from SW post	PP tip	part.	1.55 cm.	3.4 mm.	1 gm.
09-0863-03	50 m. @ 302 from SW post	PP tip	part.	part.	3 mm.	part.
09-0863-04	50 m. @ 302 from SW post	Leaf/COT?	3.32 cm.	1.82 cm.	6.9 mm.	3.4 gm.
09-0863-05	25 m. @ 207 from Datum 4	Sm. HUM/COT?	part.	1.1 cm.	5.5 mm.	1.7 gm.
09-0863-07	67 m. @ 46 from Datum 4	RS ConSt	part.	part.	4.3 mm.	1 gm.
09-0863-08	84 m. 120 from Datum 1	COT?	3.1 cm.	1.04 cm.	6.5 mm.	2.1 gm.
09-0863-09	35 m. @ 77 from Datum 2	RS CN?	part.	1.55 cm.	4.4 mm.	1.3 gm.
09-0863-10	67 m. @ 46 from Datum 4	PP MS	part.	1.6 cm.	6.5 mm.	2.6 gm.
09-0863-11	60 m. @ 238 from Datum 1	Sm. HUM/COT	part.	1.2 cm.	3.9 mm.	.07 gm.
09-0863-12	210 m. @ 178 from Datum 1	Sm. HUM BasN	part.	1.64 cm.	5.4 mm.	1.4 gm.
09-0863-14	93 m. @ 214 from Datum 1	PP base/Leaf?	part.	1.82 cm.	4.9 mm.	1.1 gm.
09-0863-15	54 m. @ 244 from Datum 1	Sm. HUM?	part.	1.6 cm.	6.8 mm.	3.3 gm.
09-0863-17	75 m. @ N 81 E from Datum 2	RS CN	part.	1.9 cm.	4 mm.	1.4 gm.
09-0863-18	4 m. @ 348 from Datum 1	FLf: Stage 2	1.35 cm.	2.0 cm.	4 mm.	1 gm.
09-0863-19	4 m. @ 348 from Datum 1	FLf: Stage 2-3	1.5 cm.	1.8 cm.	5 mm.	.8 gm.
09-0863-20	4 m. @ 348 from Datum 1	FLf: Stage 2-3	1.3 cm.	1.9 cm.	5 mm.	.8 gm.
09-0863-21	4 m. @ 348 from Datum 1	FLf: Stage 2	2.0 cm.	2.2 cm.	6 mm.	2.5 gm.
09-0863-22	4 m. @ 348 from Datum 1	FLf: Stage 2-3	1.4 cm.	1.7 cm.	5 mm.	1.4 gm.
09-0863-23	4 m. @ 348 from Datum 1	FLc: Stage 2-3	1.8 cm.	1.5 cm.	5 mm.	.9 gm.
09-0863-24	83 m. @ 51 from Datum 1	FLf: Stage 3-4	1.2 cm.	2.0 cm.	1 mm.	.4 gm.
09-0863-25	83 m. @ 51 from Datum 1	FLf: indet.	1.3 cm.	1.4 cm.	3 mm.	.3 gm.
09-0863-26	83 m. @ 51 from Datum 1	BIFf: Stage 4	2.4 cm.	2.2 cm.	4 mm.	2.3 gm.
09-0863-27	83 m. @ 51 from Datum 1	FLf: Stage 2-3	1.8 cm.	1.8 cm.	5.5 mm.	2 gm.
09-0863-28	54m. @ 66 from Datum 2	Elongated CN	2.5 cm.	1.4 cm.	7 mm.	2.2 gm.
09-0863-29*	4 m. @ 348 from Datum 1	Flake bag	n/a	n/a	n/a	8/ 5.2 gm.
09-0863-30*	83 m. @ 51 from Datum 1	Flake bag	n/a	n/a	n/a	7/ 5.3 gm.

SITE NO. 19 CA-MOD-1925 (05-09-56-1037)
SUPPLEMENTARY OHA/ SOURCE ANALYSIS
(from Van de Hoek 1991, site no. 10)

PROVENIENCE	ARTIFACT TYPE	SOURCE	HYDRATION	EST. TIME DEPTH
09-863: 18	DEB	BMO	2.2	NA
09-863: 19	DEB	BMO	NVB	NA
09-863: 20	DEB	BMO	2.3	NA
09-863: 21	DEB	BMO	1.8	NA
09-863: 22	DEB	BMO	2.3	NA
09-863: 23	DEB	BMO	2	NA
09-863: 24	DEB	BMO	2.5	NA
09-863: 25	DEB	BMO	2.5	NA
09-863: 26	DEB	BMO	1.7	NA
09-863: 27	DEB	BMO	1.7	NA

SITE NO. 19: CA-MOD-1925 (05-09-56-1037)
OHA/ XRF RESULTS

CATALOG NO.	ARTIFACT TYPE	SOURCE	HYDRATION	EST. TIME DEPTH
09-0863: 02	PPT	Blue Mountain	2.3 +/- 0.1 & 1.6 +/- 0.1	not available
09-0863: 03	PPT	Blue Mountain	2.5 +/- 0.1	not available
09-0863: 04	PPT	South Warners	5.9 +/- 0.1	not available
09-0863: 05	PPT	East Medicine Lake	4.5 +/- 0.1	4051 B.P.
09-0863: 07	PPT	Cougar Butte	3.3 +/- 0.1	not available
09-0863: 08	PPT	East Medicine Lake	5.0 +/- 0.1	4919 B.P.
09-0863: 09	PPT	East Medicine Lake	5.1 +/- 0.1	5102 B.P.
09-0863: 10	PPT	Blue Mountain	3.3 +/- 0.1	not available
09-0863: 11	PPT	East Medicine Lake	5.3 +/- 0.1	5477 B.P.
09-0863: 12	PPT	Harris Flat	5.8 +/- 0.1	not available
09-0863: 14	PPT	Blue Mountain	2.7 +/- 0.1	not available
09-0863: 15	PPT	Buck Mountain	5.l +/- 0.1	not available
09-0863: 17	PPT	East Medicine Lake	4.7 +/- 0.1	4389 B.P.
09-863: 18	DEB	Blue Mountain	2.3 +/- 0.1	NA
09-863: 19	DEB	Blue Mountain	2.6 +/- 0.1	NA
09-863: 20	DEB	Blue Mountain	2.5 +/- 0.1	NA
09-863: 21	DEB	East Medicine Lake	4.9 +/- 0.1	4739 B.P.
09-863: 22	DEB	Blue Mountain	3.0 +/- 0.1	NA
09-863: 23	DEB	Harris Flat	3.6 +/- 0.1	NA
09-863: 24	DEB	Blue Mountain	2.8 +/- 0.1	NA
09-863: 25	DEB	East Medicine Lake	4.1 +/- 0.1	3412 B.P.
09-863: 26	DEB	Blue Mountain	2.2 +/- 0.1	NA
09-863: 27	DEB	Blue Mountain	2.4 +/- 0.1	NA
09-863: 28	PPT	Blue Mountain	3.3 +/- 0.1	NA

05-09-56-1377
OHA/ XRF RESULTS
(from Van de Hoek 1991; site no.5)

CATALOG NO.	ARTIFACT TYPE	SOURCE	HYDRATION	EST. TIME DEPTH
09-1351: 02	DEB	BMO	1.5	NA
09-1351: 03	DEB	BMO	2	NA
09-1351: 05	DEB	BMO	2	NA
09-1351: 08	DEB	BMO	1.8	NA
09-1351: 10	DEB	BMO	1.5	NA
09-1351: 16	DEB	BMO	1.8	NA
09-1351: 19	DEB	BMO	1.9	NA
09-1351: 25	DEB	BMO	1.8	NA
09-1351: 27	DEB	BMO	2	NA
09-1351: 28	DEB	BMO	1.8	NA

SITE NO. 20: CA-MOD-1932 (05-09-56-1285)
OHA/ XRF SAMPLES

CATALOG NO.	PROVENIENCE	DESCRIPTION	LENGTH	WIDTH	THICK.	WEIGHT
09-1292-16	39 m. @ 290 from Datum	Ang. IND: early stage	2.4 cm.	1.5 cm.	5 mm.	1.3 gm.
09-1292-17	39 m. @ 290 from Datum	FLf: Stage 2-3	2.2 cm.	2.4 cm.	5 mm.	2.7 gm.
09-1292-18	39 m. @ 290 from Datum	FBf	1.5 cm.	4.0 cm.	7 mm.	3.7 gm.
09-1292-19	39 m. @ 290 from Datum	FLf: early indet.	1.1 cm.	2.0 cm.	6 mm.	.9 gm.
09-1292-20	39 m. @ 290 from Datum	FLf: Stage 2-3	1.7 cm.	2.5 cm.	3 mm.	1.7 gm.
09-1292-21	58 m. @ 295 from Datum	Ang. IND: early stage	2.5 cm.	1.4 cm.	9 mm.	2.7 gm.
09-1292-22	·58 m. @ 295 from Datum	Ang. IND: shatter	2.1 cm.	1.8 cm.	8 mm.	2.0 gm.
09-1292-23	58 m. @ 295 from Datum	FLf: Stage 3-4	1.5 cm.	1.7 cm.	1 mm.	.3 gm.
09-1292-24	58 m. @ 295 from Datum	FLf: Stage 3	2.0 cm.	2.0 cm.	7 mm.	2.8 gm.
09-1292-25	58 m. @ 295 from Datum	FLf: early indet.	3.1 cm.	2.1 cm.	7 mm.	3.5 gm.
09-1292-26	58 m. @ 295 from Datum	FLf: Stage 2 (c)	1.7 cm.	2.1 cm.	4.5 mm.	1.4 gm.
09-1292-27	55 m. @ 290 from Datum	DSN	2.0 cm.	1.1 cm.	4 mm.	.6 gm.

SITE NO 20: CA-MOD-1932 (05-09-56-1285)
OHA/ XRF RESULTS

CATALOG NO.	ARTIFACT TYPE	SOURCE	HYDRATION	CALENDAR DATE
09-1292: 16	DEB	East Medicine Lake	4.4 +/- 0.1	3886 B.p.
09-1292: 17	DEB	Blue Mountain	1.8 +/- 0.0	not available
09-1292: 18	DEB	Blue Mountain	2.6 +/- 0.1	not available
09-1292: 19	DEB	East Medicine Lake	4.4 +/- 0.1	3886 B.P.
09-1292: 20	DEB	Grasshopper Group	4.1 +/- 0.1	3412 B.P.
09-1292: 21	DEB	East Medicine Lake	4.4 +/- 0.1	3886 B.P.
09-1292: 22	DEB	East Medicine Lake	4.9 +/- 0.1	4739 B.P.
09-1292: 23	DEB	East Medicine Lake	4.1 +/- 0.1	3412 B.P.
09-1292: 24	DEB	Blue Mountain	2.3 +/- 0.1	not available
09-1292: 25	DEB	Grasshopper Group	4.4 +/- 0.1	3886 B.P.
09-1292: 26	DEB	East Medicine Lake	4.4 +/- 0.1	3886 B.P.
09-1292: 27	PPT	Cougar Butte	2.5 +/- 0.1	not available

05-09-56-928
OHA/ SOURCE ANALYSIS
(from Van de Hoek 1991; site no. 4)

PROVENIENCE	ARTIFACT TYPE	SOURCE	HYDRATION	EST. TIME DEPTH
09-1133: 106	DEB	BMO	1.2	NA
09-1133: 112	DEB	BMO	1.3	NA
09-1133: 113	DEB	BMO	1.3	NA
09-1133: 116	DEB	BMO	1.3	NA
09-1133: 121	DEB	BMO	1.5	NA
09-1133: 122	DEB	BMO	1.5	NA
09-1133: 126	DEB	BMO	2.7	NA
09-1133: 127	DEB	BMO	1.4	NA
09-1133: 134	DEB	BMO	1.4	NA
09-1133: 135	DEB	BMO	2.2	NA

KEY TO DATA ABBREVIATIONS

FLf: Flake, fragment
FLc: Flake, complete
UFf: Utilized flake, fragment
UFc: Utilized flake, complete
FBf: Flake blank, fragment
FBc: Flake blank, complete
Cf: Core, fragment
Ang.: Angular
IND: Indeterminate
C: Cortex
BC: Bare Creek
Sm: Small
BMO: Blue Moutain obsidian
DC: Dorsal complexity
EdMod: Edge-modified
ExSt: Expanding stem
PIN: Pinto
SlSh: Sloping shoulder
ConSt: Contracting stem
MS: Midsection
Uni: Unifacial/ uniface
KN: Knife
SqSh: Square shouldered
HUM: Humboldt series
BasNot: Basal-notched
GMO: Glass Mountain obsidian
GUN: Gunther series
RS/ RG: Rose Spring, Rosegate series
GB: Gunther Barbed
AS: Alkali Stemmed
EG: Eastgate series
SVSS: Surprise Valley Split-stem
*: not submitted

These two sites were chosen for the following reasons: a.) they are located within western Devil's Garden region and thus would likely reflect the influence of Medicine Lake sources; and b.) they were tested by obsidian hydration analysis. However, only very general data is available for each of them, so it is offered to merely supplement the information outlined above.

Site 05-09-56-1377 is recorded as a seasonal base camp located in Kokiwas territory approximately 4.5 miles southwest of the Blue Mountain obsidian source. No non-obsidian materials were noted at this site, and 91% of the obsidian debitage noted was Blue Mountain material. Ten Blue Mountain flakes were submitted for analysis with a hydration range of 1.5 to 2.0 microns and a mean of 1.9 microns.

Site 05-09-56-928 is also recorded as a seasonal base camp. It is located 9.5 miles southwest of the Blue Mountain obsidian source. No non-obsidian materials were noted for this site either, but the percentage of Blue Mountain obsidian rose to 96% of the total assemblage despite the fact that it is farther away from the source than 05-09-56-1377. Ten flakes of Blue Mountain obsidian were submitted for hydration analysis and returned a range of 1.2 to 2.7 microns, with a mean of 1.6 microns.

CONCLUSIONS

Patterns of obsidian use and procurement are recognized as undergoing a radical shift during the Middle-Late Transition period. While Middle Archaic assemblages often reflect a great deal of source variability and high percentages of non-local materials, Late Archaic assemblages tend to be more homogenous in source and almost completely reliant on local materials. The distribution of East Medicine Lake obsidian, which ranged as far south as Sacramento in strong competition with local sources during the Middle Archaic, suddenly becomes restricted to a small local sphere in Late Archaic times. This shift is thought to reflect shifting patterns of social organization and land use associated with the transition to more sedentary strategies of subsistence.

Assemblage units observed at MOD-1925 and MOD-1932 reflect this pattern as outlined above. Obsidian source variability and reliance on non-local materials is well-defined in associated with the Middle Period tool forms and hydration readings identified at both sites. Although Blue Mountain is easily the most proximate source material available for tool manufacturing activity, it does not occur in the Middle Archaic assemblage at these two sites at all. Given the dominance of its occurrence in the overall assemblage (74% and 80%, respectively), it is to be expected that a temporal link to the Middle Archaic would exist somewhere in the sample. However, neither hydration nor diagnostic tool association establishes that link.

In contrast, Late Archaic hydration and point styles are framed almost exclusively by Blue Mountain obsidian in the Kokiwas sample. It has been noted (Delacorte, et. al. 1997) that Blue Mountain obsidian hydrates at a slower rate than East Medicine Lake material, perhaps exhibiting discrepancy up to 2.0 microns. If this is true, then the case for a Late Archaic source replacement of East Medicine Lake materials with obsidian from Blue Mountain in the Kokiwas core area as proposed above is weakened considerably. The development of a specific hydration rate for Blue Mountain obsidian is essential to a more complete understanding of the dynamics of Kokiwas obsidian use-procurement patterns operating in the Middle/ Late Transition and the Late Archaic and Terminal Prehistoric periods. It must be noted, however, that the Middle/ Late Transition in northeastern California is characteristically associated with the localization of source procurement preferences.

This shift in source preference is generally held to be indicative of the adoption of more sedentary lifestyles. In the Modoc region, settlement centers were established and maintained along lakeshores; the Kokiwas at Clear Lake and the Gumbatwas at Tule Lake. The establishment of these large permanent population centers provided a base from which to organize subsistence and procurement activities; this trend toward more efficient organization may have resulted in the restriction of the former range of mobile groups and the greater localization of resource procurement.

CHAPTER 14:

Gumbatwas Core Area

The Gumbatwas core area is defined by the present study to encompass the Tule and Lower Klamath Lake basins and adjoining areas. This area is located outside of the boundaries of the Modoc National Forest and permission for field testing was not obtained. Therefore, core area indices for Late Period Gumbatwas obsidian use-procurement strategies were constructed within the confines of the existing data base for the region.

It must be noted here that much of the data available for this region is associated with large-scale excavations carried out prior to the establishment of obsidian hydration analysis as an archaeological dating tool. Hughes (1986) has provided valuable characterization analysis of diagnostic projectile points from several of these collections. This data is also not supplemented by hydration analysis, but temporal associations for the data are established in terms of diagnostic projectile points as well as radiocarbon dates.

Hughes' data provides the backbone for this discussion of the Gumbatwas core area. His observations of the Late Period assemblages occurring at CA-SIS-273, a permanent village site located on the northeastern shore of Lower Klamath Lake, and CA-MOD-27, a rockshelter site located on the southeastern shore of Tule Lake at Copic Bay, are presented below. Data from CA-MOD-151, the named ethnographic village of E'uslis, is also presented. It is held that the Late Period assemblages observed at these three sites provide adequate indices for patterns of obsidian use-procurement strategies as practiced in the late prehistoric past.

CA-SIS-273 (Nightfire Island)

Nightfire Island is a deeply stratified site located on the northeastern shore of Lower Klamath Lake. First excavated in 1969 by University of Oregon field crews under the direction of LeRoy Johnson, the data was subjected to analysis by Grayson (1976) and later in greater detail by Sampson (1985). These studies established fifteen discrete strata for the framework of Nightfire Island data representing 5000 years of occupation at the site.

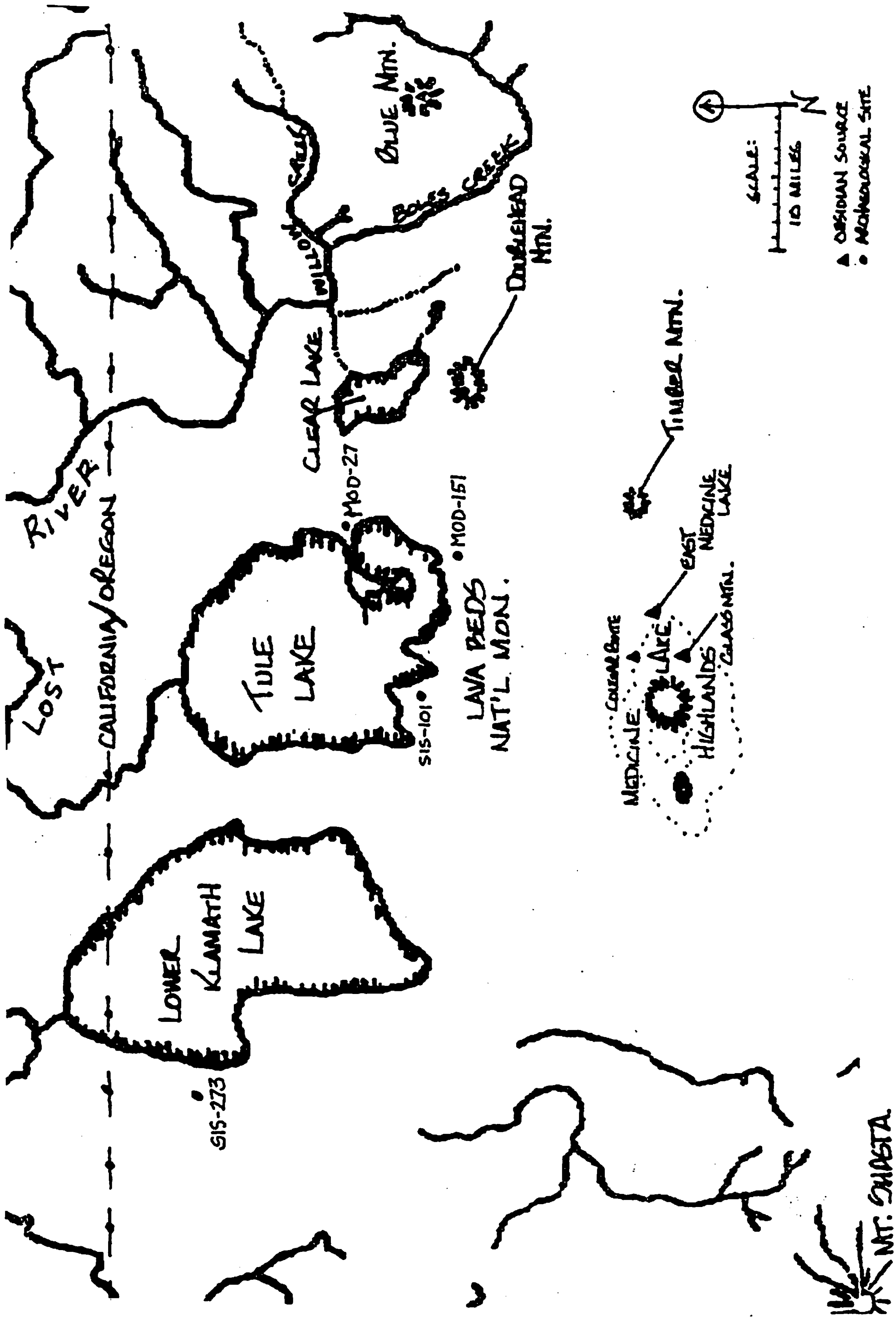
Hughes' analysis of the Nightfire Island data focuses on the source characterization analysis of selected diagnostic time-markers. Temporal control for the occurrence of these forms within the excavated strata was based on radiocarbon dates obtained from an excavation unit which presented clear stratigraphic relationships between datable charcoal and diagnostic projectile point forms.

In following with the temporal framework established by the radiocarbon analysis, Northern Side-notched points are dated to 5000-3350 B.P.; the transition into Elko traditions is dated to have occurred between 3350 and 2500 B.P.; and the appearance of Gunther Barbed within the assemblage is dated to 1800-1500 B.P.

The appearance of Gunther series points in the obsidian assemblage at Nightfire Island appears to be associated with a violent episode in the site's history. Numerous burials at the site are associated with Elko and Gunther series points. Following this episode, Gunther points are seen to supplant Elko forms in the assemblage in an assumed shift in technology from the atlatl to the bow and arrow.

Hughes notes an interesting pattern in the general Nightfire Island assemblage in terms of obsidian use-procurement patterns. During Northern Side-notched times, 80% of all points were manufactured from Medicine Lake Highlands obsidian, 14% from northeastern source materials and 6% from more distant easterly sources. During Elko times, however, only 63% of all

MAP 11: GUMBATWAS CORE AREA SITES



projectile points were manufactured from Medicine Lake material; while 26% were manufactured from northeastern obsidian and 11% utilized obsidian from eastern sources.

The introduction of Gunther series points into the site assemblage is associated with yet another shift in source preference. Obsidian from the Medicine Lake sources dominate the Gunther sample, contributing 81% of the total, while percentages of obsidian from northeastern and eastern source localities drop to 11% and 8% respectively. Hughes notes that these shifts in the obsidian use-procurement patterns through time at Nightfire Island reflects shifts not only in the distance of source materials utilized but also in the direction from which they came (Hughes 1986: 271). This in turn has implications for shifting subsistence strategies and their association with external social relationships which may have affected the accessibility of different sources to the inhabitants of Nightfire Island over time.

The use-procurement strategy reflected by Gunther projectile points is documented as remaining constant until approximately 1400 B.P. (600 A.D.), when the site is thought to have been abandoned. The absence of Glass Mountain source material at the Nightfire Island site is held by Hughes as an indication that this site fell into disuse prior to the eruption of Glass Mountain, which has been dated to 880 +/- 40 B.P. (1120 A.D.).

<u>CA-MOD-27</u>

This is a rockshelter site located near the base of The Peninsula on the southeastern shore of Tule Lake at Copic Bay. First identified in the archaeological literature by Squier and Grosscup (1955), this locality is described by Hughes (1986: 176) as a small and shallow archaeological deposit that appears to be Terminal Prehistoric in its associations. The assemblage at CA-MOD-27 is dominated by Desert Side-notched and

Cottonwood Triangular point styles, although two Gunther and four Elko series points are also in association with the deposit. Hughes proposes Gunther Barbed as a time-marker framing a temporal correlation between MOD-27 and the Late Period component at Nightfire Island associated with a radiocarbon-based date of 1450 +/- 90 B.P. (1986: 177). No hydration data is available for the MOD-27 collection.

Eighteen Desert Side-notched points were collected at CA-MOD-27. Medicine Lake Highlands sources contributed eleven samples: one from Cougar Butte, two from Grasshopper Flat/ Lost Iron Well/ Red Switchback, two from Glass Mountain, and six from East Medicine Lake. The remaining seven Desert Side-notched in the collection consists of three samples from Blue Mountain, three from Buck Mountain and one from Spodue Mountain.

Thirteen Cottonwood Triangular projectile points collected from CA-MOD-27 were manufactured from the following source localities: one from Cougar Butte, four from East Medicine Lake, two from Grasshopper Flat/ Lost Iron Well/ Red Switchback, two from Glass Mountain, two from Blue Mountain and Sugar Hill. Three Gunther points were also collected from this site: one from Cougar Butte, one from East Medicine Lake and one from an unknown obsidian source.

Four Elko series points complete the projectile point assemblage collected from this site. One sample was derived from East Medicine Lake obsidian, two from Grasshopper Flat/ Lost Iron Well/ Red Switchback and one from Buck Mountain. The presence of Glass Mountain projectile points in large number at this site is indicative of Late Archaic/ Terminal Prehistoric occupation. The great bulk of this deposit supports that position based on its diagnostic associations with late prehistoric bow-and-arrow technologies.

CA-MOD-151

This site is located on the southeastern shore of Tule Lake on Bureau of Land Management property. It is thought to be the permanent settlement named by Ray (1963) as E'uslis. Ray affiliates this site with the Kokiwas in his report, but certain patterns evident in the assemblage elements identified at this site make this assertion questionable.

Some fifty housepits and other features were identified at CA-MOD-151; and in 1986 the site was test excavated by the BLM under the supervision of Don Manuel. Due to the incredible complexity of this site only limited funding for archaeological evaluation was available. The results of this excavation have been detailed in a manuscript on file at the Bureau of Land Management office at Susanville, California (Manuel 1987).

The discovery of a tool cache containing several hundred items in an oven in association with a housepit floor at the site is exceptionally remarkable. There is no known correlate for a cache of this type in other California or Great Basin assemblages. It is currently thought to reflect a shared community tool storage unit associated with seasonal subsistence activity which took place at the site. An archaeological correlate for this behavior can be found in some ethnographic African cultures. The pooling of resources such as this is surprising when viewed in light of ethnographic accounts which assert that Modoc family groups jealously guarded their food resources for the winter in secret cache locations. Perhaps this cache of tools has implications for that behavior.

SECTION V: BOUNDARY ANALYSIS

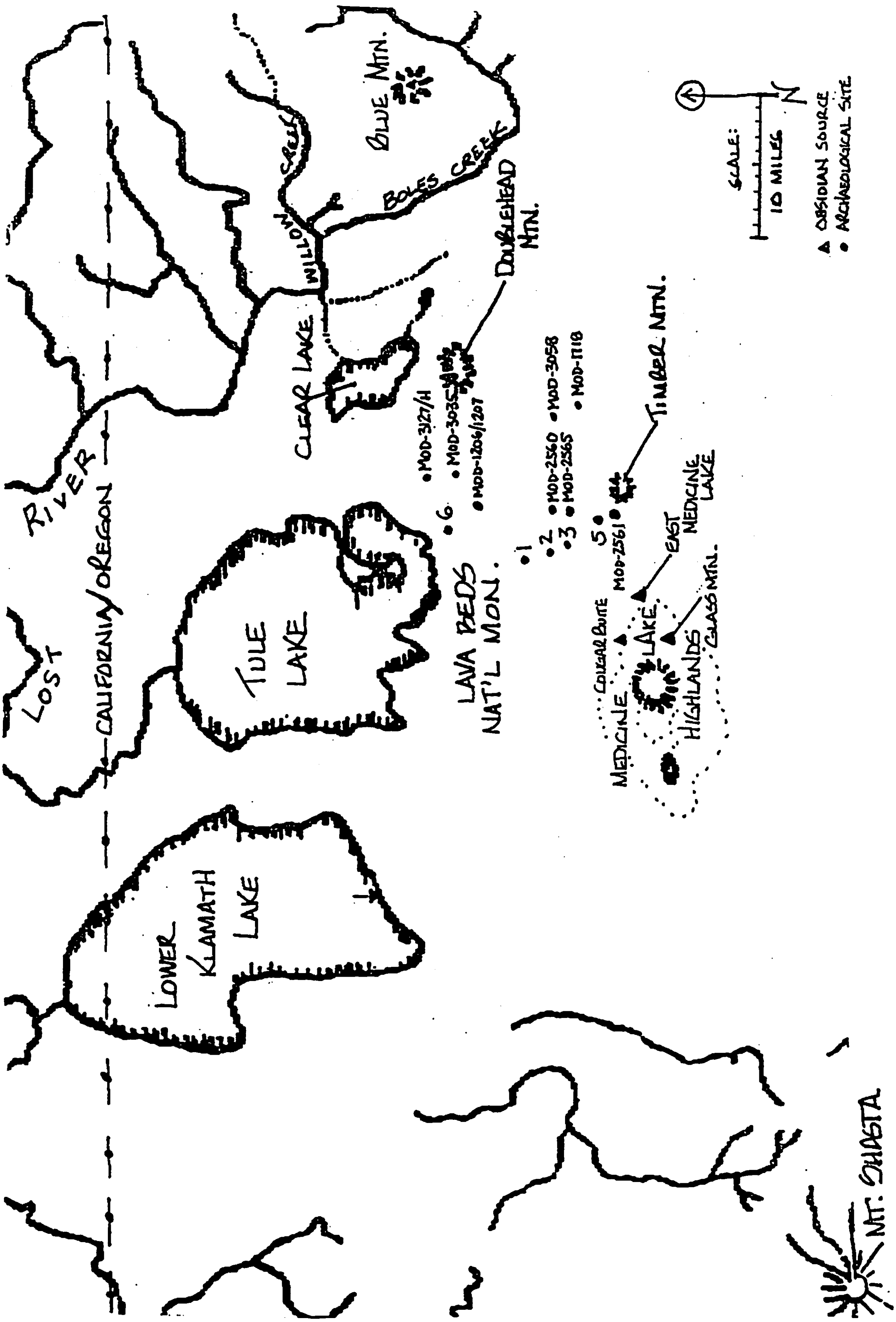
The shifting patterns in obsidian procurement patterns demonstrated for both the Gumbatwas and Kokiwas core areas have implications for the analysis of the boundary data. It has been demonstrated that both core areas are associated with shifts in source preference between the Middle and Late Archaic periods. In the Kokiwas core, the Middle Archaic reliance on East Medicine Lake obsidian is seen to shift to a decided preference for Blue Mountain material in Late Archaic times; while in the Gumbatwas region obsidian from northeastern source localities is replaced by a Late Archaic emphasis on obsidian from the eastern Medicine Lake Highland obsidian sources.

Sites located in the boundary corridor which returned hydration values indicative of relevance to the study at hand are observed to cluster into two discrete data sets associated with the western (Gumbatwas) and eastern (Kokiwas) boundary corridor margins. Patterns indicative of specific procurement strategies can be observed most clearly when examined with regard to the physical context of each site. Therefore this discussion of the boundary data is split into two sections based on geographic location.

Both sections are supplemented by existing data sets. Discussion of the Western boundary margin is supplemented by data sets established by the PGT-PG&E and Tuscarora pipeline projects; while discussion of the Eastern boundary margin is supplemented by data associated with the OTH-B Radar project. Overview of these data sets follows the discussion of each section.

Raw data tables outlining flake attributes, source characterization and hydration data for the study sites are contained in Appendix A. Results reported by the PGT-PG&E, Tuscarora and OTH-B projects are found in Appendix B.

MAP 12: WESTERN BOUNDARY MARGIN SITES
(PGT-PG&E, TUSCARORA and 1997 FIELD TESTED LOCALITIES)



CHAPTER 15:

Western Boundary Margin

SITE NO. 1:

CA-MOD-2339 (05-09-56-1414)

CA-MOD-2339 was originally recorded as a temporary camp by Dames and Moore in 1987 during the initial C-OTP transmission line survey. MOD-2339 is located on the volcanic tableland on the edge of the Tule Lake Basin in close proximity to the obsidian sources of the Medicine Lake Highlands. Both Cougar Butte and East Medicine Lake are located less than ten miles to the southwest of the site.

Over 1000 flakes were observed at this site in 1997, occurring in densities up to 50/ m2. A variety of obsidian types; including black and grey translucent glasses (80%), grey and black opaque (10%), mahogany Warner Mountains material (5%), and Blue Mountain (5%) were noted as occurring on site. Utilized/ edge-modified items occurred in the assemblage in observable amounts; a fact noted by the original 1987 site record as well.

Eleven flakes from this site were submitted for source and hydration analysis. Three flakes were sourced to Grasshopper Group; the remaining eight were identified as East Medicine Lake. Rim values for the tested sample ranged from 1.7- 6.7 microns (mean=4.2 microns). A Rose Spring/ Elko Corner-notched was also submitted for testing and was sourced to East Medicine Lake and hydrated to 5.5 microns.

Rim values of flakes occur in two distinct temporal clusters which correspond to Early and Late Archaic activity episodes. Two of the hydration readings (3.5 and 4.8 microns) have been excluded as outliers due to their lack of temporal context.

The Late Archaic hydration cluster consists of four readings: 1.7, 1.9, 2.0 and 2.7 microns (mean=2.1). All four are derived from East Medicine Lake obsidian and associated with late-stage reduction activity. One utilized flake and one flake tool fragment are included in this sample.

The Early Archaic hydration cluster also consists of four rim values: 5.8, 6.2, 6.5 and 6.7 microns (mean=6.3 microns). Two are sourced to East Medicine Lake and two are assigned to the Grasshopper Group. The debitage associated with this data cluster is largely representative of early stage reduction.

SITE NO. 2:

CA-MOD-2618 (05-09-56-1660)

CA-MOD-2618 was originally recorded in 1990 by Jensen and Associates as part of the C-OTP transmission line survey. It is classified as a light-to-moderate lithic scatter. MOD-2618 is located on the volcanic tableland approximately four miles to the northwest of Timber Mountain. The Cougar Butte, East Medicine Lake and Glass Mountain source localities are in close proximity to this site. Cougar Butte and East Medicine Lake are located only five miles to the southwest; Glass Mountain a few miles further on the same transect.

Two tool fragments and ten obsidian flakes were collected from this site and submitted for source and hydration analysis. The tool specimens were a corner-notched projectile point which was sourced to East Medicine Lake and hydrated to 3.7 microns; and a biface fragment which was also sourced to East Medicine Lake and hydrated to 6.0 microns.

All ten flakes were sourced to Glass Mountain, thus firmly assigning this site to a Terminal Prehistoric period of use based on the known 880+/- 40 B.P.

eruption date of this source. Range of hydration is between 2.0- 3.6 microns (mean=2.9) based on readings from seven flakes which exhibited rim values. This hydration spread is rather large considering the limited time frame by which the data is bracketed. Glass Mountain material is noted to consistently return anomalous results in terms of hydration readings (see Moratto, et. al. 1995). The tremendous amount of temporal discrepancy exhibited by this hydration sample is matched by unusually high rim values returned for Glass Mountain Late Archaic/ Terminal Prehistoric diagnostic artifacts elsewhere in the study area. This discrepancy must be further evaluated in order to address Glass Mountain data confidently.

Analysis of the debitage attributes associated with the collected sample reflected both early and mid-stage reduction activity. Two flakes were identified as primary flakes on the basis of size (greater than 3.5 cm. in length). Six others were categorized as early-to-mid-stage on the basis of platform morphology and percussion development; and the remaining two were determined to represent Stage 3 forms based on the presence of pressure modifications.

The lithic assemblage noted for this site during 1997 field investigations was charcterized by large, thick early stage materials, cortical flakes, large-to-medium-sized interior flakes with little complexity and unifacially-worked items. Most flakes were fragmentary forms. These observations coupled with the data results support the conclusion that MOD-2618 represents a locality where Glass Mountain obsidian was reduced from large primary flake blanks obtained at the source into mid-stage rough-outs or bifacial blanks.

SITE NO. 3:

CA-MOD-1374 (05-09-56-0928)

CA-MOD-1374 is located approximately halfway between sites MOD-2618 and MOD-2983 on the edge of the volcanic tableland to the east of the Medicine Lake Highlands. Once again, the East Medicine Lake, Cougar Butte and Glass Mountain obsidian sources are in close proximity to the site; all are located less than eight miles away.

Originally recorded in 1978 by the Modoc National Forest, MOD-1374 was re-recorded in 1993 as part of the County Road 10 survey. It is classified as a light-to-moderate (up to 20/ m2) density lithic scatter. Several visually distinct obsidian types were observed on the site in 1997. These were: dense grey semi-opaque (70%); black and black-banded translucent (15%); grey-banded translucent and glassy black opaque (15%).

Ten flakes were submitted for source and hydration analysis from this locality; all of which were sourced to East Medicine Lake. The range of hydration was 3.2- 4.3 microns (mean=3.7), which places the age of use for this locality in greater association with the Middle Archaic than the Late Archaic. The assemblage associated with this locality is characterized by large flake size, percussion flaking and little surface complexity; indicating early stage primary reduction activity. One core fragment was noted at the site.

The assemblage defined for site MOD-1374 is very similar to those described at MOD-2983 and MOD-2618. The relative tight hydration ranges that are associated with all three of these neighboring localities suggests that they represent expedient campsites associated with the procurement and reduction of obsidian. The similarity of their assemblages implies a degree of continuity in the mode of procurement practiced by late Middle Archaic, Late Archaic and Terminal Prehistoric tool producers.

SITE NO. 5:

CA-MOD-2983 (05-09-56-1978)

CA-MOD-2983 is located on the volcanic tableland approximately one mile northwest of Tionesta on the margin of the Medicine Lake Highlands. The East Medicine Lake obsidian source is located approximately four miles to the west of this site. The Cougar Butte and Glass Mountain source localities are also in very close proximity; both are located less than eight miles away.

This site was originally recorded in 1993 by Coyote and Fox during a survey of County Road 10 as contracted by the Modoc National Forest. It is classified as a light density lithic scatter. The 1993 survey noted approximately 150+ waste flakes as occurring on the site. Obsidian types observed on site during the 1997 field season in terms of debitage were black- and grey-banded translucent (90%) and black glassy opaque (10%).

Formal artifacts collected in 1993 included two scrapers, one leaf-shaped biface, two Guntheroid projectile points and one Rose Spring/ possible Guntheroid. The three projectile points were submitted for analysis and are included in the data set presented here.

The three projectile points sourced and hydrated by this study fell within expected temporal ranges. One Guntheroid point was sourced to Glass Mountain, thus assigned a Terminal Prehistoric age of use; the other Guntheroid was derived from East Medicine Lake obsidian and hydrated to 3.6 microns. The Rose Spring/ possible Guntheroid fragment was unidentifiable by source (Unknown 1) and hydrated to 2.1 microns.

Ten flakes were submitted for source and hydration analysis from this locality. All are sourced to East Medicine Lake. Hydration readings for the sample range from 2.5- 4.2 microns (mean=3.2), indicating a Late Archaic/

Middle-to-Late Transition age of occupation for the site. An unusually high percentage of complete flakes (40%) was observed for the collected sample.

Analysis of the collected sample indicates that primary reduction of material was the focus of tool-manufacturing activity at this site. Materials tend to be much larger (avg. length of flakes 3.1 cm.) than those noted at other sites in the boundary sample. Four of the flakes in the collected sample were identified as early stage forms; another two were classified as indeterminate and three others were assigned a general assignation as early-to-mid-stage material. Only one flake was assigned to a definite stage (3); the lack of distinctive morphological attributes made classification beyond general description difficult.

SITE NO. 6

CA-MOD-2668/H (05-09-56-1756)

This site is located on the floor of Dobie Flat on the margin of the Tule Lake Basin. It is located approximately a mile and a half to the northeast of MOD-2339. The East Medicine Lake, Cougar Butte and Glass Mountain obsidian source localities are located ten miles to the southwest of the site. MOD-2668/H was originally recorded in 1992 by Far Western Anthropological Research as part of the initial survey associated with the PGT-PG&E pipeline project.

Field observations from the 1992 site record define the lithic assemblage at MOD-2668/H as 100 obsidian flakes of Medicine Lake and Blue Mountain material. One Guntheroid and one Desert Side-notched projectile point were collected in 1992 but not submitted for analysis here.

1997 field observations noted the same basic site features as those recorded earlier with the exception of Blue Mountain material. No material from that source was seen to occur at this site. Obsidian types observed on site in 1997 were smoky black/ smoky black-banded translucent (90%) and grey opaque (10%). Flakes of the grey opaque variety were medium-sized (ca. 2.0 cm. in length) interior flakes, all of which exhibited surface complexity in varying degrees. Flakes of the smoky black translucent variety tended to be larger pieces indicative of early-stage reduction activity. 1997 field observations also note the occurrence of one cortical flake of this visual type.

Ten flakes were submitted for source and hydration analysis by this study. Five specimens were sourced to Cougar Butte while the other five sourced as East Medicine Lake. Hydration rim values range from 3.2-6.3 microns (mean=4.4 microns); but occur in a neatly consecutive sequence (3.2, 3.4, 3.5, 3.7, 4.1, 4.4, 4.8, 5.1, 5.5, 6.3) which indicates that this site was a consistently used locality through the Middle Archaic into the Middle-Late transition. The occurrence of a Desert Side-notched implies association with the Terminal Prehistoric period; unfortunately this is not borne out by hydration data.

The two sources represented in the data exhibit the same basic flake attributes. Flakes associated with the same stage of reduction activity consistently demonstrate comparable measurements of weight, length, thickness and width. Early-to-late stage biface reduction activity is represented in the sample for both sources; thick angular shatter implies that core reduction took place at this site.

CHAPTER 16:

Western Boundary Supplement: PGT-PG&E Data Overview

Information presented here is from the PGT-PG&E Pipeline project report (Moratto, et. al. 1995). This report outlines the results of source and hydration analysis associated with excavated site localities which are located in the boundary corridor defined as a unit of analysis by this study. Selected sites which exhibited assemblages temporally relevant to the analysis of the ethnographic boundary are presented below as a supplementary data set to the data base established by this project.

These sites are presented in a sequence which represents increasing distance from the East Medicine Lake obsidian source (south to north); distance from the site appears to be related with different sequences of the East Medicine Lake lithic production system operating late in prehistory. It is the position of this paper that the western boundary margin sites outlined above represent the first phase in the late prehistoric Medicine Lake Highlands lithic production system; while the sites discussed below reflect a secondary lithic production phase associated with increased distance from the source. Thus while the data presented above reflects primary post-procurement reduction activity, sites located along this pipeline corridor are representative of the secondary reduction of mid-stage material to final-stage forms.

PGT-PG&E SUPPLEMENT SITE A:

CA-MOD-1206/ 1207

Located approximately eight miles north of Timber Mountain on the Modoc Plateau, CA-MOD-1206/ 1207 is a composite of two sites originally recorded by the Modoc National Forest. This site exhibits evidence of sporadic episodes of occupation associated with the Early Holocene, Early Archaic and Terminal Prehistoric periods; and was chosen for discussion here based on the well-defined nature of the Terminal Prehistoric assemblage.

This assemblage is a discrete analytical unit defined in association with a housepit floor. Radiocarbon assays of wood collected from the floor of the housepit returned a date of 490+/-50 B.P. Hydration results of 21 East Medicine Lake and Grasshopper Group obsidian flakes resulted in a range of 0.9-1.9 microns (mean 1.3 microns; excluding two statistical outlers of 2.7 and 2.9). Standard deviation for the sample was established at 0.3 microns.

Medicine Lake sources dominate the sample submitted for source and hydration testing from MOD-1206/ 1207. East Medicine Lake, Grasshopper Group, Glass Mountain and Cougar Butte together make up 92% of the total sample submitted. Blue Mountain obsidian is identified as the greatest non-local contributor to the obsidian sample submitted for source and hydration analysis from this site (5%). Buck Mountain, Sugar Hill, Cowhead Lake/ Drews Creek/ Butcher Flat obsidians were also identified in the tested sample, but occurred less frequently than the Blue Mountain material.

Blue Mountain obsidian occurs in association with both Early Archaic and Late Archaic components identified at MOD-1206/ 1207. Interestingly, Blue Mountain obsidian is not represented to any great degree in the debitage index associated with either temporal component; rather it occurs in both contexts in the form of formal tools. In the Early Archaic sample of thirteen tools, Blue Mountain contributes 30% of the total tool sample (n=4). It drops significantly (10%) within the greater Late Archaic/ Terminal Prehistoric tool index; contributing four specimens to a much larger sample (n=36).

The assemblage asociated with the Terminal Prehistoric occupation span is charcterized by late stage reduction debitage. The presence of very large pressure flakes, up to 3.0 cm. in length and 1.0 cm. in width is taken to possibly indicate the manufacture of very large ceremonial blades. The PGT-PG&E analysis notes a significant increase in pressure-flaked bifaces as well as a greater emphasis on late-stage biface thinning and pressure flaking debris in the Terminal Prehistoric assemblage in comparison to the Early Archaic assemblage at this site. This can be taken to indicate that the manufacture of finished tools was of primary importance at this site during the Terminal Prehistoric period.

PGT-PG&E SUPPLEMENT SITE B:
CA-MOD-2561

This site is a lithic scatter located near Tionesta at the northwest base of Timber Mountain. It is in close proximity to MOD-1374 and MOD-2983. This assemblage is dominated by debitage and exhibits the same general characteristics in term of flake size and morphology. 82% of diagnostic percussion flakes are early-to-late stage biface thinning flakes between 3.0-4.0 cm. in length, with 6.8% of the sample exhibiting cortex.

Two occupation spans were identified on the basis of hydration analysis; these were dated to Middle Archaic/ Late Archaic and Late Archaic/ Teminal Prehistoric. Middle Archaic occupation was based on a hydration range of 2.3-3.9 microns (mean=3.0 microns); while Late Archaic/ Terminal Prehistoric occupation was based on a hydration range of 1.4-1.9 microns (mean=1.7 microns). 34 of 40 samples were sourced to East Medicine Lake while the rest were sourced to the Grasshopper Group. This assemblage is indicative of the same pattern of early stage biface thinning and percussion flake blank reduction noted at the other sites in the vicinity.

PGT-PG&E SUPPLEMENT SITE C:

CA-MOD-2565

This site is located one mile slightly northeast of MOD-2561 but exhibits a radically different assemblage. Four samples hydrated from excavation locality MRR 3 exhibit a hydration range of 1.1-1.3 microns; indicating a Terminal Prehistoric date of use. This is corroborated by the collection of three Desert Side-notched points from the site, two of which were sourced to East Medicine Lake (1.5 and 1.6 microns); and one which was sourced to Blue Mountain (4.7 microns).

Debitage analysis of fifty-three flakes collected from MRR 3 indicates the reduction of one or more small, angular cobbles of Blue Mountain material, approximately 15% of which still retains cortex. It is noted that the reduction emphasis of the Blue Mountain material appears to be placed on the production of select flakes rather than biface reduction. East Medicine Lake/ Grasshopper Group and Blue Mountain are roughly equal contributors (40% each) to the overall lithic assemblage observed at MRR 3; obsidian from the Cowhead Lake obsidian source of south-central Oregon also is noted to contribute the remaining 10% of the total sample.

There is a very low occurrence of percussion biface thinning flakes associated with this deposit indicating that production manufacture of this type was not a priority at this location. This site appears to reflect subsistence activity rather than lithic procurement; the rich faunal remains recovered in association with this cultural deposit would appear to reflect an emphasis on seasonal large-game hunting.

On the basis of these materials, the assemblage present at MOD-2565 is thought to indicate an expedient campsite locality. Unlike those observed at other sites in the vicinity, however, the assemblage present at MOD-2565 appears to represent a single episode associated with subsistence activity (hunting) rather than the procurement of East Medicine Lake obsidian. The presence of Blue Mountain and Cowhead Lake obsidian types in the MOD-2565 assemblage may possibly indicate that this campsite is associated with Kokiwas activity in the area.

PGT-PG&E SUPPLEMENTARY SITE D:
CA-MOD-2560

This site is located slightly to the northeast of MOD-2561 on the margins of seasonal Dry Lake. It is described as an extensive lithic scatter ranging in density from 30 to 300 flakes/m2. Fifty-eight projectile points largely indicative of Late Archaic occupation were collected at the site. Exact source and hydration data can be reported for the Desert Side-notched and Cottonwood series points collected for MOD-2560; however, the data sets for Gunther, Rosegate and Small Corner-notched series points are presented in more general terms.

The four Desert Side-notched projectile points submitted for analysis returned the following information: one was sourced to East Medicine Lake/ Grasshopper Group at 1.3 microns; another was sourced to East Medicine Lake at 2.7 microns; the third was sourced to Buck Mountain and hydrated to 2.5 microns; and the fourth was sourced to Glass Mountain (no hydration data). The one Cottonwood series projectile point in this assemblage was sourced to East Medicine Lake/ Grasshopper Group and returned a hydration rim of 1.7 microns.

Of the twelve Rosegate points tested, seven were sourced to East Medicine Lake/ Grasshopper Group and exhibited a hydration range of 1.5-2.7 microns (mean=2.1 microns); while the remaining specimens were sourced either to Buck Mountain or to an unknown source locality (no hydration data). Of the fourteen Gunther series projectile points reported at the site, eleven are sourced to East Medicine Lake/ Grasshopper Group with a hydration range of 1.2-2.8 microns (mean=2.2 microns); no data is given for the rest of the sample outside of the identification of Buck Mountain as the parent source of at least one of them. Of the seven Small Corner-notched types recovered at MOD-2560, hydration data for two specimens sourced to East Medicine Lake/ Grasshopper Group returned rim values of 2.4 and 2.6 microns. The rest of the sample is also sourced to East Medicine Lake/ Grasshopper Group except for two specimens which are identified as deriving from Cougar Butte and an unknown source locality.

Four discrete Late Archaic/ Terminal Prehistoric excavation loci were identified at MOD-2560. Nearly two thousand pieces of obsidian debitage and forty-one pieces of non-obsidian debitage (18 cryptocrystalline, 23 basalt) were recovered from Analytic Unit A/ Lithic Concentration 26. This deposit also contained three obsidian, two basalt and one cryptocrystalline cores; forty-seven bifaces, eight patterned flake tools and forty-nine unpatterned flake tools.

Debitage from this deposit is noted to fall in one of three visual groups: 50% is reported to candle to a golden hue, another 30% is reported to be clouded or banded, while the remaining 20% is described as gray to flat-black opaque. Brown and mahogany obsidian were also sparsely represented in the excavated sample. One large flake of Blue Mountain obsidian indicative of core reduction was recovered in association from another Late Archaic assemblage at MOD-2560, but no associated debitage was noted.

The bifaces recovered from AU A/ LC 26 are predominately late-stage forms. Fifteen are identified as Stage 4 forms, another twenty-six are representative of Stage 5. Attributes observed in association with this biface sample reflects a specific manufacturing process by which small- to medium-sized projectile points were produced from interior percussion flakes by means of pressure reduction techniques. This deposit defines a particular lithic production technique that is easily differentiated from standard Late Archaic late-stage assemblage components, and can be held to indicate that core-to-flake blank pressure-refining was one Late Archaic tool manufacturing process occurring in the Medicine Lake Highlands obsidian lithic production system.

The archaeological evidence supports the theory that late-stage reduction activity can be seen to increase in direct proportion with distance from source localities. At MOD-2560, located three-and-one-half miles north of MOD-2561, the reduction emphasis of East Medicine Lake material is seen to shift from early-stage reduction activity indicative of the reduction of primary forms into flake blanks to an emphasis on the reduction of flake blanks to finished forms.

CHAPTER 17:

Western Boundary Supplement: Tuscarora Pipeline Data Overview

All data presented in this section is from the Tuscarora Pipeline project report (Delacorte, et. al. 1997). The sites identified by the Tuscarora project are located along a transect which runs in a northwesterly fashion from the southeastern corner of the boundary corridor to a point approximately five miles north of Timber Mountain, where it converges upon the PGT-PG&E pipeline corridor. From this point the pipeline changes course and heads in a northerly direction roughly parallel to the course taken by the PGT-PG&E pipeline corridor.

The Tuscarora pipeline data discussed below is not as specific as that presented earlier in conjunction with the PGT-PG&E pipeline project due to the fact that most of these sites were test probe localities. Results from the test probe analyses are presented below without regard to lithic production charateristics; but are included based on the source associations they present in terms of Late Archaic and Terminal Prehistoric temporal assemblage units.

TUSCARORA SUPPLEMENTARY SITE A:

CA-MOD-3127/H (05-09-56-2156)

This site is described as a large, low-density lithic scatter. It is located roughly halfway between Tule and Clear Lakes at the southwestern tip of the Clear Lake Hills. The East Medicine Lake obsidian source is located approximately fourteen miles southwest of MOD-3127/H; while Blue Mountain is located to the east of the site about sixteen miles. It is associated with both western and eastern boundary margin localities. MOD-2668/H, a site included in the western boundary sample at Dobie Flat, is located approximately two miles to the southwest of MOD-3127/H; while two sites included in the eastern sample fall within the same parameters of proximity. MOD-1478, in the Clear Lake Hills, is located about one mile to the northeast of this site; MOD-2236, near the edge of the Clear Lake Basin, is two miles to the southeast.

The assemblage observed at MOD-3127/H included seventy-one formed tools, debitage, millingstone fragments and one bedrock mortar. The projectile points observed at the site were primarily Middle Archaic in association; eight Siskiyou Side-notched, one Northern Side-notched and three Elko series points form the backbone of the formed tool inventory. Late Archaic/ Terminal Prehistoric associations were indicated by four Rose Spring, one arrow-sized indeterminate and two Desert Side-notched projectile points.

The Desert Side-notched and arrow-sized projectiles were collected in association with one Cottonwood series point of cryptocrystalline from a surface scrape unit (S3/E40). A debitage sample of eleven flakes collected from this surface scrape displayed a hydration range of 0.9-4.3 microns (mean=1.55 microns), indicating a Terminal Prehistoric pulse of occupation. While the majority of these flakes sourced to East Medicine Lake (n=4); Glass Mountain (n=1), Buck Mountain (n=2) and Blue Mountain (n=1) were also represented in the sample. Other flakes were too weathered or too thin to accurately assign to source.

MOD-3127/H is noted to have a high flaked stone tool to debitage ratio. The flakes collected in the S3/E40 surface scrape were identified as one margin biface fragment, one medial biface fragment, one edge-preparation flake, one early biface thinning fragment, two Stage 5 biface fragments and four late biface thinning fragments. This indicates that at this site tool production focused on formed artifacts. The Tuscarora project report identifies this as a pattern observed for all three Terminal Prehistoric sites in the project area.

The occurrence of Blue Mountain obsidian is observed intrusively mixed throughout almost all of the excavated data sets. Blue Mountain hydration rim values are consistently low, exhibiting a hydration range of 1.6-2.6 microns (mean=1.9 microns). However, the data set of debitage is small (n=4); and rim values associated with the three projectile points derived from Blue Mountain obsidian are all considered to be anomalous readings for their types.

Blue Mountain hydration readings for one Northern Side-notched and one Siskiyou Side-notched each returned a rim value of 1.8 microns; while an Elko series point returned a reading of 2.3 microns. In comparison, four Siskiyou Side-notched projectile points sourced to East Medicine Lake returned tight hydration readings of 4.2, 4.6, 4.6 and 4.9 microns; and a single East Medicine Lake Elko point returned a rim value of 4.8 microns. The disparity in hydration readings between the Blue Mountain and East Medicine Lake sources returned for points of like temporal association may indicate that Blue Mountain obsidian hydrates at a substantially slower rate than East Medicine Lake.

This makes it difficult to make a case for MOD-3127/H as exhibiting evidence for source replacement in late prehistory due to the lack of hydration correspondence with temporal diagnostics demonstrated by the East Medicine Lake and Blue Mountain obsidian sources. It should be mentioned here that the level of discrepancy between these two sources at this site is much higher than that demonstrated by the PGT-PG&E data; this may indicate that environmental factors are somehow connected to the degree of hydration anomaly exhibited by Blue Mountain material. However, in terms of source replacement it is of some interest to note that both eastern and western source localities are reflected in the Teminal Prehistoric tool assemblage; of the two Desert Side-notched points were recovered from MOD-3127/H, one was derived from Buck Mountain obsidian (1.6 microns) while the other was identified as Glass Mountain (1.8 microns).

The results of the Tuscarora investigation at MOD-3127/H were interpreted to indicate that this site was used sporadically through time as a hunting locality. The Terminal Prehistoric component discussed above and its association with the groundstone concentration observed on site is held to be indicative of a greater degree of occupational intensity during this later period.

TUSCARORA SUPPLEMENTARY SITE B:
CA-MOD-3035 (05-09-56-2053)

This site is located just over a mile directly south of MOD-3127/H, and is roughly equidistant between MOD-2668/H to the west and MOD-2236 to the east. It is situated on the Modoc Plateau near Harvey Lake; in close association with the chain of buttes that mark the center of the boundary corridor between the Tule and Clear Lake basins. This site was chosen for inclusion into discussion here on the basis of its demonstrated association with a Terminal Prehistoric occupation episode. The location of this site, at a point roughly equidistant from the obsidian sources of the Medicine Lake Highlands and Blue Mountain, makes it a potentially valuable indicator of late prehistoric source distribution dynamics.

The East Medicine Lake obsidian source is located approximately thirteen miles southwest of this site. Blue Mountain is a little more distant from the site, located approximately eighteen miles to the northeast. The assemblage observed at MOD-3035 did not correspond to distance-to-K expectations in terms of the balanced distribution of these two sources; thus providing further support for the position that a distributional obsidian source imbalance existed in the boundary region during late prehistoric times.

Limited test probe excavation carried out at MOD-3035 revealed that the deposit was surficial in nature. The sole tool recovered from the site was a Siskiyou Side-notched of East Medicine Lake obsidian that was collected from the site surface. This projectile point hydrated to 4.3 microns, falling within the parameters of temporal expectations for points of that style. Twenty-five pieces of obsidian debitage were also collected from the site; ten of these were submitted for source and hydration analysis and revealed a Terminal Prehistoric association. Debitage was sourced to both East Medicine Lake and Cougar Butte and exhibited a hydration range of 1.1-4.8 microns. The 4.8 rim value is an outlier; and when excluded the range clusters between 1.1-2.1 microns (mean=1.4 microns).

The deposit observed at this site most probably represents a single Terminal Prehistoric use episode. Of the seventeen flakes analyzed, eleven were identified as late biface thinning fragments, three as late pressure flakes, two as early biface thinning, and one as an edge-preparation fragment. This assemblage indicates an emphasis on late stage biface thinning activity at the site similar to that observed at MOD-3127/H.

TUSCARORA SUPPLEMENTARY SITE C:
CA-MOD-3058

This site is located five miles to the south of MOD-3035. It is associated geograpically with the southern center of the boundary corridor; and PGT-PG&E sites MOD-2565, MOD-2559 and MOD-2560 are located in close proximity approximately one-and-a-half miles to the northwest of the site.

This site is classified as Late Archaic in temporal association although diagnostic projectile forms indicative of all periods were recovered from the site.

This classification is based on the identification of a single discrete Late Archaic component at the site that was excavated to 30 cm. depth.

Late Archaic projectile points recovered at this site are: four Rose Spring projectile points, three sourced to East Medicine Lake (hydration range: 3.2-3.6 microns, mean=3.3 microns), the other to Buck Mountain (3.2 microns); three Small Stemmed projectile points, one sourced to Glass Mountain (1.0 microns), one sourced to Railroad Grade (1.6 microns), and one sourced to Buck Mountain (1.9 microns); and one arrow-sized point sourced to East Medicine Lake (3.4 microns).

Hydration rims from 24 flakes recovered from this unit were submitted for source and hydration analysis and returned a tight hydration range of 2.1-3.8 microns (mean=2.6 microns). All flakes in this sample which could be assigned to source were determined to derive from East Medicine Lake material.

Three Stage 4-5 biface fragments and one flake tool were recovered from the Late Archaic unit at MOD-3058. Of the 1/8" sample recovered during excavation, nearly 25% was comprised of early pressure flakes. Edge preparation flakes (18%) made up the next largest part of the total sample; followed by complex interior flakes (16%), late biface thinning flakes (14%), early biface thinning and simple interior flakes (10% each), late pressure specimens (4%) and cortical (2%). This assemblage is indicative of late stage formed tool production.

TUSCARORA SUPPLEMENTARY SITE D:

CA-MOD-1718/ 1719/ 1720/H (05-09-56-1060)

This site is located approximately three miles northeast of Tionesta along the western edge of the Devil's Garden. It is located eight miles directly east of the East Medicine Lake obsidian source, and the Glass Mountain and Cougar

Butte glass flows are not five miles more in the same vicinity. The site's trinomial reflects the "lumping" of three formerly distinct archaeological localities into a single entity; at this time, MOD-1718/H consists of a collective of eleven discrete lithic concentration areas in association with some groundstone and ochre.

MOD-1718/H was selected for inclusion into the data set presented here because it represents a continuous archaeological deposit spanning the Middle Archaic, Middle/Late Transition, Late Archaic and Terminal Prehistoric periods. MOD-1718/H exhibits clearly defined temporal profiles which can be used to identify key assemblage components associated with each transition period. This site is thought to be a seasonal base camp which was used for the same subsistence and hunting activities throughout later prehistory.

There are eleven discrete temporal loci identified at this site; seven are associated with the Middle Archaic, one represents the Middle/ Late Transition, and three others are associated with the Late Archaic period. The Terminal Prehistoric is sparsely represented in the Late Archaic record as well. The Late Archaic component of this site will be discussed in greater detail below than the Middle Archaic component in the interest of both space and relevance.

Seven Late Archaic diagnostic projectile points were recovered at MOD-1718/H. One of the two arrow-sized projectile points found at the site sourced to East Medicine Lake (3.6 microns); while the other was from the Buck Mountain source (3.4 microns). Two Rose Spring points, both of East Medicine Lake obsidian, were hydrated to 2.0 and 4.9 microns. Two of the three Small Stemmed points collected were sourced to East Medicine Lake (1.8 and 1.8 microns); but a third specimen was sourced to Tuscan and hydrated to 1.1 microns.

The three Late Archaic components were associated with three hydration clusters of eight rims. At Locus C, level 0-10 cm. returned a cluster of 1.2-3.3 microns (mean=2.0 microns); and level 20-30 cm. returned a cluster of 1.7-3.8 microns (mean=2.7 microns). At FSC-1 B, another cluster of rims came in at 2.1-3.4 microns (mean=2.7 microns). The Middle/ Late Transition component at Locus D returned a hydration range of 2.1-3.7 microns (mean=3.6 microns) based on twenty samples. These hydration readings are associated with East Medicine Lake obsidian in almost every case.

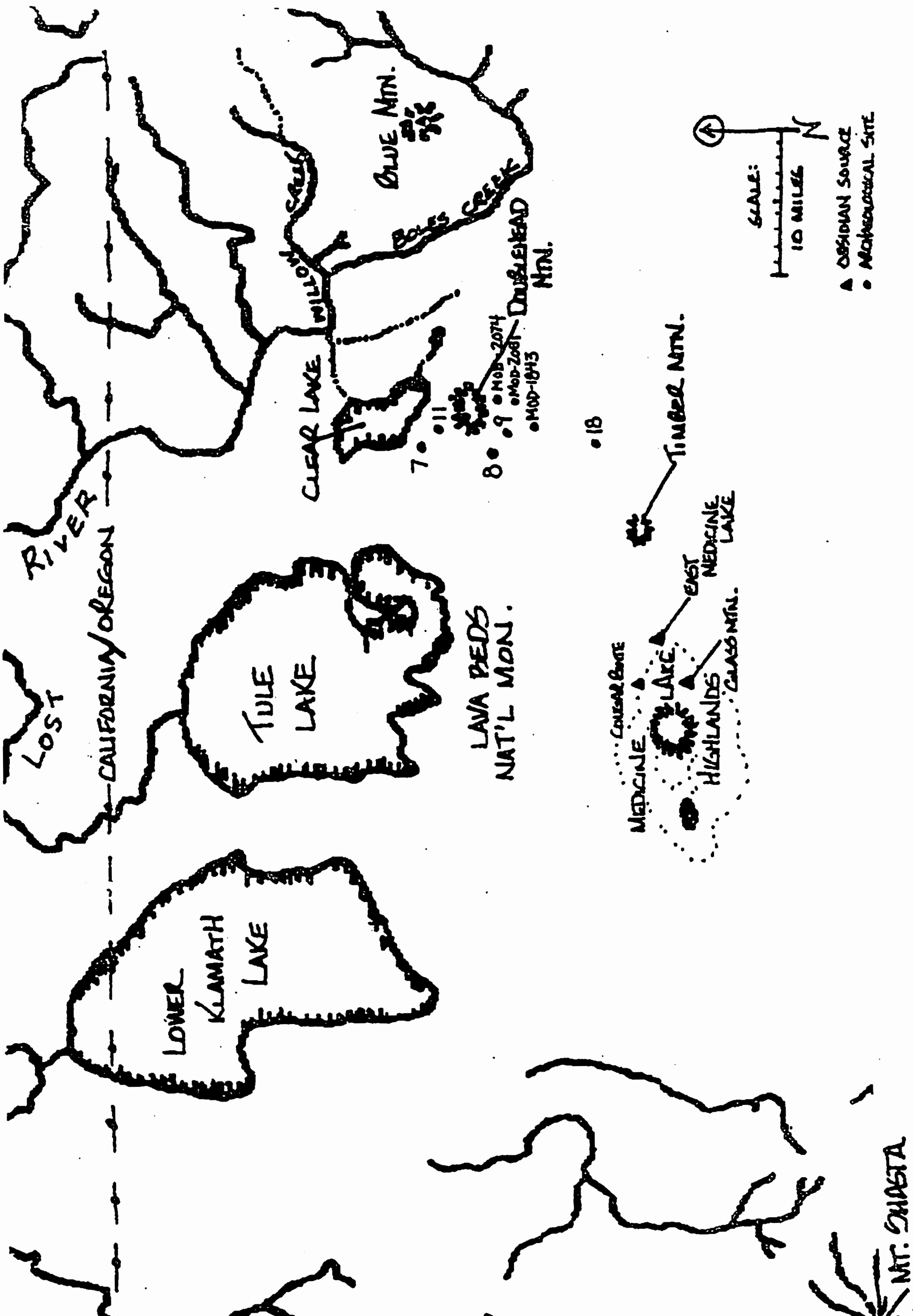
Middle Archaic debitage indicate that during that temporal period there was a definite emphasis on mid-stage biface reduction, with early biface thinning (7%), late biface thinning (5%), and platform development/ pressure (7%) flakes making up the greatest percentage of diagnostic flakes. Simple fragments (52%) and complex fragments (17%) made up the greatest percentage of the assemblage overall .

During the Middle/ Late Transistion, some radical shifts are seen to occur in the debitage index. While simple fragments (50%) and complex fragments (22%) are still seen to dominate the assemblage, the percentages in all other diagnostic debitage categories are seen to decrease dramatically to 1% or less. The only increase is seen in the categories of early biface thinning flakes (12%) and late biface thinning flakes (6%). However, the ratio of tool to debitage is very low for this component (1/1113), so shifts in the debitage index are not necessarily indicative of a greater emphasis on tool finishing.

In the Late Archaic debitage index, the shift observed for the Middle/ Late Transition is seen to swing back the other way. The percentages in all diagnostic debitage categories quantified mirror closely those that were observed in the Middle Archaic debitage index. However, the number of simple fragments in the sample rises to 67%; while the percentage of complex fragments decrease to almost half of earlier figures (9%).

The absence of cores at this site indicates a preference for biface reduction. This assemblage appears to represent an emphasis on hunting-oriented activity, based on the numerous points observed; while the amount of debitage on site indicates the production and rejuvenation of stone tools.

MAP NO. 13: EASTERN BOUNDARY MARGIN SITES
(OTH-B RADAR AND 1997 FIELD TESTED LOCALITIES)



CHAPTER 18:

Eastern Boundary Margin

SITE NO. 11:

CA-MOD-2236 (05-09-56-1208)

CA-MOD-2236 was originally recorded in 1986 by the Modoc National Forest as a temporary camp. It is located on the edge of the Clear Lake Basin approximately one mile northwest of Doublehead Mountain. Clear Lake is two miles to the northeast of the site and Blue Mountain is eight miles to the east. Archaeological materials noted at the site in 1986 were 20+ pieces of black translucent and Blue Mountain obsidian debitage, one basalt flake and a Desert Side-notched projectile point.

1997 field observations were limited to the eight flakes collected for analysis. All eight flakes were sourced to Blue Mountain. The sample hydrated to a range of 1.7- 3.5 microns (mean=2.7). The tight clustering of rim values (2.6, 2.6, 2.7, 2.8, 2.9, 3.1) within the sample may be indicative of a single reduction episode if viewed in terms of the sparse number of flakes at the site.

Early stage reduction is indicated in the sample by a large core fragment (13.5 gms.); and four Stage 2 flake fragments. The rest of the sample is middle stage indeterminate; small, fine fragments exhibiting parallel dorsal flake scars and crushed platforms.

SITE NO. 7:

CA-MOD-1478 (05-09-56-1012)

This site is located on the margin of the Clear Lake Hills approximately two miles west of Clear Lake. It was originally recorded in 1978 by the Modoc National Forest as a lithic scatter/ temporary camp locality. Four projectile points, including one Gunther, were collected in 1978. Nine previously collected projectile points were submitted for analysis along with the materials from this study.

The results of the tool sample submitted for analysis indicates a Late Archaic age of use. Two of the points, a Gunther Barbed and a leaf-shaped/ possible Cottonwood, were sourced to North Warners sources at Sugar Hill (3.0 microns) and Buck Mountain (7.1 microns). Three other projectile points, a possible Bare Creek/ Elko Corner-notched, a Rose Spring and a possble Rose Spring Contracting Stem, were sourced to East Medicine Lake with a hydration range of 1.9-3.7 microns (mean=2.8).

The remaining four specimens, a small fishtail projectile point, two possible Rose Spring/ Elko and an Elko Eared; were derived from Blue Mountain material and assigned a hydration range of 1.7 -3.5 microns (mean=2.4). If the 3.5 rim value is excluded from this sample as an outlier the range is narrowed appreciably to 1.9-2.6 microns (mean=2.0 microns).

Only seven flakes were observed at the site in 1997; all of which were collected and submitted for source and hydration analysis. The results of this analysis was variable. Four of the flakes tested were sourced to East Medicine Lake; the hydration range of these flakes was 3.7- 5.1 microns (mean=4.3). Two flakes were derived from the Blue Mountain obsidian source and exhibited rim values of 1.8 and 2.4 microns (mean=2.1 microns). A single flake was sourced to Cougar Butte. This specimen returned a hydration reading of 3.7 microns.

The East Medicine Lake debitage sample includes one Stage 4 biface fragment, one Stage 2-3 flake fragment, one middle stage utilized flake and one middle stage flake fragment. This appears to indicate that this source material arrived at the site in the form of formal tools or bifacial blanks. Blue

Mountain material is observed to reflect early stage reduction activity, consisting of a large primary flake fragment and one Stage 2 flake fragment. These two sources are located roughly equidistant from the site so the opposition of the two procurement strategies represented by this limited sample must be explained either temporally or culturally. This site displays the same pattern observed for the Kokiwas core area; in which East Medicine Lake obsidian is seen to dominate the Middle Archaic assemblages and Blue Mountain the Late Archaic assemblages.

SITE NO. 8:

05-09-56-1538

This site is located on the western edge of the Devil's Garden approximately two miles southwest of Doublehead Mountain. It is roughly equidistant between the Blue Mountain and East Medicine Lake obsidian sources; located approximately fifteen miles from each. This site is one of a cluster of sites in the area identified by the Modoc National Forest as part of the survey coverage for OTH-B Radar Wildlife Mitigation. Originally recorded in 1989, 05-09-56-1538 is classified as a permanent/ seasonal village site with associated midden deposit, housepit and extensive lithic scatter.

Well over 1000 flakes were observed at this site. The total lithic assemblage was dominated by Medicine Lake glasses, with Blue Mountain materials making up only an estimated 3% of the sample. Ten flakes and three projectile points were submitted for source and hydration analysis by this project.

Analysis of the point sample returned readings of 2.0 microns for one small Rose Spring Corner-notched specimen sourced to Glass Mountain; 2.0 microns for a Guntheroid sourced to the Grasshopper Group; and 5.4 microns for a point identified as a Surprise Valley Split-stem sourced to Cougar Butte. This indicates a consistant use of Medicine Lake obsidian at the site from Middle Archaic through Terminal Prehistoric times.

The debitage sample consisted of Medicine Lake glass varieties. Cougar Butte (n=1), Grasshopper Group (n=1) and East Medicine Lake (n=8) made up the collected sample. Hydration range of this material was between 3.1-5.0 microns (mean=3.7), indicating a Middle Archaic age of use. The Cougar Butte and Grasshopper samples were appreciably smaller than the East Medicine Lake materials; and represent late-stage biface reduction activity.

The majority of the East Medicine Lake sample consisted of large Stage 2 flake fragments which averaged 3.0 cm. in length. Two large primary flakes were also collected as well, but these were not submitted for analysis. One of these exhibits 25% cortex. The hydrated sample also contained three Stage 3-4 items. This indicates that during the Middle Archaic East Medicine Lake was brought to the site and reduced from large flake blanks.

The assemblage observed at 05-09-56-1538 does not exhibit the Late Archaic source replacement of East Medicine Lake with Blue Mountain which is characteristically associated with Kokiwas core area assemblages. This position is based on the Middle Period source associations established by hydration as well as the complete lack of Blue Mountain material in the lithic assemblage at the site as observed in both 1989 and 1997. While the presence of the two Terminal Prehistoric projectile points indicates that use of the site was occurring quite late in prehistory, they may reflect isolated hunting episodes which are separate from the village assemblage. It is possible that the site was abandoned at the the end of the Middle Archaic; five village localities located within one mile of 05-09-56-1538 are noted to exhibit Late Archaic diagnostic artifacts. These sites are by definition Kokiwas in affiliation based on Ray's ethnographic description of at least one summer village site associated with Doublehead Mountain, but this site does not fit Kokiwas core area patterns of expectations in terms of tools or debitage.

SITE NO. 9:

05-09-56-1561

This site is located approximately five miles to the south of Clear Lake at the southern base of Doublehead Mountain. Site 05-09-56-1538 is located one mile to the northwest of this locality. Both sites are located in association with a large settlement cluster of village sites originally recorded by the Modoc National Forest during survey for the OTH-B Radar project in 1989. Like 05-09-56-1538, this site is classified as a permanent / seasonal village locality. A housepit feature, midden deposit and hopper mortar are associated with an extensive lithic scatter at this site. The 1989 site record noted over 5000 waste flakes of translucent glass, Blue Mountain, basalt and chert as occurring on the site.

Sixteen projectile points collected at the site in 1989 indicate use of the site occurred from the Middle Archaic through the Terminal Prehistoric. Twelve of these, representing the whole temporal span, were submitted for source and hydration analysis along with a debitage sample of ten flakes collected during 1997 field investigations.

The lithic assemblage observed on site in 1997 was dominated by Medicine Lake glass (70%). Blue Mountain material made up the remaining 30% of the total. No non-lithics were observed. Flakes at this site tended to be small, averaging 1.5 cm. in length. Few items large enough to be indicative of early stage reduction or primary procurement materials were observed. This is in opposition to the asemblage observed at 05-09-56-1538, where large primary flakes of East Medicine Lake were a large part of the assemblage.

The tool sample submitted for analysis clustered into two distinct data sets affiliated with the Middle and Late Archaic periods as expected. Hydration results met expectations of temporal affiliation in most cases. The exceptions were two Rose Spring specimens which exhibited strong Middle Archaic rim values of 4.7 and 4.6 microns and one Elko Eared which hydrated to 2.7 microns. The latter was derived from Blue Mountain material, which is thought to hydrate at a rate slower than other obsidian types.

Two of the twelve tools submitted for analysis did not return results. These were a Mc Kee uniface sourced to East Medicine Lake and a drill sourced to Blue Mountain. The Late Archaic was sparsely represented in the sample by two tools. These were a Rose Spring from East Medicine Lake which hydrated to 2.5 microns and a Gunther Barbed of Grasshopper Group obsidian which hydrated to 3.4 microns. An Elko Eared derived from Blue Mountain material which hydrated to 2.7 microns is held to be an outlier indicative of the Middle Archaic.

The Middle Archaic was represented by five specimens exhibiting a hydration range of 4.3-5.3 microns (mean=4.8 microns). Four specimens were sourced to East Medicine Lake. These were: an Elko Corner-notched which hydrated to 4.3 microns; an unidentified projectile tip which hydrated to 5.3 microns; a possible Desert Side-notched which hydrated to 5.0 microns; and a possible Pinto Sloping Shoulder which hydrated to 3.6 microns. A small Rose Spring Expanding Stem point was also sourced to the Drews Creek/ Butcher Flat source and returned a hydration rim of 4.6 microns. It must be noted that these are exceedingly odd hydration readings which do not correspond to expectations as per type.

The debitage sample of ten flakes also returned mixed results. Seven flakes were sourced to East Medicine Lake, two others sourced to Blue Mountain and one flake was derived from Grasshopper Flat/ Red Switchback/ Lost Iron Well obsidian. The hydration range for nine rims was 1.6- 8.1 microns (mean=3.7 microns). Six rims in the sample exhibit no patterned affiliation within 0.7 microns of each other. Temporal affiliation is demonstrated by a subset of four rims (1.6, 2.7, 2.8, 3.2 microns; range=2.5 microns) which are indicative of the Late Archaic. The high and low values of this range are associated with two Blue Mountain flakes; while Grasshopper Flat/ Red Switchback/ Lost Iron Well and East Medicine Lake each contribute a single rim to the central rim values.

One large primary flake of Blue Mountain obsidian with 25% cortex and a Stage 2-3 reduction flake of East Medicine Lake was the only early stage material in the collected sample. It is interesting that both fall within the Late Archaic subsample. The rest of the collected flakes are all small, Stage 3-4 thinning flakes indicating an emphasis on biface reduction at the site. These flakes are most representative of the lithic assemblage as observed at the site.

While the data base presented for this site is sketchy at best, enough information is available to make some generalizations about the assemblage. It is interesting that while use of Medicine Lake obsidian during the Middle Archaic is supported by tool and debitage hydration values at both 05-09-56-1561 and its sister site 05-09-56-1538, the mode of procurement is markedly different. While East Medicine Lake material at 56-1538 was characterized by both early and late stage reduction activities, East Medicine Lake obsidian material hydrated to the Middle Period was characteristically defined by small late stage biface thinning flakes. No evidence of early stage reduction was noted at the site either.

The limited hydration data available for Blue Mountain obsidian indicates that this source was indeed in use during the Late Archaic period. No evidence for Middle Archaic use of this material is documented by tool or debitage hydration data. This may be held to imply that Middle-Late Transition source replacement occurred at this site, but it is sketchy at best.

SITE NO. 18:

CA-MOD-2296 (05-09-56-1311)

CA-MOD-2296 is located approximately six miles east of Timber Mountain on the western edge of the Devil's Garden. It is equidistant between the obsidian sources at Blue Mountain and the Medicine Lake Highlands. This site was originally recorded in 1987 as a lithic scatter. Only black translucent obsidian was reported as occurring on the site at that time; and preliminary analysis of seventeen flakes collected from two shovel scrapes at the site identified them as tertiary materials.

One Cottonwood/ possible small Humboldt projectile point collected from this site in 1987 and ten flakes collected in 1997 were submitted for source and hydration analysis. The projectile point was sourced as Unknown 1 and hydrated to 5.2 microns. All ten flakes sourced from the East Medicine Lake obsidian source. The hydration range of these flakes was 2.7- 4.6 microns (mean=3.6 microns), indicating a Middle Archaic age of use at the site. While some large flakes were observed at the site, the collected flakes in the sample are all associated with late stage reduction activity. This sample includes one late stage utilized flake. This data indicates that the primary reduction activity undertaken at the site was biface reduction.

CHAPTER 19:

Eastern Boundary Margin Supplement: OTH-B Radar Data Overview

All information presented in this section is from the OTH-B Radar project report (Busby, et. al. 1990). The OTH-B Radar project presents an archaeological overview of the region associated with the eastern margin of the boundary corridor. Source and hydration analysis results from selected sites in the OTH-B data set that are judged to be temporally relevant to the study of the ethnographic boundary are presented below.

It is worthy of note that eighteen of the thirty-three sites tested by the OTH-B project are associated with diagnostic artifacts. The majority of these are Late Archaic and Terminal Prehistoric forms, with Rose Spring (32.8%), Guntheroid (13.6%) and Desert Side-notched (14.3%) providing the greatest percentage of the sample (60.7%). However, following the pattern established by analysis of samples collected and analyzed by this study, the majority of sites exhibit debitage assemblages which return hydration rim values which are associated with the Middle Archaic/ Middle-Late Transition.

This is in direct opposition to the pattern observed on the western boundary margin, in which Late Archaic/ Terminal Prehistoric diagnostic artifacts are seen in consistent association with debitage assemblages with temporally-corresponding rim values. This is taken to support the conclusion that while this area was intensively exploited during the Middle Archaic through the Transition, it was largely abandoned during the Late Archaic and exploited by small seasonal gathering parties.

It is also of interest to note that the projectile points from all temporal periods collected during the OTH-B investigations were predominately derived from East Medicine Lake obsidian. Of the Late Archaic and Terminal

Prehistoric projectile points recovered, only two Gunther, one Surprise Valley Split-stem and three Rose Spring Stemmed were identified as deriving from Blue Mountain obsidian. Warner Mountains obsidian comprised a greater percentage of the overall projectile point assemblage in terms of quantity than did Blue Mountain, making up 12.7% of the total in comparison to Blue Mountain, which contributed only 7.5%. Since it has been established that the Kokiwas Late Archaic debitage index observed in the core area is dominated by Blue Mountain obsidian, then use of this area by those people should be reflected in terms of diagnostic Late Archaic tools derived from that source. That is not seen to be the case. The Late Archaic toolkit as established by this data is dominated by forms derived from Medicine Lake and Warners sources.

In terms of debitage, Medicine Lake Highlands obsidian was the source of 96.85% of the total debitage index examined. East Medicine Lake was the dominant Highlands source represented, contributing 95.85% of the Medicine Lake total. Cougar Butte was the next source represented in terms of debitage quantity, returning 4.11% of the sample. Blue Mountain obsidian contributed only 1.96% of the total.

OTH-B RADAR SUPPLEMENTARY SITE A:
CA-MOD-1843 (05-09-56-1168)

This site is located in association of a large seasonal wetland patch near Rimrock Lake. It is approximately two-and-one-half miles south of site 05-09-56-1561. It is classified as a large, light density lithic scatter associated with several thousand flakes of obsidian. The predominate type observed was black translucent obsidian. Despite its proximity to the wetlands described above, there is no evidence for food processing at this site in terms of groundstone.

Diagnostic tools identified during investigation of this site were Late Archaic forms; other tools noted were in fragmentary form and could not be identified to type. Two Rose Spring Corner-notched projectile points sourced to East Medicine Lake hydrated to 3.3 and 4.8 microns. One Gunther Barbed was collected and sourced to East Medicine Lake, with a rim value of 2.8 microns. A Desert Side-notched is also noted, but no supplementary data for this artifact is available.

The debitage collected from this site was sourced almost completely to East Medicine Lake. Fifty-seven flakes were hydrated to a range between 1.3-7.0 microns. The 7.0 micron reading is clearly an outlier; the majority of readings cluster between 3.5 and 4.5 microns. Only a small number of flakes exhibit Late Archaic rim values, however; despite the temporal association demonstrated by the diagnostic artifacts found at the site. No Blue Mountain obsidian was observed at site MOD-1843; East Glass Mountain (n=1) and Cougar Butte (n=10) were the only other sources identified during analysis.

OTH-B RADAR SUPPLEMENTARY SITE B:

CA-MOD-2081 (05-09-56-1229)

This site is located approximately two miles northeast of MOD-1843 and one mile east of 05-09-56-1561. It is located in the vicinity of several small seasonal ponds approximately one-and-a-half miles south of the base of Doublehead Mountain, in an area noted by Ray to have ethnographic associations with the Kokiwas.

The site is classified as a small light-density lithic scatter consisting of approximately two hundred obsidian flakes, primarily of translucent obsidian. Two flakes of Blue Mountain were observed on the surface as well. One Rose

Spring Corner-notched projectile of East Medicine Lake obsidian (2.1 microns) was collected.

The debitage sample consisted of twenty-three flakes which were sourced primarily to East Medicine Lake with a hydration range of 1.3-5.0 microns (mean=3.3). Three flakes of Blue Mountain obsidian were identified in this sample; and all exhibited the three consecutively lowest rim values (1.1, 1.5, and 1.5 microns). This is somewhat indicative of the Kokiwas core area source replacement shift given the fact that the East Medicine Lake range, excluding the Blue Mountain rims and the 5.0 outlier, is tightly clustered between 2.2 and 3.5 microns.

OTH-B RADAR SUPPLEMENTARY SITE C:

CA-MOD-2074 (05-09-56-1222)

This site is located approximately one-half mile north of MOD-2081 one mile from the southern base of Doublehead Mountain. It is classified as a low-density lithic scatter of 350-450 interior obsidian waste flakes. The primary material observed by surface survey of the site was translucent obsidian. Two Rose Spring Corner-notched, one Gunther Barbed, one Elko Side-notched and one Northern Side-notched were collected during investigation at the site. Other tool forms recovered were fragmentary and could not be identified to type.

These points returned source and hydration results as follows: the two Rose Spring projectiles sourced to East Medicine Lake (3.8 microns/ dh); the Gunther Barbed sourced to Drews Creek/ Butcher Flat (3.6 microns); the Elko sourced to East Medicine Lake (4.4 microns); and the Northern Side-notched was derived from East Medicine Lake and hydrated to 3.6 microns.

Excavation at MOD-2074 resulted in the recovery of 314 pieces of debitage. Forty-nine of these were analyzed by source and hydration analysis.

Range for this sample was established as 2.2-6.3 microns. The greatest number of readings cluster at 2.5 microns and between 4.2 and 5.0 microns, indicating pulses of occupation that occurred during the Middle and Late Archaic periods. All obsidian submitted for testing was derived from East Medicine Lake obsidian.

SECTION VI: CONCLUDING REMARKS

CHAPTER 20:

Analysis Conclusions

Sites MOD-1478, -2339, -2983, -2668/H and -2618 are associated with the western boundary cluster and are located in close proximity to the Medicine Lake Highlands obsidian sources. As expected, these sites exhibit assemblages closely associated with the procurement of Medicine Lake obsidian. Flakes at these sites tended to be larger on average than those observed along the eastern boundary margin.

Sites MOD-2983, -2668/H, and -1478 are held to be representative of expedient campsite locations within a source procurement catchment zone. Cores brought from East Medicine Lake were reduced to formed blanks at these sites. The assemblages at these sites are dominated by large-sized flakes over 3.0 cm. in length indicating core reduction; mid-stage debitage tends to be thick and associated with percussion flaking. There is a degree of temporal continuity in the procurement strategies implied by these sites, which are associated with the Middle and Late Archaic periods.

MOD-2618, which is temporally affiliated with the Terminal Prehistoric period rather than the Late Archaic; appears to be an expedient campsite location associated specifically with the procurement of obsidian much like those described above. However, flake size is noticeably smaller on average than those at the other sites and small, thin material generally identified as Stage 3 is well-represented in the collected sample. A large biface fragment observed at the site but not collected may be taken to imply that the reduction of Glass Mountain material from primary flakes obtained at the source was reduced to large bifacial blanks at this site.

MOD-2339 is a site which is associated with the procurement of obsidian from East Medicine Lake during the Late Archaic and procurement of Grasshopper Group material during the Early Archaic. Due to the fact that the Grasshopper designation is a theoretical construct to deal with overlap between East Medicine Lake and Grasshopper Flat materials, it is entirely possible that the Grasshopper Group sample may actually represent East Medicine Lake material.

This assemblage is thought to represent a seasonal base camp associated with hunting and the procurement of obsidian. Unlike the other assemblages, MOD-2339 exhibits a high percentage of middle-to-late stage reduction activity associated with the Late Archaic component. The Early Archaic emphasis on early stage reduction stands in contrast to the Late Archaic emphasis on biface thinning and has implications for a shift in temporal modes of procurement occurring at this locality.

The eastern boundary margin sample is represented by MOD-2236, -1478, -2296, 05-09-56-1538 and 05-09-56-1561. There are few discrete patterns readily discernible in the assemblages from this area apart an obvious Middle Archaic preference for East Medicine Lake material.

The assemblages present at MOD-2236 and MOD-1478; both of which are located on the northern edge of the eastern boundary margin, provide limited support for the replacement of East Medicine Lake obsidian by Blue Mountain material in the Late Archaic Kokiwas assemblage. However, site number 05-09-56-1538 is seen to stand in contradiction of this predicted obsidian source replacement model. This site also presents a different mode of East Medicine Lake procurement than that which is commonly observed in along the eastern margin, demonstrating primary early stage reduction activity in the form of large flakes. The standard mode of procurement as reflected at other sites of comparable age is the reduction of formed blanks into finished forms.

It should be noted in this discussion that Blue Mountain material was seen to decrease in a southerly direction along the eastern boundary margin. At MOD-2236, located at the southern base of the Clear Lake Hills, Blue Mountain obsidian hydrated to the Late Archaic made up 100% of the collected sample. This is the only site tested in the boundary sample that exhibited such a strong Blue Mountain assemblage.

Despite the inclusion of sites into the sampling universe on the basis of Late Archaic/ Terminal Prehistoric diagnostic types, sites in the eastern boundary margin sample consistently returned hydration readings associated with Middle Archaic age dates. With the exception of the two sites located in the northern section of the eastern boundary margin, Late Archaic hydration readings occur as discrete entities rather than clusters. While Late Archaic diagnostic tools most generally return hydration values which meet the expectations defined by their affiliations, the sites on which they are found do not exhibit Late Archaic temporal affiliation in terms of hydrated debitage samples. This is rather unusual given the fact that assemblages located in the western boundary margin do not share this characteristic divergence from expectations.

The divergence of temporal association between Late Archaic and Terminal Prehistoric diagnostic artifact forms and archaeological context is discussed in length in Moratto, et. al. (1995). It is postulated that late period projectile points occur in archaeological contexts largely independent of formal occupational deposits. This is tied to the shift in land-use strategy in the Modoc region around 2000 B.P., when a shift from the mobile subsistence strategies of the Middle Archaic to a more sedentary lifestyle tied to permanent village locations located on lakeshore margins is seen to occur. This shift is associated with a decrease in mobility as well as an increase in logistical land-use strategies and territoriality. This is reflected in the archaeological record by the decreased visibility of Late Archaic and Terminal Prehistoric assemblages. Activity which took place outside of the late-period residential bases was of short-term duration and associated with specific subsistence activity such as hunting.

Interrelated with this shift in the mode of social organization is the introduction of new technology. Once the bow-and-arrow was introduced into Northeastern California, the demand for obsidian is seen to decrease. Middle Archaic deposits are archaeologically visible due to the fact that they were oriented toward both subsistence activity <u>and</u> the procurement/ reduction of lithic material. The production of early stage biface forms is seen to peak during the Middle Archaic period; the intensity of that peak is well-reflected in the archaeological record due to the amount of reduction debris that it produced. Lack of territorial restrictions in the Middle Archaic, coupled with the high mobility of the population, made obsidian a readily accessible resource in terms of direct access to the source. The large size of dart points associated with the atlatl tradition made biface production an expedient technology.

In contrast, Late Archaic and Terminal Prehistoric deposits are more ephemeral in nature due to their almost exclusive association with subsistence activity. The late period decrease in the size of projectile points made the large bifaces of the Middle Archaic a moot issue. Obsidian of size large enough for the manufacture of arrow-sized implements could be gathered from local Middle Archaic biface reduction sites, making procurement from the source unnecessary. Late prehistoric assemblages are characterized by the near absence of cores and cortical debris they present, and reflect a greater emphasis on late-stage biface thinning activity as reflected by the presence of late-stage bifaces and associated biface thinning debitage.

Late Archaic assemblages appear to be almost absent along the eastern boundary margin. It is entirely possible that their identification within specific archaeological contexts is maked by the ephemeral nature of the activity which they represent, as discussed above. However, it is unusual that tools derived from Blue Mountain obsidian are absent from the assemblages present in this margin area. The large amounts of Blue Mountain debitage observed in the Kokiwas core is indicative of the production of tools on a sizeable scale. Where did they go? They are certainly not represented in the materials collected by this study; nor are they present in the material collected by the PGT-PG&E, Tuscarora or OTH-B Radar projects.

The distribution of Blue Mountain material is noted to fall-off in the eastern boundary margin at a rate that cannot be explained in terms of standard distance-to-K expectations as modelled. In localities that are equidistant between the Medicine Lake and Blue Mountain sources, assemblages are expected to exhibit relative balance in distribution. This is not the case here. East Medicine Lake is seen to be exerting more influence over a larger area than would be predicted by a distance-to-K model; while Blue Mountain displays distributional restriction possibly indicative of social factors beyond source preference.

Results from the sites sampled by this project are held to be indicative of a Late Archaic transition in regional territoriality in which Kokiwas populations withdrew from the boundary corridor area and expanded southward. This was not necessarily associated with Gumbatwas expansion into the area left vacant by Kokiwas populations; the lack of Late Archaic assemblages in association with observed Late Archaic diagnostic projectile points indicate that perhaps in some cases the projectiles are separate from the assemblages and represent use of these localities for purposes such as hunting.

The distribution of Blue Mountain obsidian as established by Van de Hoek (1991) is offered in support of this position. The constriction of the isoplethic range of Blue Mountain obsidian in the eastern boundary margin area is associated with an extension of its southern distributional range beyond expected fall-off parameters. Tuscarora data sets also note an increase in Blue Mountain material to a greater overall percentage in Late Archaic/ Terminal Prehistoric assemblages located southeast of the study area in the vicinity of Blacks Canyon. This is associated with a decline in the occurrence of East Medicine Lake obsidian and an increase in the occurrence of material from Buck Mountain.

It is also of note that Late Archaic/ Terminal Prehistoric time-markers derived from Blue Mountain obsidian are common occurrences on the central Devil's Garden. If the area defined as the eastern boundary margin had been exploited by the Kokiwas people during late prehistory, then it follows that this activity would be visible in the archaeological record in the form of Blue Mountain diagnostics. The core area sites investigated by this study are located under ten miles from the eastern boundary margin; and yet the Late Archaic assemblage in this hinterland region reflects no core area influence.

It is postulated that the population shift toward a greater degree of sedentism by the Kokiwas resulted in increased exploitation of the Clear Lake Basin and central wetland patches of the Devil's Garden. This is supported by the observation that Blue Mountain obsidian is associated with the Clear Lake catchment at the northern extent of the boundary corridor (MOD-2236; MOD-1478).

The data reviewed here does not support Ray's position that the ethnographic boundary shared by the Gumbatwas and Kokiwas extends westward to the southeastern tip of Tule Lake. Assemblages from the eastern shore of Tule Lake associated with stratified deposits are in agreement with Gumbatwas core area indices and demonstrate no affiliation with Kokiwas core indices. It is the position of this paper that if the Kokiwas maintained permanent village locations along the eastern Tule Lake shoreline up to historic times as reported by Ray, then Kokiwas assemblages located in the core area would not reflect a full-scale source replacement of East Medicine Lake obsidian with Blue Mountain material in the Late Archaic period because East Medicine Lake material would still be readily available to them.

Ray's boundary can also be questioned on the basis of its proximity to the main Gumbatwas settlement cluster. Ray's boundary is placed to bisect Tule Lake at a point approximately two miles from the named ethnographic village Gu'mbat. Considering the propensity of the Modoc to make war on not only neighbors but also rival villages, it does not seem logical that the Gumbatwas would recognize a boundary which intruded upon the periphery of their established center.

CHAPTER 21:

Directions For Future Research

The data presented here is a ready supplement for the strong existing data base established by the numerous pipeline projects which have criss-crossed this portion of the Modoc Plateau and western Devil's Garden in recent years. A comprehensive overview of this data, placed into a computer framework, would be an invaluable research tool and is definitely worthy of consideration as a direction of future research.

The extensive archaeological coverage of this area provides the framework necessary for regional studies in terms of settlement pattern, land-use strategies and their temporal dynamics. By geographic definition this area is a long-established corridor for regional movement in terms of goods and people across the landscape. Its proximity to the obsidian fields of the Medicine Lake Highlands defines it as an archaeological "pulse" sensitive to the investigation of prehistoric resource procurement patterns.

One potential avenue of inquiry in this context would be the Middle to Late Period transition (ca. 2000 years B.P.) and its association with the constriction of obsidian source distribution across the landscape. This shift is especially marked in terms of Medicine Lake sources. Medicine Lake sources were widely distributed throughout northeastern California during the Early and Middle Periods, increasing in distribution through time until a dramatic shift in its procurement during the Late Archaic transition led to the effective restriction and localization of the resource.

A direction for future research proposed by Van de Hoek (1991) involving the establishment of a source-specific rate for Blue Mountain obsidian still holds true at this time. While current opinion holds that the hydration rate of Blue Mountain material is appreciably slower than that of the Medicine Lake glasses there is little in the way of concrete data to support this position. The Tuscarora report puts forth an estimated range of hydration discrepancy between Blue Mountain and East Medicine Lake of 1.3-2.0 microns. In review of that data it can certainly be seen to be true. However, the PGT-PG&E data did not exhibit such a wide range of discrepancy between these sources. In many cases, the hydration range reported for specific diagnostics for Blue Mountain source material fell within the same range as that reported for the same diagnostics derived from Grasshopper Flat/ Lost Iron Well/ Red Switchback and Buck Mountain. This indicates that perhaps environmental factors associated with mean ground temperature, depth of deposit or intrinsic water content may be of some effect on the hydration rate of the porous Blue Mountain material.

The use of thermal cells to measure the effective hydration rate of Blue Mountain obsidian is one research direction that would be of great benefit to archaeological investigations in northeastern California by providing another source for greater temporal control of data. Research into the effects of different environmental factors such as fire, ground temperature, soil pH and depth of deposition on the hydration rate of specific obsidians is another valuable avenue of investigation which could be explored in depth in an obsidian-rich region such as Modoc County.

Also of research interest is the hydration rate of Glass Mountain obsidian. This source is reported to be of very recent age. Current data established by Donnelley-Nolan, et. al. (1990) establishes the age of its eruption at approximately 850 B.P. However, the range of hydration readings associated with this source material does not correspond to such a limited window of time. Data from the PGT-PG&E pipeline project notes that the range of hydration returned from the analysis of 89 artifacts from the Glass Mountain source is 1.0-

5.5 microns. Given the recent age of the eruption, there should not be hydration readings for this source above 2.0 microns. It may be possible that the recent obsidian flow at Glass Mountain effectively covers an older flow from the same parent material; this would perhaps account for the large hydration discrepancies observed in the archaeological record.

The distribution of Glass Mountain obsidian is another potential direction for future research. This obsidian flow covers an area of five square miles in the eastern Highlands region in close proximity to other sources that are well-distributed throughout prehistory. Yet while there is ample evidence of prehistoric quarrying activity at the source, Glass Mountain material is rarely seen in prehistoric contexts. Given the quality of the source material it is to be expected that it would enter the archaeological record to some degree; but that is not the case. It is estimated that Glass Mountain material makes up approximately 1% of the total regional lithic assemblage. Where is it going after it leaves the quarry sites?

In short, the Modoc Plateau/ western Devil's Garden region offers endless research opportunities for scholastic advancement both in the field and in the lab. The development of a comprehensive computer data base is but one direction of lab research; another is the comparitive analysis of curated artifacts in terms of a specific directive. Field research directions are limited only to the vision of the researcher. There is no shortage of archaeological material in the region amenable to fruitful research directions; and the Modoc National Forest actively supports academic research pursuits.

Good Luck and have fun!

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APPENDIX A

KEY TO DATA ABBREVIATIONS

FLf: Flake, fragment

FLc: Flake, complete

UFf: Utilized flake, fragment

UFc: Utilized flake, complete

FBf: Flake blank, fragment

FBc: Flake blank, complete

Cf: Core, fragment

Ang.: Angular

IND: Indeterminate

C: Cortex

BC: Bare Creek

Sm: Small

BMO: Blue Moutain obsidian

DC: Dorsal complexity

EdMod: Edge-modified

*: not submitted

ExSt: Expanding stem

PIN: Pinto

SlSh: Sloping shoulder

ConSt: Contracting stem

MS: Midsection

Uni: Unifacial/ uniface

KN: Knife

SqSh: Square shouldered

HUM: Humboldt series

BasNot: Basal-notched

GMO: Glass Mountain obsidian

GUN: Gunther series

RS/ RG: Rose Spring, Rosegate series

GB: Gunther Barbed

AS: Alkali Stemmed

EG: Eastgate series

SVSS: Surprise Valley Split-stem

SITE NO. 1: CA-MOD-2339 (05-09-56-1414)
XRF/ OHA SAMPLES

CATALOG NUMBER	PROVENIENCE	DESCRIPTION	LENGTH	WIDTH	THICK.	WEIGHT
09-1455: 03	34 m. @ 30 from Datum	Ang. IND.	2.9 cm.	1.8 cm.	6 mm.	3.4 gm.
09-1455: 04	34 m. @ 30 from Datum	FLf: Stage 3	2.8 cm.	2.4 cm.	3 mm.	3.3 gm.
09-1455: 05	34 m. @ 30 from Datum	BIFf: Stage 3	1.9 cm.	1.1 cm.	3 mm.	.9 gm.
09-1455: 06	34 m. @ 30 from Datum	FLf: Stage 2-3	2.2 cm.	1.6 cm.	3 mm.	1.4 gm.
09-1455: 07	34 m. @ 30 from Datum	FLf: early stage	3.4 cm.	1.8 cm.	3 mm.	3.1 gm.
09-1455: 08	34 m. @ 30 from Datum	FLf: indet.	1.8 cm.	1.0 cm.	7 mm.	.6 gm.
09-1455: 09	34 m. @ 30 from Datum	Ang. IND.	3.4 cm.	1.7 cm.	3 mm.	5.55 gm.
09-1455: 10	34 m. @ 30 from Datum	FLf: early stage	1.6 cm.	1.4 cm.	1.7 mm.	1.1 gm.
09-1455: 11	34 m. @ 30 from Datum	FLf: early stage	1.4 cm.	1.0 cm.	3 mm.	1.2 gm.
09-1455: 12	34 m. @ 30 from Datum	UF: Stage 3	4.0 cm.	1.6 cm.	2 mm.	3 gm.
09-1455: 13*	34 m. @ 30 from Datum	flake bag	n/a	n/a	n/a	5/14.4 gm.
09-1455: 14	unknown	Rose Spring/ Elko CN	unk.	unk.	unk.	unk.

SITE NO 1: CA-MOD-2339 (05-09-56-1414)
OHA/ XRF RESULTS

CATALOG NO.	ARTIFACT TYPE	SOURCE	HYDRATION	CALENDAR DATE
09-1455: 19	PPT	East Medicine Lake	5.5 +/-0.1	5864 B.P.
09-1455: 03	DEB	East Medicine Lake	1.7 +/- 0.1	673 B.P.
09-1455: 04	DEB	East Medicine Lake	1.9 +/- 0.1	826 B.P.
09-1455: 05	DEB	Grasshopper Group	4.8 +/- 0.1	4563 B.P.
09-1455: 06	DEB	East Medicine Lake	3.5 +/- 0.1	2548 B.P.
09-1455: 07	DEB	East Medicine Lake	2.0 +/- 0.1	908 B.P.
09-1455: 08	DEB	East Medicine Lake	6.7 +/- 0.1	8439 B.P.
09-1455: 09	DEB	Grasshopper Group	6.5 +/- 0.1	7980 B.P.
09-1455: 10	DEB	East Medicine Lake	6.2 +/- 0.1	7314 B.P.
09-1455: 11	DEB	Grasshopper Group	5.8 +/- 0.1	6468 B.P.
09-1455: 12	DEB	East Medicine Lake	2.7 +/- 0.1	1473 B.P.

SITE NO. 2: CA-MOD-2618 (05-09-56-1660)
OHA/ XRF SAMPLES

CATALOG NUMBER	PROVENIENCE	DESCRIPTION	LENGTH	WIDTH	THICK.	WEIGHT
09-1954-01	80 m. @ 354 from Datum	PP CN	unk.	unk.	unk.	unk.
09-1954-02	80 m. @ 354 from Datum	BIF stem	unk.	unk.	unk.	unk.
09-1954-03	60 m. @ 270 from Datum	FLf: early stage	2.8 cm.	2.3 cm.	2 mm.	1.9 gm.
09-1954-04	60 m. @ 270 from Datum	FLc: early stage	4.7 cm.	3.1 cm.	4 mm.	7.8 gm.
09-1954-05	60 m. @ 270 from Datum	FLc: Stage 3	.7 cm.	.45 cm.	1 mm.	.6 gm.
09-1954-06	60 m. @ 270 from Datum	FLf: early to middle	.65 cm.	3 mm.	1 mm.	.3 gm.
09-1954-07	60 m. @ 270 from Datum	FLf: early to middle	1.1 cm.	.525 cm.	3 mm.	.5 gm.
09-1954-08	60 m. @ 270 from Datum	FLf: early to middle	1.8 cm.	1.5 cm.	1.5 mm.	.8 gm.
09-1954-09	60 m. @ 270 from Datum	FLf: early to middle	1.1 cm.	.4 cm	1 mm.	.45 gm.
09-1954-10	60 m. @ 270 from Datum	Flf: middle stage	1.125 cm.	.7 cm.	1 mm.	.8 gm.
09-1954-11	60 m. @ 270 from Datum	FLf: early to middle	2.9 cm.	1.3 cm.	3 mm.	1 gm.
09-1954-12	60 m. @ 270 from Datum	FLf: primary	3.6 cm.	2.1 cm.	7 mm.	4.2 gm.
09-1954-13*	60 m. @ 270 from Datum	Flake bag	n/a	n/a	n/a	4/ 1.775 gm.

SITE NO 2: CA-MOD-2618 (05-09-56-1660)
OHA/ XRF RESULTS

CATALOG NO.	ARTIFACT TYPE	SOURCE	HYDRATION	CALENDAR DATE
09-1954: 01	PPT	East Medicine Lake	3.7 +/- 0.1	2823 B.P.
09-1954: 02	BIF	East Medicine Lake	6.0 +/- 0.1	6885 B.P.
09-1954: 03	DEB	Glass Mountain	2.4 +/- 0.1	1271 B.P.
09-1954: 04	DEB	Glass Mountain	3.0 +/- 0.1	1918 B.P.
09-1954: 05	DEB	Glass Mountain	NA	NA
09-1954: 06	DEB	Glass Mountain	3.4 +/- 0.1	2416 B.P.
09-1954: 07	DEB	Glass Mountain	NA	NA
09-1954: 08	DEB	Glass Mountain	3.3 +/- 0.1	2286 B.P.
09-1954: 09	DEB	Glass Mountain	NA	NA
09-1954: 10	DEB	Glass Mountain	2.0+/- 0.1	908 B.P.
09-1954: 11	DEB	Glass Mountain	3.6 +/- 0.1	2684 B.P.
09-1945: 12	DEB	Glass Mountain	2.8 +/- 0.1	1689 B.P.

SITE NO. 3: CA-MOD-1374 (05-09-56-0928)
OHA/ XRF SAMPLES

CATALOG NUMBER	PROVENIENCE	DESCRIPTION	LENGTH	WIDTH	THICK.	WEIGHT
09-2950-02	44 m. @ 280 -Datum	FLf: Stage 2	2.4 cm.	.8 cm.	1 mm.	.6 gm.
09-2950-03	44 m. @ 280 -Datum	FLf: Stage 2-3	3.3 cm.	3.1 cm.	2.5 mm.	3.4 gm.
09-2950-04	44 m. @ 280 -Datum	FLc: Stage 2	4.8 cm.	3.3 cm.	4 mm.	5.7 gm.
09-2950-05	44 m. @ 280 -Datum	FLc: Stage 2	3.1 cm.	2.9 cm.	1.5 mm.	2.75 gm.
09-2950-06	44 m. @ 280 -Datum	FLc: Stage 2	2.3 cm.	2.5 cm.	4 mm.	2.4 gm.
09-2950-07	44 m. @ 280 -Datum	FLc: Stage 2-3	2.9 cm.	2.7 cm.	5.5 mm.	2.7 gm.
09-2950-08	44 m. @ 280 -Datum	FLc: Stage 3	3.6 cm.	2.7 cm.	2 mm.	3.3 gm.
09-2950-09	44 m. @ 280 -Datum	FLc: Stage 2-3	2.8 cm.	2.03 cm.	2 mm.	2 gm.
09-2950-10	44 m. @ 280 -Datum	FLc: Stage 2	3.0 cm.	2.0 cm.	3 mm.	2.7 gm.
09-2950-11	44 m. @ 280 -Datum	FLc: Stage 2-3	2.9 cm.	2.1 cm.	2 mm.	1.7 gm.
09-2950-12*	44 m. @ 280 -Datum	flake bag	n/a	n/a	n/a	n/a
09-2950-13*	44 m. @ 280 -Datum	Cf.	n/a	n/a	n/a	n/a

SITE NO. 3: CA-MOD-1374 (05-09-56-0928)
OHA/ XRF RESULTS

CATALOG NO.	ARTIFACT TYPE	SOURCE	HYDRATION	CALENDAR AGE
09-2950: 02	DEB	East Medicine Lake	3.5 +/- 0.1	2584 B.P.
09-2950: 03	DEB	East Medicine Lake	3.3 +/- 0.1	2286 B.P.
09-2950: 04	DEB	East Medicine Lake	3.9 +/- 0.1	3111 B.P.
09-2950: 05	DEB	East Medicine Lake	3.9 +/- 0.1	3111 B.P.
09-2950: 06	DEB	East Medicine Lake	3.5 +/- 0.1	2548 B.P.
09-2950: 07	DEB	East Medicine Lake	4.3 +/- 0.1	3725 B.P.
09-2950: 08	DEB	East Medicine Lake	3.3 +/- 0.1	2286 B.P.
09-2950: 09	DEB	East Medicine Lake	3.9 +/- 0.1	3111 B.P.
09-2950: 10	DEB	East Medicine Lake	3.2 +/- 0.1	2160 B.P.
09-2950: 11	DEB	East Medicine Lake	4.2 +/- 0.1	3567 B.P.

SITE NO. 5: CA-MOD-2983 (05-09-56-1978)
OHA/ XRF SAMPLES

CATALOG NO.	PROVENIENCE	DESCRIPTION	LENGTH	WIDTH	THICK.	WEIGHT
09-2506-01	no provenience	GB	unk.	unk.	unk.	unk.
09-2506-02	no provenience	GUN	unk.	unk.	unk.	unk.
09-2506-03	no provenience	RS/ GUN	unk.	unk.	unk.	unk.
09-2506-04	no provenience	Leaf-shaped PP.	unk.	unk.	unk.	unk.
09-2506-05	27 m. @ 320 from Datum	FLc: early to middle	3.4 cm.	1.7 cm.	6 mm.	2.4 gm.
09-2506-06	27 m. @ 320 from Datum	Flf: early to middle	unk.	unk.	unk.	unk.
09-2506-07	27 m. @ 320 from Datum	FLc: early to middle	3.4 cm.	3.0 cm.	4 mm.	3.75 gm.
09-2506-08	27 m. @ 320 from Datum	FLc: middle stage	2.6 cm.	2.3 cm.	1 mm.	1.2 gm.
09-2506-09	27 m. @ 320 from Datum	FLf: early stage	3.1 cm.	2.5 cm.	6 mm.	2.8 gm.
09-2506-10	27 m. @ 320 from Datum	FLf: early stage	2.2 cm.	1.5 cm.	7 mm.	1.0 gm.
09-2506-11	27 m. @ 320 from Datum	FLf: indet.	3.1 cm.	1.5 cm.	5 mm.	1.5 gm.
09-2506-12	27 m. @ 320 from Datum	FLf: indet.	4.5 cm.	1.3 cm.	3 mm.	1.5 gm.
09-2506-13	27 m. @ 320 from Datum	FLc: early stage	3.4 cm.	2.0 cm.	5 mm.	2.5 gm.
09-2506-14	27 m. @ 320 from Datum	FLf: early stage	2.6 cm.	3.3 cm.	3 mm.	2.5 gm.
09-2506-15	27 m. @ 320 from Datum	Flake bag	n/a	n/a	n/a	10/3.8 gm

SITE NO. 5: CA-MOD-2983 (05-09-56-1978)
OHA/ XRF RESULTS

CATALOG NO.	ARTIFACT TYPE	SOURCE	HYDRATION	CALENDAR DATE
09-2506: 01	PPT	Glass Mountain	3.1 +/- 0.1	
09-2506: 02	PPT	East Medicine Lake	3.6 +/- 0.1	2684 B.P.
09-2506: 03	PPT	Unknown 2	2.1 +/- 0.1	unknown
09-2506: 04	PPT	East Medicine Lake	4.4 +/- 0.1	3886 B.P.
09-2506: 05	DEB	East Medicine Lake	2.8 +/- 0.1	1689 B.P.
09-2506: 06	DEB	East Medicine Lake	2.5 +/- 0.1	1370 B.P.
09-2506: 07	DEB	East Medicine Lake	2.9 +/- 0.1	1802 B.p.
09-2506: 08	DEB	East Medicine Lake	2.8 +/- 0.1	1689 B.P.
09-2506: 09	DEB	East Medicine Lake	3.6 +/- 0.1	2684 B.P.
09-2506: 10	DEB	East Medicine Lake	3.1 +/- 0.1	2037 B.P.
09-2506: 11	DEB	East Medicine Lake	3.3 +/- 0.1	2286 B.P.
09-2506: 12	DEB	East Medicine Lake	3.7 +/- 0.1	2823 B.P.
09-2506: 13	DEB	East Medicine Lake	3.0 +/- 0.1	1918 B.P.
09-2506: 14	DEB	East Medicine Lake	4.2 +/- 0.1	3567 B.P.

SITE NO. 6: CA-MOD-2668/H (05-09-56-1756)
OHA/ XRF SAMPLES

CATALOG NO.	PROVENIENCE	DESCRIPTION	LENGTH	WIDTH	THICK.	WEIGHT
09-0476-01	61 m. @ 38 from Datum	FLf: Stage 3	2.5 cm.	1.5 cm.	5 mm.	3.5 gm.
09-0476-02	61 m. @ 38 from Datum	FLf: Stage 2-3	2.5 cm.	2.4 cm.	8 mm.	3.5 gm.
09-0476-03	46 m. @ 70 from Datum	FLc: Stage 3	1.9 cm.	1.6 cm.	1.5 mm.	1.1 gm.
09-0476-04	46 m. @ 70 from Datum	FLf: Stage 3-4	1.8 cm.	1.5 cm.	1 mm.	.7 gm.
09-0476-05	38 m. @ 150 from Datum	FLf: early indet.	2.8 cm.	1.5 cm.	3 mm.	1.35 gm.
09-0476-06	38 m. @ 150 from Datum	FLf: Stage 2-3	2.6 cm.	2.0 cm.	1 mm.	1.2 gm.
09-0476-07	38 m. @ 150 from Datum	FLf: Stage 2-3	2.2 cm.	2.7 cm.	5 mm.	2.2 gm.
09-0476-08	38 m. @ 150 from Datum	Ang. IND.	2.5 cm.	1.7 cm.	5 mm.	1.9 gm.
09-0476-09	38 m. @ 150 from Datum	FLf: early indet.	2.0 cm.	1.8 cm.	3 mm.	1.0 gm.
09-0476-10	38 m. @ 150 from Datum	Ang. IND (c)	2.8 cm.	1.6 cm.	5 mm.	1.3 gm.
09-0476-11*	38 m. @ 150 from Datum	Flake bag	n/a	n/a	n/a	6/ 2.5 gm.

SITE NO. 6: CA-MOD-2668/H (05-09-56-1756)
OHA/ XRF RESULTS

CATALOG NO.	ARTIFACT TYPE	SOURCE	HYDRATION	CALENDAR DATE
09-0476: 01	DEB	East Medicine Lake	3.5 +/- 0.1	2548 B.P.
09-0476: 02	DEB	East Medicine Lake	4.8 +/- 0.1	4563 B.P.
09-0476: 03	DEB	Cougar Butte	4.1 +/- 0.1	not available
09-0476: 04	DEB	East Medicine Lake	5.1 +/- 0.1	5102 B.P.
09-0476: 05	DEB	Cougar Butte	3.2 +/- 0.1	not available
09-0476: 06	DEB	East Medicine Lake	3.7 +/- 0.1	2823 B.P.
09-0476: 07	DEB	Cougar Butte	4.4 +/- 0.1	not available
09-0476: 08	DEB	Cougar Butte	6.3 +/- 0.1	not available
09-0476: 09	DEB	Cougar Butte	3.4 +/- 0.1	not available
09-0476:10	DEB	East Medicine Lake	5.5 +/- 0.1	5864 B.P.

SITE NO. 7: CA-MOD-1478 (05-09-56-1012)
OHA/ XRF SAMPLES

CATALOG NO.	PROVENIENCE	DESCRIPTION	LENGTH	WIDTH	THICK.	WEIGHT
09-0398-01	none recorded	GB	unk.	unk.	unk.	unk.
09-0398-02	none recorded	BC/ ELKO C-N?	unk.	unk.	unk.	unk.
09-0398-03	none recorded	RS?	unk.	unk.	unk.	unk.
09-0398-04	none recorded	RS C-N?	unk.	unk.	unk.	unk.
09-0398-05	none recorded	ELKO EARED	unk.	unk.	unk.	unk.
09-0398-06	none recorded	ELKO/ RS C-N?	unk.	unk.	unk.	unk.
09-0398-07	none recorded	LEAF-SHAPED/COT?	unk.	unk.	unk.	unk.
09-0398-08	none recorded	RS/ ELKO?	unk.	unk.	unk.	unk.
09-0398-09	none recorded	SM. FISHTAIL?	unk.	unk.	unk.	unk.
09-0398-10	13 m. @ 212 from Datum	Ang. IND. (c)	1.9 cm.	1.6 cm.	8 mm.	1.6 gm.
09-0398-11	16 m. @ 150 from Datum	FLf: middle stage	1.75 cm.	1.1 cm.	5.5 mm.	.85 gm.
09-0398-12	51 m. @ 212 from Datum	FLf: Stage 2	3.1 cm.	2.1 cm.	4 mm.	2.4 gm.
09-0398-13	27 m. @ 124 from Datum	BIFc: Stage 4	2.2 cm.	1.5 cm.	4 mm.	1.2 gm.
09-0398-14	28 m. @ 220 from Datum	Flf: primary	5.2 cm.	3.1 cm.	12 mm.	17.5 gm.
09-0398-15	35 m. @ 180 from Datum	Flf: Stage 2	1.4 cm.	1.8 cm.	2 mm.	1.05 gm.
09-0398-16	31 m. @ 180 from Datum	UFc: Stage 2-3	3.4 cm.	2.5 cm.	7 mm.	4.2 gm.

SITE NO. 7: CA-MOD-1478 (05-09-56-1012)
OHA/ XRF RESULTS

CATALOG NO.	ARTIFACT TYPE	SOURCE	HYDRATION	CALENDAR DATE
09-0378: 01	PPT	Sugar Hill	3.0 +/- 0.1	not available
09-0378: 02	PPT	East Medicine Lake	3.7 +/- 0.1	2823 B.P.
09-0378: 03	PPT	East Medicine Lake	1.9 +/- 0.1	826 B.P.
09-0378: 04	PPT	East Medicine Lake	2.7 +/- 0.1	1579 B.P.
09-0378: 05	PPT	Blue Mountain	1.6 +/- 0.1	not available
09-0378: 06	PPT	Blue Mountain	3.5 +/- 0.1	not available
09-0378: 07	PPT	Buck Mountain	7.1 +/- 0.1	not available
09-0378: 08	PPT	Blue Mountain	2.6 +/- 0.1	not available
09-0378: 09	PPT	Blue Mountain	1.7 +/- 0.1	not available
09-0378: 10	DEB	Cougar Butte	3.7 +/- 0.1	not available
09-0378: 11	DEB	East Medicine Lake	5.1 +/- 0.1	5102 B.P.
09-0378: 12	DEB	East Medicine Lake	3.7 +/- 0.1	2823 B.P.
09-0378: 13	BIF	East Medicine Lake	4.7 +/- 0.1	4389 B.P.
09-0378: 14	DEB	Blue Mountain	2.4 +/- 0.1	not available
09-0378: 15	DEB	Blue Mountain	1.8 +/- 0.1	not available
09-0378: 16	DEB	East Medicine Lake	3.7 +/- 0.1	2823 B.P.

SITE NO. 8: 05-09-56-1538
OHA/ XRF SAMPLES

DESCRIPTION	PROVENIENCE	DESCRIPTION	LENGTH	WIDTH	THICK.	WEIGHT
09-1931-01	no provenience	Sm. RS C-N	unk.	unk.	unk.	unk.
09-1931-02	95 m. @ S 70 E from Datum 2	GUN	unk.	unk.	unk.	unk.
09-1931-03	no provenience	SVSS	unk.	unk.	unk.	unk.
09-1931-06	24 m. @ 90 from Datum 2	FLf: early indet.	2.25 cm.	3.0 cm.	5 mm.	3.2 gm.
09-1931-07	24 m. @ 90 from Datum 2	UFf: Stage 2	4.8 cm.	1.9 cm.	6 mm.	4.2 gm.
09-1931-08	24 m. @ 90 from Datum 2	FLf: Stage 3	1.7 cm.	1.2 cm.	2 mm.	.5 gm.
09-1931-09	24 m. @ 90 from Datum 2	FLf: Stage 2	4.0 cm.	2.1 cm.	7 mm.	4.2 gm.
09-1931-10	24 m. @ 90 from Datum 2	FLf: Stage 2-3	2.1 cm.	1.6 cm.	4 mm.	1.3 gm.
09-1931-11	24 m. @ 90 from Datum 2	FLf: Stage 3-4	1.8 cm.	4.0 cm.	4 mm.	2.25 gm.
09-1931-12	24 m. @ 90 from Datum 2	FLf: EdMod	3.2 cm.	1.8 cm.	8 mm.	4.3 gm.
09-1931-13	24 m. @ 90 from Datum 2	FLc: Stage 3	3.1 cm.	2.1 cm.	5 mm.	3.1 gm.
09-1931-14	24 m. @ 90 from Datum 2	FLf: middle stage (c)	1.9 cm.	1.2 cm.	4 mm.	1.1 gm.
09-1931-15	24 m. @ 90 from Datum 2	UFf: Stage 2	2.2 cm.	1.65 cm.	5 mm.	1.0 gm.
09-1931-16*	24 m. @ 90 from Datum 2	Ang IND.	n/a	n/a	n/a	1/ 1.5 gm.
09-1931-17*	24 m. @ 90 from Datum 2	2 Cf: 1(c)	n/a	n/a	n/a	2/10.1 gm.

SITE NO. 8: 05-09-56-1538
OHA/ XRF RESULTS

CATALOG NO.	ARTIFACT TYPE	SOURCE	HYDRATION	CALENDAR DATE
09-1931: 01	PPT	Glass Mountain	2.0 +/- 0.1	not available
09-1931: 02	PPT	Grasshopper Group	2.0 +/- 0.1	908 B.P.
09-1931: 03	PPT	Cougar Butte	5.4 +/- 0.1	not available
09-1931: 06	DEB	East Medicine Lake	3.7 +/- 0.1	2823 B.P.
09-1931: 07	DEB	East Medicine Lake	3.6 +/- 0.1	2684 B.P.
09-1931: 08	DEB	Grasshopper Group	3.9 +/- 0.1	3111 B.P.
09-1931: 09	DEB	East Medicine Lake	5.0 +/- 0.1	4919 B.P.
09-1931: 10	DEB	East Medicine Lake	3.3 +/- 0.1	2286 B.P.
09-1931: 11	DEB	East Medicine Lake	4.7 +/- 0.1 & 3.1 +/- 0.0	4389/ 2037 B.P.
09-1931: 12	DEB	East Medicine Lake	3.1 +/- 0.1	2037 B.P.
09-1931: 13	DEB	East Medicine Lake	4.1 +/- 0.1	3412 B.P.
09-1931: 14	DEB	Cougar Butte	3.3 +/- 0.1	not available
09-1931: 15	DEB	East Medicine Lake	3.4 +/- 0.1	2416 B.P.

SITE NO. 9: 05-09-56-1561
OHA/ XRF SAMPLES

CATALOG NO.	PROVENIENCE	DESCRIPTION	LENGTH	WIDTH	THICK.	WEIGHT
09-1829-01	45 m. @ N86W from Datum 1	Sm. RS CN	2.12 cm.	1.03 cm.	4.15 mm.	.5 gm.
09-1829-05	48 m. @ S 66W from Datum 1	Sm. RS ExpSt	*1.635 cm.*	.75 cm.	7.5 mm.	*.5 gm.*
09-1829-08	51 m. @ N30W from Datum 1	Mc Kee uniface	5.78 cm.	1.67 cm.	5.1 mm.	.55 gm.
09-1829-09	93 m. @ S15W from Datum 1	Elko CN	5.035 cm.	2.1 cm.	6.2 mm.	4.4 gm.
09-1829-12	105 m. @ N09E from Datum 2	Drill frag./BMO	no meas.	no meas.	no meas.	no meas.
09-1829-14	67 m. @ N12E from Datum 2	GB	2.75 cm.	1.87 cm.	4.4 mm.	1.1 gm.
09-1829-15	100 m. @ S52W from Datum 3	PP tip	2.75 cm.	1.34 cm.	4.3 mm.	1.2 gm.
09-1829-16	115 m. @ N21W from Datum 3	RS SN	3.06 cm.	1.49 cm.	4.05 mm.	1.9 gm.
09-1829-17	70 m. @ N77W from Datum 3	GUN	1.58 cm.	1.4 cm.	2.95 mm.	.8 gm.
09-1829-18	42 m. @ N29E from Datum 3	PIN SISh	4.85 cm.	2.17 cm.	6.45 mm.	6.6 gm.
09-1829-20	49 m. @ N45W from Datum 4	Elko Eared/BMO	2.01 cm.	2.54 cm.	4.9 mm.	3.2 gm.
09-1829-21	72 m. @ S56E from Datum 4	PP ConSt	3.25 cm.	1.91 cm.	6.5 mm.	3 gm.
09-1829-23	11 m. @ 330 from Datum 1	FLf: mid to late BMO	1.5 cm.	1.0 cm.	2 mm.	.25 gm.
09-1829-24	11 m. @ 330 from Datum 1	FLc: Stage 2-3	3.2 cm.	1.5 cm.	4 mm.	2.1 gm.
09-1829-25	11 m. @ 330 from Datum 1	Ang. IND: early stage	1.1 cm.	1.7 cm.	4 mm.	.65 gm.
09-1829-26	11 m. @ 330 from Datum 1	FLc: mid to late stage	1.8 cm.	1.4 cm.	1.5 mm.	.3 gm.
09-1829-27	45 m. @ 182 from Datum 4	FLc: mid to late stage	2.0 cm.	1.5 cm.	2mm.	.4 gm.
09-1829-28	45 m. @ 182 from Datum 4	FLf: early stage (c)	2.5 cm.	3.3 cm.	6 mm.	3.6 gm.
09-1829-29	45 m. @ 182 from Datum 4	FLf: mid to late stage	1.5 cm.	2.1 cm.	2 mm.	.6 gm.
09-1829-30	16 m. @ 342 from Datum 4	UNIf: Stage 4	2.3 cm.	1.2 cm.	4 mm.	1 gm.
09-1829-31	16 m. @ 342 from Datum 4	FLf: early indet.	1.5 cm.	2.2 cm.	8 mm.	1.1 gm.
09-1829-32	16 m. @ 342 from Datum 4	FLf: Stage 3-4	1.5 cm.	1.2 cm.	1 mm.	.05 gm.
09-1829-33*	11 m. @ 330 from Datum 1	Flake bag	n/a	n/a	n/a	7/ 1 gm.
09-1829-34*	16 m. @ 342 from Datum 4	Flake bag	n/a	n/a	n/a	12/1.7 gm
09-1829-35	33 m. @ 186 from Datum 4	RS	3.8 cm.	1.9 cm.	4 mm.	2.65

SITE NO. 9: 05-09-56-1561
OHA/ XRF RESULTS

CATALOG NO.	ARTIFACT TYPE	SOURCE	HYDRATION	CALENDAR DATE
09-1829: 01	PPT	East Medicine Lake	2.5 +/- 0.1	1370 B.P.
09-1829: 05	PPT	Drews Creek/ Butcher	4.6 +/- 0.1	not available
09-1829: 08	UNI	East Medicine Lake	NA	NA
09-1829: 09	PPT	East Medicine Lake	4.3 +/- 0.1 & 2.8 +/- 0.1	3725 & 1689 B.P.
09-1829: 12	DRL	Blue Mountain	NA	not available
09-1829: 14	PPT	Grasshopper Group	3.4 B.P.	2416 B.P.
09-1829: 15	PPT	East Medicine Lake	5.3 +/- 0.1	5477 B.P.
09-1829: 16	PPT	Sugar Hill	5.0 +/- 0.1 & 2.2 +/- 0.1	not available
09-1829: 17	PPT	East Medicine Lake	2.9 +/- 0.0 & 1.5 +/- 0.1	1802 & 534 B.P.
09-1829: 18	PPT	East Medicine Lake	3.6 +/- 0.1	2684 B.P.
09-1829: 19	PPT	East Medicine Lake	5.0 +/- 0.1	4919 B.P.
09-1829: 20	PPT	Blue Mountain	2.7 +/- 0.1	not available
09-1829: 21	PPT	East Medicine Lake	4.8 +/- 0.1	4563 B.P.
09-1829: 23	DEB	Blue Mountain	3.2 +/- 0.1	not available
09-1829: 24	DEB	East Medicine Lake	2.7 +/- 0.0	1579 B.P.
09-1829: 25	DEB	East Medicine Lake	NA	NA
09-1829: 26	DEB	GF/LIW/RS	2.8 +/- 0.1	1689 B.P.
09-1829: 27	DEB	East Medicine Lake	3.9 +/- 0.1	3111 B.P.
09-1829: 28	DEB	Blue Mountain	1.6 +/- 0.1	not available
09-1829: 29	DEB	East Medicine Lake	5.4 +/- 0.1	5669 B.P.
09-1829: 30	DEB	East Medicine Lake	6.3 +/- 0.1	7533 B.P.
09-1829: 31	DEB	East Medicine Lake	8.1 +/- 0.1	11974 B.P.
09-1829: 32	DEB	East Medicine Lake	4.6 +/- 0.1	4218 B.P.
09-1829: 35	PPT	Buck Mountain	4.7 +/- 0.0	not available

SITE NO. 11: CA-MOD-2236 (05-09-56-1208)
OHA/ XRF SAMPLES

CATALOG NO.	PROVENIENCE	DESCRIPTION	LENGTH	WIDTH	THICK.	WEIGHT
09-0474-01	13 m. @ 316 from Datum	Cf: BMO	4.0 cm.	2.9 cm.	8 mm.	13.5 gm.
09-0474-02	7 m. @ 286 from Datum	FLf: Stage 2 BMO	3.0 cm.	1.9 cm.	4 mm.	2.4 gm.
09-0474-03	9 m. @ 286 from Datum	FLc: Stage 3-4	1.6 cm.	.8 cm	.25 mm.	.3 gm.
09-0474-04	7 m. @ 264 from Datum	FLf: Stage 2	1.3 cm.	1.2 m.	1 mm.	1.8 gm.
09-0474-05	9 m. @ 264 from Datum	FLf: Stage 2	1.8 cm.	1.4 cm.	.25 mm.	.4 gm.
09-0474-06	14 m. @ 261 from Datum	FLf: Stage 2-3 BMO	1.9 cm.	1.7 cm.	2 mm.	1.4 gm.
09-0474-07	7 m. @ 241 from Datum	FLf: Stage 3 BMO	1.2 cm.	1.8 cm.	5 mm.	.6 gm.
09-0474-08	13 m. @ 234 from Datum	FLf/ BMO	1.4 cm.	2.1 cm.	5 mm.	1.4 gm.

SITE NO. 11: CA-MOD-2236 (05-09-56-1208)
OHA/ XRF RESULTS

CATALOG NO.	ARTIFACT TYPE	SOURCE	HYDRATION	CALENDAR DATE
09-0474: 01	DEB	Blue Mountain	2.9 +/- 0.1	not available
09-0474: 02	DEB	Blue Mountain	1.7 +/-0.1 & 3.9 +/-0.1	not available
09-0474: 03	DEB	Blue Mountain	2.8 +/- 0.1	not available
09-0474: 04	DEB	Blue Mountain	2.6 +/- 0.1	not available
09-0474: 05	DEB	Blue Mountain	2.7 +/- 0.1	not available
09-0474: 06	DEB	Blue Mountain	3.1 +/- 0.1	not available
09-0474: 07	DEB	Blue Mountain	3.5 +/- 0.1	not available
09-0474: 08	DEB	Blue Mountain	2.6 +/- 0.1	not available

SITE NO. 18: CA-MOD-2296 (05-09-56-1311)
OHA/ XRF SAMPLES

CATALOG NO.	PROVENIENCE	DESCRIPTION	LENGTH	WIDTH	THICK.	WEIGHT
09-1463-01	No provenience	COT/ Sm. HUM?	unk.	unk.	unk.	unk.
09-1463-02	14 m. @ 12 from Datum	FLf: indet. late stage	1.2 cm.	1.6 cm.	1 mm.	.5 gm.
09-1463-03	14 m. @ 12 from Datum	FLf: indet. late stage	1.4 cm.	1.1 cm.	1 mm.	.3 gm.
09-1463-04	14 m. @ 12 from Datum	FLf: Stage 2	2.9 cm.	2.8 cm.	4 mm.	3.4 gm.
09-1463-05	14 m. @ 12 from Datum	FLf: indet.	2.4 cm.	.9 cm.	2 mm.	.65 gm.
09-1463-06	14 m. @ 12 from Datum	FLf: indet.	1.0 cm.	2.2 cm.	2 mm.	.6 gm.
09-1463-07	17 m. @ 30 from Datum	FLf: Stage 2-3	2.1 cm.	1.9 cm.	4 mm.	1.3 gm.
09-1463-08	17 m. @ 30 from Datum	FLf: Stage 3-4	2.4 cm.	1.5 cm.	1 mm.	.75 gm.
09-1463-09	17 m. @ 30 from Datum	FLf: indet. mid stage	1.1 cm.	1.9 cm.	2 mm.	.5 gm.
09-1463-10	17 m. @ 30 from Datum	FLf: Stage 3	3.0 cm.	2.7 cm.	5 mm.	2.6 gm.
09-1463-11	17 m. @ 30 from Datum	UFf: late stage	1.9 cm.	1.4 cm.	1 mm.	.7 gm.
09-1463-12*	17 m. @ 30 from Datum	Flake Bag	n/a	n/a	n/a	3/.8 gm.

SITE NO 18: CA-MOD-2296 (05-090-56-1311)
OHA/ XRF RESULTS

CATALOG NO.	ARTIFACT TYPE	SOURCE	HYDRATION	CALENDAR DATE
09-1463: 01	PPT	Unknown 1	5.2 +/- 0.1	not available
09-1463: 02	DEB	East Medicine Lake	4.6 +/- 0.1	4218 B.P.
09-1463: 03	DEB	East Medicine Lake	NA	NA
09-1463: 04	DEB	East Medicine Lake	3.7 +/- 0.1	2823 B.P.
09-1463: 05	DEB	East Medicine Lake	4.2 +/- 0.1	3567 B.P.
09-1463: 06	DEB	East Medicine Lake	2.7 +/- 0.1	1579 B.P.
09-1463: 07	DEB	East Medicine Lake	3.6 +/- 0.0	2684 B.P.
09-1463: 08	DEB	East Medicine Lake	3.6 +/- 0.1	2684 B.P.
09-1463: 09	DEB	East Medicine Lake	3.7 +/- 0.1	2823 B.P.
09-1463: 10	DEB	East Medicine Lake	2.8 +/-0.1	1689 B.P.
09-1463: 11	DEB	East Medicine Lake	3.4 +/- 0.1	2416 B.P.

APPENDIX B

PGT-PG&E PIPELINE SITE A:
CA-MOD-1206/ 1207 (Locus 4)
OHA/ XRF RESULTS

ARTIFACT TYPE	SOURCE	HYDRATION	EST. TIME DEPTH
DEB (21 pieces)	East Medicine Lake/ GG	0.9-1.9 (1.3 mean)	208-826 B.P. (410 mean)
DEB (4 pieces)	Cougar Butte	1.0-3.9 (1.9 mean)	not available
DEB (4 pieces)	Glass Mountain	0.9-3.6 (2.2 mean)	post-eruption
DEB (3 pieces)	Other sources	1.2-3.8 (2.1 mean)	not available
DSN	East Medicine Lake	1	253 B.P.
DSN	East Medicine Lake	1	253 B.P.
DSN	Other source	1.5	not available
DSN	Other source	1.8	not available
COT	East Medicine Lake	1	253 B.P.
COT	East Medicine Lake	1	253 B.P.
COT	East Medicine Lake	1.2	354 B.P.
COT	East Medicine Lake	1.7	673 B.P.
COT	Other source	1.2	not available
COT	Other source	1.7	not available

PGT-PG&E SITE B:
CA-MOD-2561
XRF/ OHA RESULTS

PROVENIENCE	ARTIFACT TYPE	SOURCE	HYDRATION	EST. TIME DEPTH
NA	DEB (5)	EML/ GG	1.4-1.9 microns (mean 1.7)	826-470 B.P. (623 B.P.)
NA	DEB (32)	EML/ GG	2.3-3.9 microns (mean 3.0)	3111-1175 B.P. (1918 B.P.)

PGT-PG&E SITE C:
CA-MOD-2565 (MRR 3)
XRF/ OHA RESULTS

PROVENIENCE	ARTIFACT TYPE	SOURCE	HYDRATION	EST. TIME DEPTH
MRR3	DSN	BMO	4.7	NA
Non-Locus	Sm. C-N	EML	2	908 B.P.
Non-Locus	DSN	EML	1.5	534 B.P.
Non-Locus	DSN	EML	1.6	588 B.P.
MRR3	DEB (4)	EML/ GG	1.1-1.3 (mean 1.2)	300-410 B.P. (354 B.P.)
MRR3	DEB (2)	BMO	1.2-1.4 (mean 1.3)	NA
MRR3	DEB (1)	Cowhead Lake	1.3	NA

PGT-PG&E SITE D:
CA-MOD-2560 (LC's 26, 27, 32, 36)
OHA/ XRF RESULTS

PROVENIENCE	ARTIFACT TYPE	SOURCE	HYDRATION	EST. TIME DEPTH
LC 32	DSN (1)	EML/GG	1.3	410 B.P.
unknown	COT (1)	EML/GG	1.7	673 B.P.
LC 26, AU C	RG (7)	EML/GG	1.5-2.7 (2.1 mean)	534-1579 B.P. (994 mean)
LC 26, LC 27	GUN (11)	EML/GG	1.2-2.8 (2.2 mean)	354-1689 B.P. (1082 mean)
LC 26	SM CN (2)	EML/GG	2.4, 2.6	1271 B.P., 1473 B.P.
unknown	ELKO (2)	EML/ GG	1.3, 1.5	410 B.P., 534 B.P.
LC 32	DSN	EML	2.7	1579 B.P.
LC 32	DSN	Buck Mountain	2.5	not available
LC 36	DEB (16)	GG/EML/GF	2-2.8 (2.5 mean)	908-1689 B.P. (1370 mean)
LC 36	DEB (8)	GG/EML/GF	1.3-1.8 (1.6 mean)	410-748 B.P. (602 mean)
LC 27	DEB (12)	GG/EML/GF	1.3-2.4 (1.9 mean)	410-1271 B.P. (826 mean)

TUSCARORA PIPELINE SITE A:
CA-MOD-3127/H
OHA/ XRF RESULTS

CATALOG NO.	ARTIFACT TYPE	SOURCE	MEAN RIM	CALENDAR DATE
3127-19	DSN	Glass Mountain	1.8	post-eruption
3127-2	RS	Drews Crk/Butcher Flt	2.3	not available
3127-5	RS	East Medicine Lake	3.1	2037 B.P.
3127-18	RS	Cougar Butte	3.5	not available
3127-9	BIF	East Medicine Lake	1.2	354 B.P.
3127-88b	DEB	East Medicine Lake	2.5	1370 B.P.
3127-88c	DEB	East Medicine Lake	1.4	470 B.P.
3127-88d	DEB	Glass Mountain	1.5	post-eruption
3127-88e	DEB	Buck Mountain	0.9	not available
3127-88f	DEB	Buck Mountain	1.6	not available
3127-88g	DEB	East Medicine Lake	2.1	994 B.P.
3127-88h	DEB	Buck Mountain	1.4	not available
3127-88i	DEB	Buck Mountain	1.6	not available
3127-88j	DEB	East Medicine Lake	1.3	410 B.P.
3127-89	DSN	Buck Mountain	1.6	not available
3127-90	BIF	Buck Mountain	1.2	not available
SSC 1: 93a	DEB	East Medicine Lake	5.4	5669 B.P.
SSC 1: 93b	DEB	East Medicine Lake	1.5	534 B.P.
SSC 1: 93c	DEB	East Medicine Lake	NA	NA
SSC 1: 93d	DEB	East Medicine Lake	NA	NA
SSC 1: 93e	DEB	East Medicine Lake	1.8	748 B.P.
SSC 1: 93f	DEB	Blue Mountain	3.3	not available
SSC 1: 93g	DEB	East Medicine Lake	4.7	4389 B.P.
SSC 1: 93h	DEB	Blue Mountain	2.6	not available
SSC 1: 93i	DEB	East Medicine Lake	4.5	4051 B.P.
SSC 1: 93j	DEB	Cougar Butte	9.4	not available
SSC 1: 93k	DEB	East Medicine Lake	2.9	1802 B.P.

TUSCARORA PIPELINE SITE B:
CA-MOD-3035 (05-09-56-2053)
OHA/ XRF RESULTS

CATALOG NO.	ARTIFACT TYPE	SOURCE	MEAN RIM	CALENDAR DATE
SSC 1: 8a	DEB	East Medicine Lake	1.2	354 B.P.
SSC 1: 8b	DEB	East Medicine Lake	1.1	302 B.P.
SSC 1: 8c	DEB	East Medicine Lake	1.3	410 B.P.
SSC 1: 8d	DEB	Cougar Butte	1.7	not available
SSC 1: 8e	DEB	East Medicine Lake	4.8	4563 B.P.
SSC 1: 8f	DEB	East Medicine Lake	DF	NA
SSC 1: 8g	DEB	East Medicine Lake	1.1	302 B.P.
SSC 1: 8h	DEB	East Medicine Lake	1.1	302 B.P.
SSC 1: 8i	DEB	East Medicine Lake	1.7	673 B.P.
SSC 1: 8j	DEB	East Medicine Lake	2.1	994 B.P.

TUSCARORA PIPELINE SITE C: CA-MOD-3058 (05-09-56-2005) OHA/ XRF RESULTS

CATALOG NO.	ARTIFACT TYPE	SOURCE	MEAN RIM	CALENDAR DATE
3058-02	RS	East Medicine Lake	3.2	2160 B.P.
3058-03	Arrow-sized indet.	East Medicine Lake	3.4	2416 B.P.
3058-04	RS	East Medicine Lake	3.6	2684 B.P.
3058-06	Small stemmed	Railroad Grade?	1.6	not available
3058-09	Small stemmed	Buck Mountain	1.9	not available
3058-10	RS	Buck Mountain	3.2	not available
3058-13	RS	East Medicine Lake	3.3	2286 B.P.
N22.5W17: 47a	DEB	NA	2.6	NA
N22.5/W17: 47b	DEB	NA	2.5	NA
N22.5/W17: 47c	DEB	NA	2.3	NA
N22.5/W17: 47d	DEB	NA	2.4	NA
N22.5/W17: 47e	DEB	NA	3.1	NA
N22.5/W17: 47f	DEB	NA	2.3	NA
N22.5/W17: 47g	DEB	NA	2.4	NA
N22.5/W17: 47h	DEB	East Medicine Lake	3.6	2684 B.P.
N22.5/W17: 47i	DEB	East Medicine Lake	2.8	1689 B.P.
N22.5/W17: 47j	DEB	East Medicine Lake	1.7	673 B.P.
N22.5/W17: 47k	DEB	East Medicine Lake	3.3	2286 B.P.
N22.5/W17: 47l	DEB	East Medicine Lake	5.4	5669 B.P.
N22.5/W17: 47m	DEB	East Medicine Lake	2.2	1082 B.P.
N22.5/W17: 47n	DEB	East Medicine Lake	2.6	1473 B.P.
N22.5/W17: 49a	DEB	East Medicine Lake	2.5	1370 B.P.
N22.5/W17: 49b	DEB	East Medicine Lake	2.7	1579 B.P.
N22.5/W17: 49c	DEB	no reading	2.5	NA
N22.5/W17: 49d	DEB	East Medicine Lake	2.1	994 B.P.
N22.5/W17: 49e	DEB	East Medicine Lake	2.5	1370 B.P.
N22.5/W17: 51a	DEB	NA	3.8	NA
N22.5/W17: 51b	DEB	NA	2.7	NA
N22.5/W17: 51c	DEB	NA	2.3	NA
N22.5/W17: 51d	DEB	NA	2.3	NA
N22.5/W17: 51e	DEB	NA	2.3	NA
N15.8/W5.8: 52a	DEB	NA	0	NA
N15.8/W5.8: 52b	DEB	East Medicine Lake	1.1	302 B.P.
N15.8/W5.8: 52c	DEB	East Medicine Lake	3.5	2548 B.P.
N15.8/W5.8: 52d	DEB	East Medicine Lake	1.7	673 B.P.
N15.8/W5.8: 52e	DEB	no reading	1.6	NA
N15.8/W5.8: 52f	DEB	no reading	3	NA
N15.8/W5.8: 52g	DEB	NA	0	NA
N15.8/W5.8: 52h	DEB	no reading	2.4	NA
N15.8/W5.8: 52i	DEB	no reading	2.4	NA
N15.8/W5.8: 52k	DEB	East Medicine Lake	2.2	1082 B.P.
N15.8/W5.8: 52m	DEB	East Medicine Lake	3.5	2548 B.P.
N15.8/W5.8: 52o	DEB	Glass Mountain	2.2	post-eruption
N15.8/W5.8: 52p	DEB	East Medicine Lake	2.2	1082 B.P.
N15.8/W5.8: 52q	DEB	East Medicine Lake	2.2	1082 B.P.
N15.8/W5.8: 52r	DEB	Cougar Butte	3.1	not available
N15.8/W5.8: 52s	DEB	East Medicine Lake	6.6	8208 B.P.

TUSCARORA PIPELINE SITE D:
CA-MOD-1718 (05-09-56-1060)
OHA/ XRF RESULTS

PROVENIENCE	ARTIFACT TYPE	SOURCE	HYDRATION	EST. TIME DEPTH
1711: 04	Arrow-sized	EML	3	1918 B.P.
1711: 05	RS	BUCK	2.3	NA
1711: 09	RS	EML	2.3	1175 B.P.
1711: 10	RS	EML	1.8	748 B.P.
1711: 11	Arrow-sized	EML	3.5	2548 B.P.
1711: 44	RS	EML	2.7	1579 B.P.
FSC 1/ N3E0 (8)	DEB	EML	1.5-4.0 (2.8 mean)	534-3260 B.P. (1689 mean)
Loc C/ N28W4 (3)	BIF	EML	3.1-4.3 (3.7 mean)	2037-3725 B.P. (2823 mean)
Loc C/ N28W4 (30)	DEB	EML	0.9-4.4 (2.6 mean)	208-3886 B.P. (1473 mean)

OTH-B RADAR SITE A:
CA-MOD-1843 (05-09-56-1168)
OHA/ XRF RESULTS

PROVENIENCE	ARTIFACT TYPE	SOURCE	HYDRATION	EST. TIME DEPTH
09-1370: 01	RSCN	EML	3.3	2286 B.P.
09-1370: 03a, b	RSCN	EML	4.8, 5.3	4563-5477 B.P.
09-1370: 05	GB frag	EML	2.8	1689 B.P.
N72E18 (8)	DEB	CB	1.5-3.6 (3.2 mean)	NA
N72E18 (1)	DEB	EGM	4.3	NA
N72E18 (8)	DEB	EML	2.9-3.7 (3.1 mean)	1802-2823 B.P. (2037 mean)

OTH-B RADAR SITE B:
CA-MOD-2081 (05-09-56-1229)
OHA/ XRF RESULTS

PROVENIENCE	ARTIFACT TYPE	SOURCE	HYDRATION	EST. TIME DEPTH
09-1246: 01	RSCN	EML	2.7	1579 B.P.
N2E9 (3)	DEB	BMO	1.1, 1.5, 1.5 (mean 1.4)	NA
N2E9 (17)	DEB	EML	1.3-5.0 (2.8 mean)	410-4919 B.P. (1689 mean)

OTH-B RADAR SITE C:
CA-MOD-2074 (05-09-56-1222)
OHA/ XRF RESULTS

PROVENIENCE	ARTIFACT TYPE	SOURCE	HYDRATION	EST. TIME DEPTH
09-1242: 01	RSCN	EML	3.8	2966 B.P.
09-1242: 02	GB	DC/ BF	3.6	NA
N27W21 (28)	DEB	EML	2.1-4.7 (mean 3.0)	994-4389 B.P. (1918 mean)