A SPATIAL AND TEMPORAL STUDY OF BLUE MOUNTAIN OBSIDIAN: TERRITORIAL IMPLICATIONS ON THE DEVIL'S GARDEN IN NORTHEASTERN CALIFORNIA

by

Enid J. Van de Hoek

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Dr. David A. Fredrickson, Chair

Dr. Shirley Silver

Mr. Gerald R. Gates

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Date

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ABSTRACT

Purpose of the Study:

The Devil's Garden in northeastern California was inhabited by ethnographically-documented Pit River and Modoc Indians who shared a boundary on the volcanic tableland. Researchers placed the tribal boundary between the two groups at different locations, creating an overlapping border zone. The Blue Mountain obsidian source lies north of the boundary area in Modoc territory.

The purpose of this research is to examine the boundary area and territorial systems of Modoc and Pit River tribelets on the Devil's Garden through a spatial and temporal study of Blue Mountain obsidian debitage.

Procedure:

To examine the territorial systems of Pit River and Modoc tribelets on the Devil's Garden, this study has used ethnographic, historical, and climatic information in conjunction with results obtained from obsidian hydration analysis, visual sourcing of Blue Mountain obsidian, and quantification of obsidian debitage.

Findings:

Ethnographic data, quantification of obsidian debitage, and hydration analysis of Blue Mountain obsidian debitage indicate that the overlapping tribal zone was utilized in ethnographic times by Modocs, but not by Pit River people. Evidence for a southern Modoc territorial expansion into this area is provided by historical accounts, which discuss slave-raiding of Pit River Indians by Modocs. Climatic data point to a drought in the first half of the nineteenth century, indicating a possible need by Modocs for increased territory.

Conclusions:

Hypotheses were developed to address the problem of territoriality on the Devil's Garden. One hypothesis proposes a late southern expansion of Modocs into areas once shared by both Indian groups. Another hypothesis proposes equal access to the Devil's Garden by Pit River and Modoc tribelets. Study results do not support equal access to the Blue Mountain obsidian source or to areas within or north of the boundary overlap zone by Pit River people. Results indicate that a southern expansion of Modocs occurred in late prehistoric and historical times.

Chair David A. Fredrickson
Signature

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CHAPTER 1

INTRODUCTION

The northeastern corner of California is a vast region of volcanic plains, dormant cinder cones, basalt lava reefs, and fault-block mountains. It is in this region that three distinct geomorphological provinces merge: the Great Basin, the southern reach of the Columbia Plateau called the Modoc Plateau, and the Cascade Ranges. From the Modoc Plateau rises the Devil's Garden, an approximate 1,000-square-mile lava tableland. Named for its desolate terrain, the Devil's Garden actually holds numerous plant and animal resources, the objectives of ethnographically-documented Modoc and Pit River Indian groups on their similar seasonal rounds. This study is concerned with the territorial systems of several Pit River and Modoc bands on the Devil's Garden.

In the 1920s, researchers C. Hart Merriam (1926) and Fred B. Kniffen (1928) drew a nearly identical boundary across the Devil's Garden between the two groups from information provided by Pit River individuals (Figures 1 and 2). However, using a Modoc informant bias, Vern F. Ray (1963) placed the boundary several miles farther south (Figures 3 and 4), creating an overlapping border zone (Figure 5).

This study examines possible reasons for the boundary discrepancy by focusing on the geographic distribution of

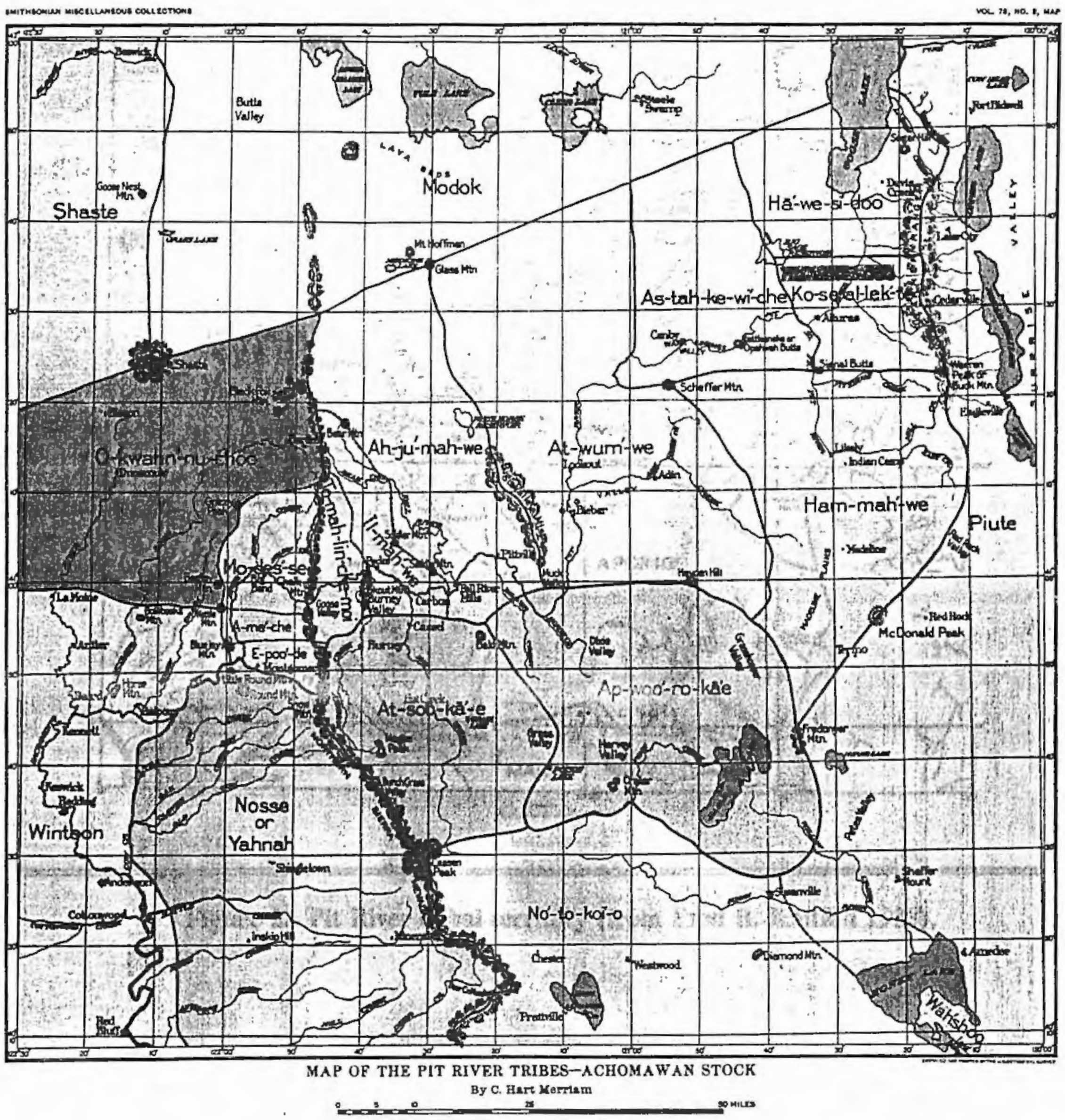

Figure 1. Pit River tribal territory (from C. Hart Merriam 1926: color map insert).

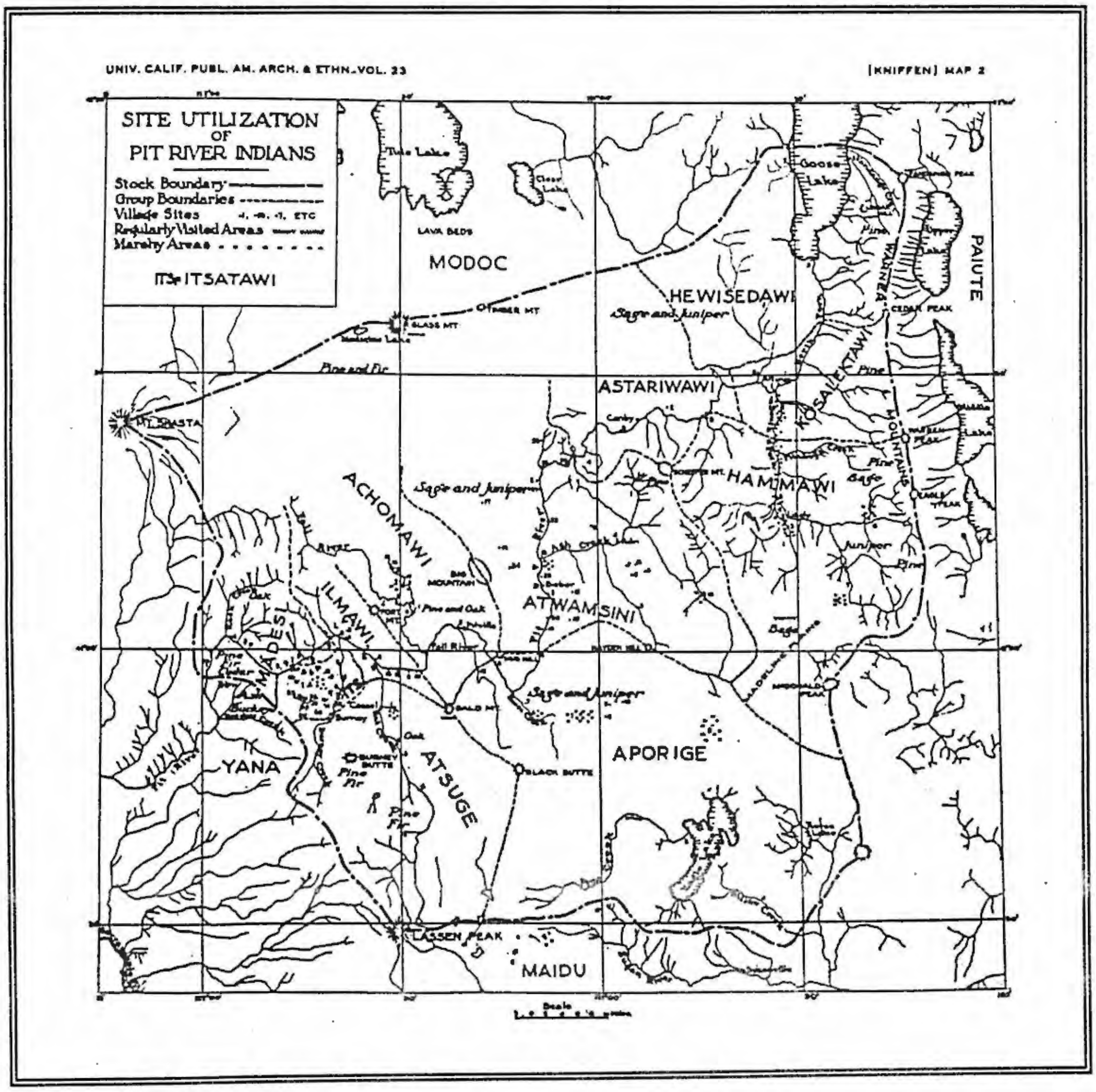

Figure 2. Pit River tribal territory (from Fred B. Kniffen 1928).

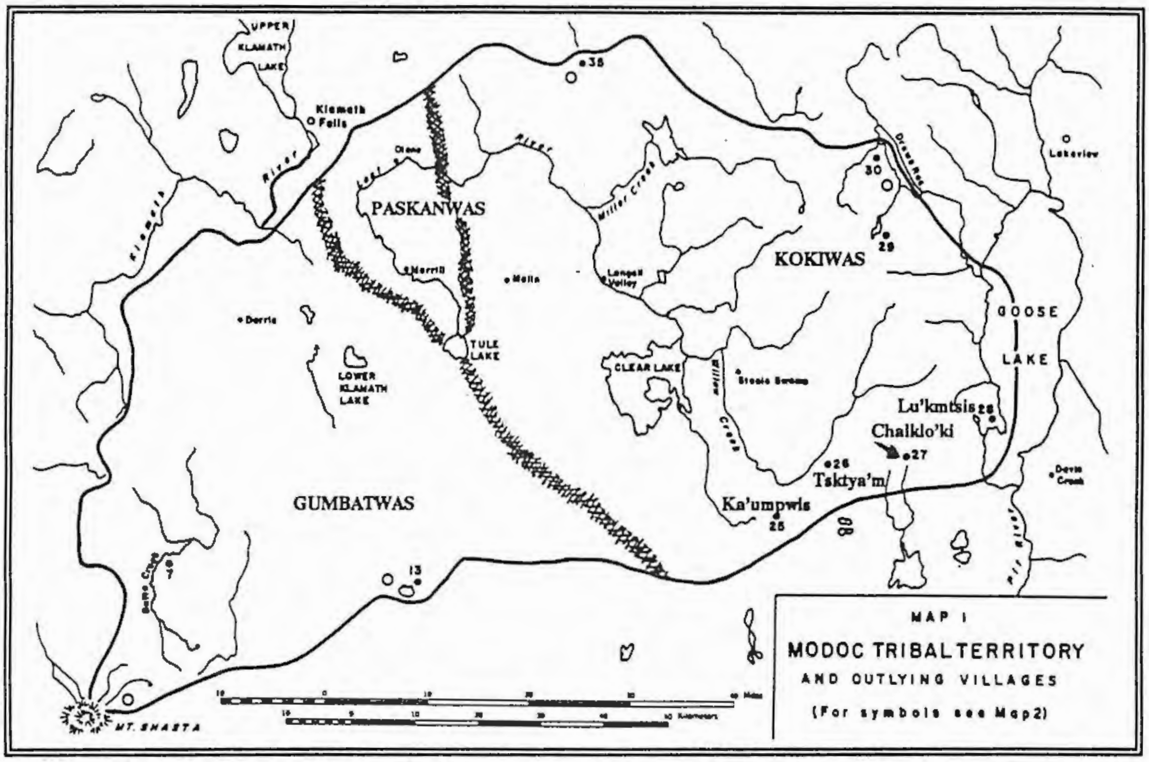

Figure 3. Modoc tribal territory (adapted from Ray 1963: Map 1).

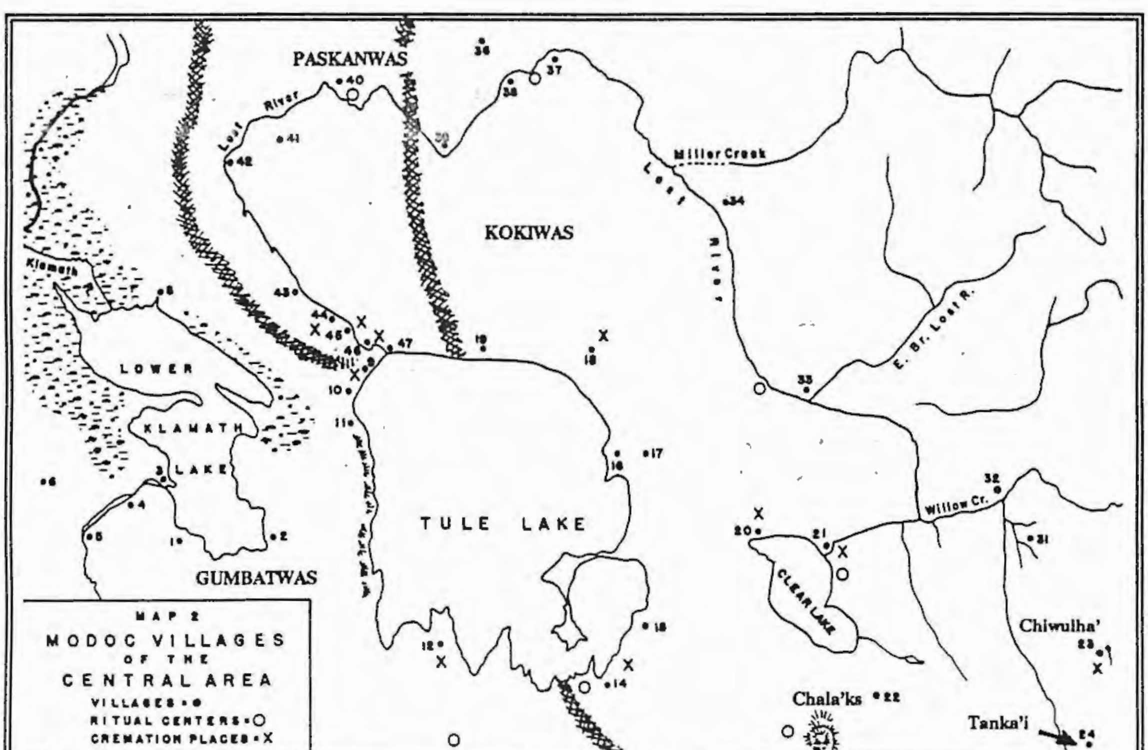

Figure 4. Modoc village locations (adapted from Ray 1963: Map 2).

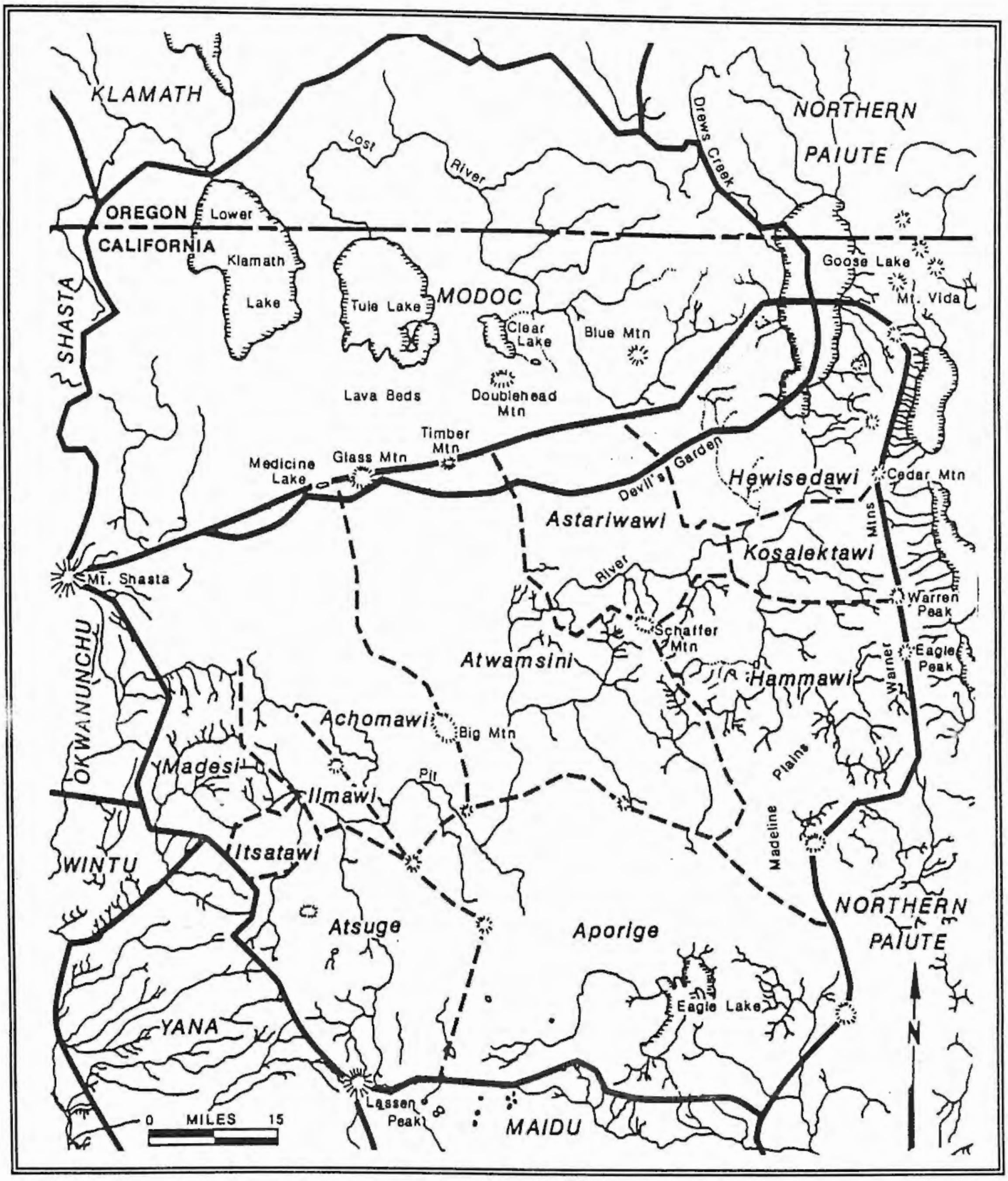

Figure 5. Modoc and Pit River tribal boundary zone (from Basin Research Associates 1990: Figure 3.3, as adapted from Gates 1983: Figure 12).

surface debitage (defined as waste flakes from the shaping of tools) from one visually distinct obsidian source. Lying in Modoc territory, the Blue Mountain obsidian source is the only available obsidian on the Devil's Garden; its proximity and usefulness for shaping into tools and weapons by groups on the Garden are obvious, especially given a lack of other appropriate lithic materials. If Modocs were the sole controllers of the Blue Mountain source, an expected sharp drop-off of obsidian debitage from this source would be a good indicator of their southern territorial limits.

Historical and ethnographic information places both Indian groups on the Devil's Garden. However, a strong case is also presented for a southern migration of Modocs into areas formerly utilized by Pit River people. A boundary shift may be demonstrated by the diachronic study of Blue Mountain obsidian debitage distributions and fall-off rates in conjunction with temporal information from the results of obsidian hydration analysis. The objective is to discover if spatial and temporal trends indicate territorial expansion by Modocs during late prehistoric and historical times.

A volcanic glass amenable to shaping into tools such as projectile points for arrows, obsidian was a valued commodity, not only for utilitarian purposes, but for esthetic reasons, since obsidian is known to have been fashioned into items having importance in a socio-religious context. The Blue Mountain obsidian source and numerous other sources of obsidian in the region provide an accessible means to study prehistoric subsistence and settlement patterns.

Theoretical issues in archaeology and commonly utilized research methods for studying obsidian and its procurement are addressed in the following chapter. Chapter 3 adds the research design and methods used in this study.

Chapter 4 provides a synopsis of the cultural and historical backgrounds of the Modoc and Pit River Indians, while Chapter 5 discusses the boundary overlap and settlements as they relate to the Modoc and Pit River groups on the Devil's Garden. Also covered are slave-raiding practices by the Modoc tribe and the potential effects of a drought which occurred during the first half of the nineteenth century.

Chapter 6 covers in some detail the Garden's physical environment. Indisputable in archaeology are the roles of both cultural and physical environments in an interrelated context. Discussed in Chapter 7 are past archaeological investigations relevant to the present study.

Research results are provided in Chapter 8, while Chapter 9 presents concluding remarks and implications for future work in the Devil's Garden region.

CHAPTER 2

THEORETICAL AND METHODOLOGICAL CONCEPTS

Recent approaches in archaeology are viewed as part of an evolutionary continuum. An early part of this continuum was Julian Steward's 1938 theory of "culture ecology" and its scientific focus on interrelated human cultures and their environments. His reasoning was largely responsible for the dismissal of environmental determinism, a widely-held theory explaining the actions of prehistoric hunters and gatherers. From this concept grew an increased desire for explanations about human behavior. Concern for process was first addressed in the 1960s with Binford's (1962; 1964) contention that cultural systems were preserved in the archaeological record and only constrained by the limits of archaeological research designs. The hypothetico-deductive approach was a direct result of processual concern and incorporated methods used in the natural sciences to the study of archaeology.

The 1970s and 1980s evolved into years concerned with regional analysis and spatial archaeology necessitating the use of quantification to study archaeological materials. Theories from other disciplines such as geography and economics were widely embraced and applied to spatial studies, for instance, site catchment analysis and nearest neighbor studies. Decision-making factors were also considered as part of a contextual approach to archaeology, and the concept of human ecosystems was postulated by Butzer (1982:6-7), whereby he stressed the environment and the choices taking place within it.

At the same time, approaches to cultural anthropology since the 1960s have influenced archaeological theory. Three main orientations are: ecological, involving needs and resultant adaptive strategies within an environmental context; substantive (or structural), involving the rules and values of cultural groups; and economic (or formalist), involving rational decision-making efforts. A natural outcome of these orientations coupled with scientific advances in obsidian analysis has been increased interest in obsidian procurement and exchange networks in California. Exchange is defined as "the spatial distribution of materials from hand to hand and from social group to social group" (Earle 1982:2).

Relative dates are now possible through obsidian hydration analysis for sites which previously could be dated only by comparing projectile point types attributed to certain time periods. Obsidian artifacts can now also be tied to their origin, or parent obsidian source in many cases. Greater spatial and temporal control of obsidian provides an excellent base from which questions about the behavioral systems of prehistoric and ethnographic groups can be directed.

One major focus of recent research has been on the use of obsidian to identify discrete groups of people, their boundaries, and the exchange of commodities between them. In northeastern California, Heipel (1987) utilized obsidian sourcing methods to distinguish Atsugewi groups south of the Pit River area. Sourcing and hydration analysis were effectively used at Nightfire Island south of Lower Klamath Lake to study temporal variability and boundaries (Sampson 1985). In her study of the ethnographic boundary between the Shasta and Modoc Indians, Nilsson (1985) used obsidian sourcing and hydration analysis in conjunction with examining stone tool flaking technologies. Obsidian sourcing and hydration analysis also proved useful in verifying an ethnographic boundary between the Northern Paiutes and the Pit River Indians (Gates 1987).

All of these studies evolved from the pioneering work of researchers such as Jackson (1974) and Jack (1976), who successfully utilized X-ray fluorescence to trace artifacts to their obsidian source. Ericson (1977) additionally used artifact distributions to examine exchange systems.

A strong criticism of attention focused solely on exchange and the resultant distribution of obsidian has been that little emphasis is placed on the causative human actions. Hughes (1986:7-8) voiced criticism of assumptions that ethnolinguistic groups were responsible for obsidian distributions and therefore are represented in the distributions, adding: "A preoccupation with ethno-linguistic units may mask the complexity of exchange relations within and between these units." Paramount is a consideration of the dynamics and complexities of interrelating sociocultural systems of which obsidian distributions are a result.

Hughes and Bettinger (1984:164-165) studied obsidian debitage from the visually-distinct Fish Springs source in central Owens Valley, California. Their objective was to see if the presence of territories, as evinced by prehistoric boundaries, could be ascertained from obsidian debitage frequencies. Indirect access through trade by groups not controlling the Fish Springs source and direct access by those in control of it is indicated in "sharp discontinuities" in the frequency of the debitage. At the same time, projectile points are represented by obsidians from more distant sources than debitage, which comes from the nearest source. Thus they "represent the by-products of different prehistoric systems . . . " (Hughes and Bettinger 1984:168).

That "significant differences in fall-off rates occur between localities" has been shown in the Geysers Region of the North Coast Ranges (Fredrickson 1990:99). Fredrickson found that obsidian is distinctively patterned within localities. Consequently, it is possible to examine the "social distance" between adjacent localities. As will be discussed, the methods used here may have applicability to the social distance of sites on the Devil's Garden.

SPATIAL ANALYSIS OF SURFACE MATERIALS

This research project proposes to define the territorial systems of some Modoc and Pit River tribelets by looking at the fall-off rates of Blue Mountain obsidian debitage with increasing distance from that source. Renfrew's 'Law of Monotonic Decrement' holds that "raw materials from a source become increasingly scarce as one moves away from the source" (Earle and Ericson 1977:7). A simple fall-off model contains concentric circles which surround a source. A change in the quantity of source materials compared to the quantity of materials from other sources is called the "exchange index," a ratio expressed as a percent and viewed as the result of distance from the source being examined (Ericson 1982:133). This kind of two-dimensional approach, considering the variables of distance and quantity, is seen by Ericson (1981:105) to depend on the symmetry of the system in question. Regression analysis shows the regional trend in a symmetrical system, where the percentages of materials decrease in a predictable way with increasing distance from the source.

Although barriers and corridors are considered to be important as they relate to energy costs in procuring obsidian, the cost of obtaining it is most often measured by the linear distance from the source to the site (as is done in this study). Outliers, or deviations from the regression line through the sites plotted on a graph, need to be considered in order to look at variability in sites and possible anomalies within the territorial system under investigation. Figure 6 is a simple fall-off model for Blue Mountain debitage, showing the idealized fall-off percentages of flakes with distance from the source as well as site outliers which do not conform to the model.

Ericson's (1981:117) three-dimensional approach overcomes the limits imposed by looking only at distance from the source and relative quantity of materials at a given site. Using synagraphic mapping, he created ten source-specific, overlapping exchange maps, 90 percent of which are asymmetrical, indicating the "directedness" of obsidian movement. The concentric circles are seen as contours, or isopleths, each succeeding contour outward denoting a 10 percent decrease in source-specific materials. Additionally, he looked at a set of variables ignored in the two-dimensional approach: alternate sources, prehistoric trails, and ethnographic boundaries (Ericson 1981:175). Thus the statistical outliers seen in simple regression analysis are addressed as they may relate to these other variables.

Isopleths are placed around the Blue Mountain obsidian source through all debitage frequency percentages of equal value in order to utilize Ericson's method where territorial systems, rather than exchange systems, are of interest (Figure 7). This approach is useful in looking at the fall-off rate of Blue Mountain debitage. Implications of the debitage distribution frequencies shown on the map are discussed in the results section of this study.

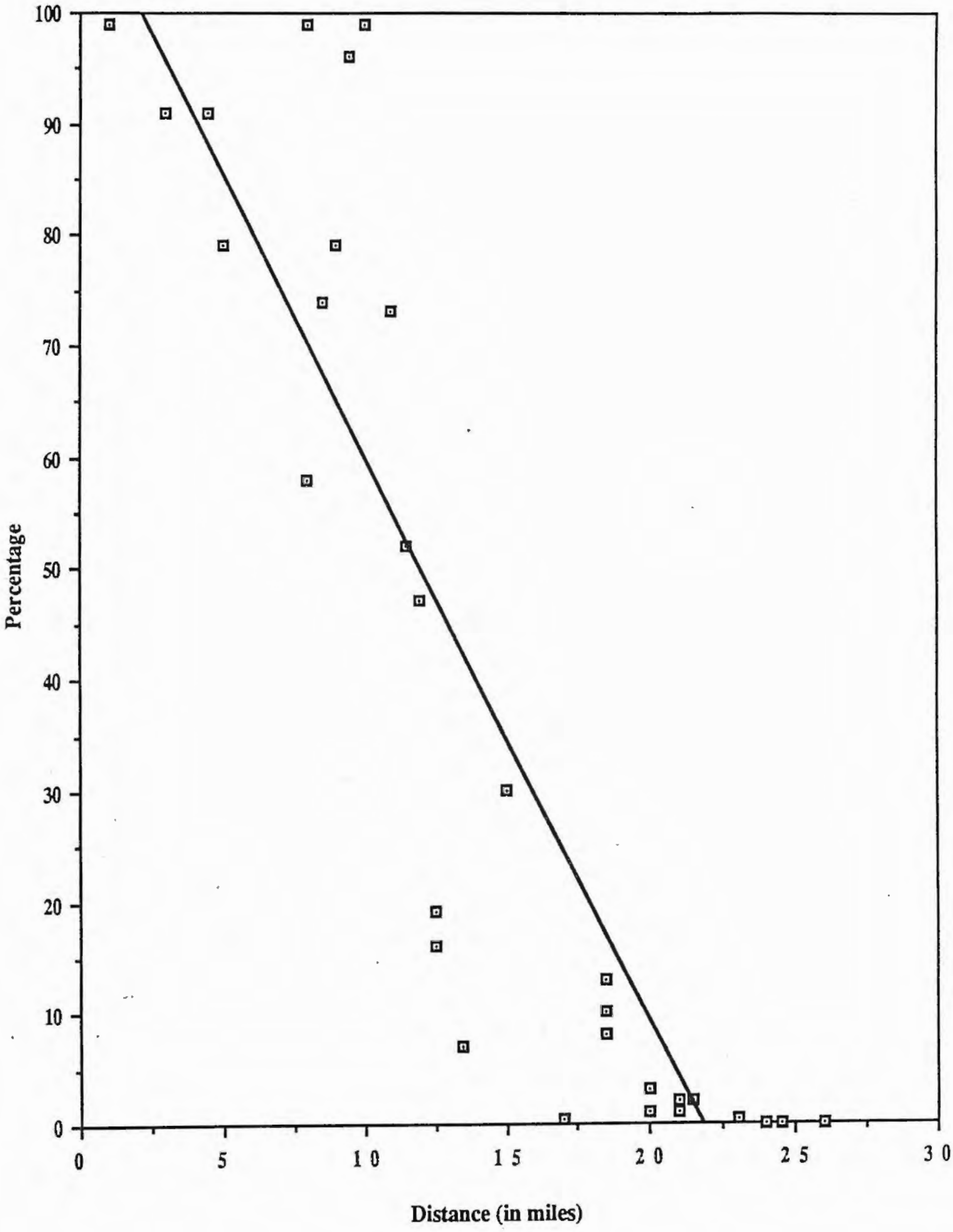

Figure 6. Least squares line: fall-off rate of Blue Mountain obsidian debitage percentages with distance from source.

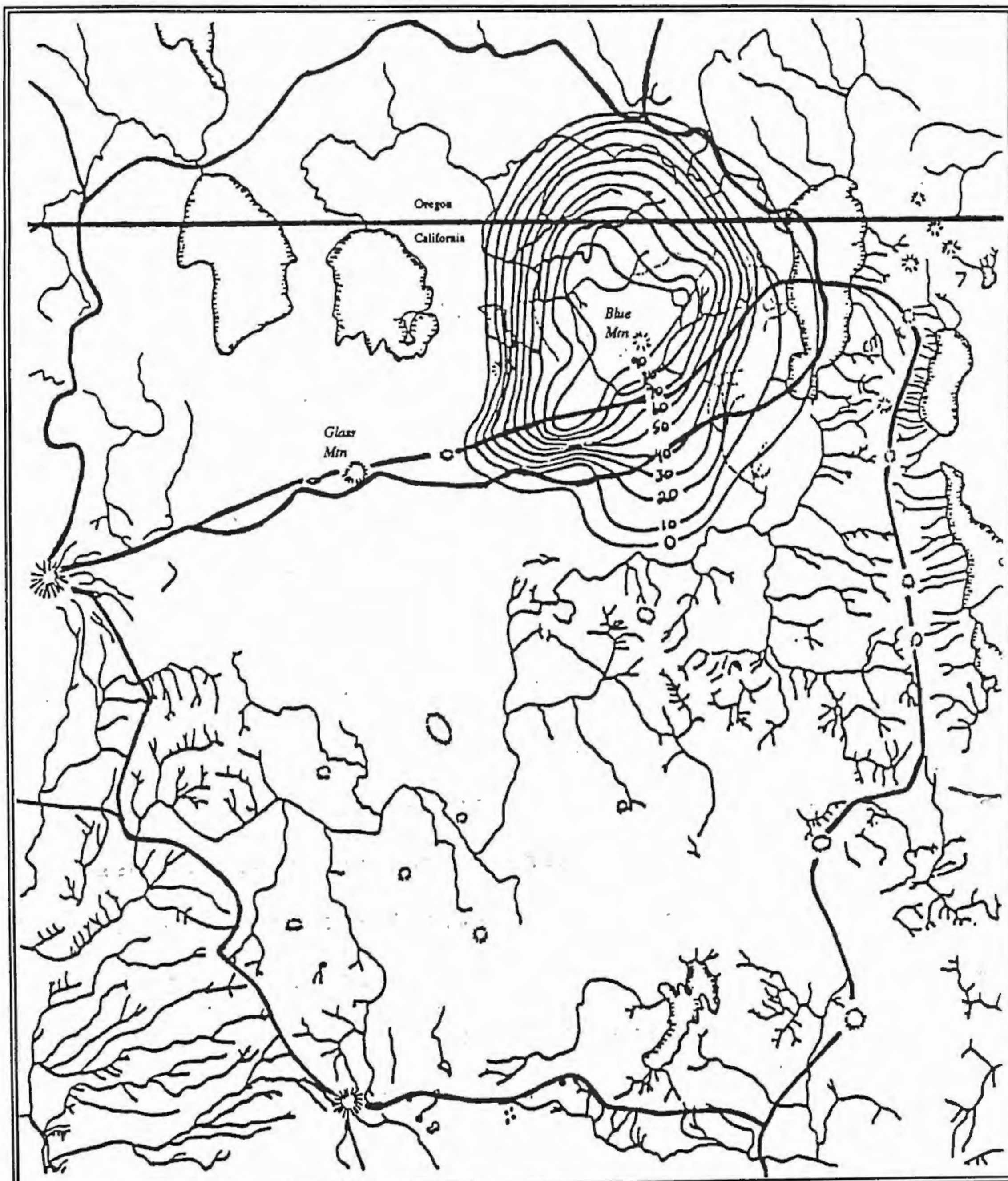

Figure 7. Isoplethic map of Blue Mountain obsidian debitage frequencies by percentage to illustrate fall-off rate.

CHAPTER 3

RESEARCH DESIGN

The Devil's Garden has not been a focus of intensive archaeological investigation other than work done to fulfill legally-required surveys prior to land modifying activities by Modoc National Forest. The result has been the recording and management of over 3,000 sites in the vicinity of the Devil's Garden. Despite this significant data base, few excavations have taken place and few resultant analyses exist which could answer questions concerning settlement and subsistence patterns. Additionally, no work has been completed to address questions regarding ethnicity or the boundary overlap zone on the Devil's Garden. At present it is not possible to attribute archaeological sites, other than named ethnographic village sites, to either the Kokiwas band of Modocs or to Pit River groups thought to have utilized the area.

This project proposes to address the gap in existing knowledge by studying the social boundary between the Kokiwas and some Pit River tribelets on the Devil's Garden. To achieve this goal, the regional distribution of Blue Mountain obsidian debitage, the source of which lies well within Modoc territory, will be investigated. The primary objective is to discover if this visually distinct obsidian can be used to define territorial systems on the Devil's Garden in late prehistoric and historical times.

The first hypothesis proposes that Blue Mountain obsidian can be used to better approximate placement of the ethnographic boundary. If this hypothesis is found to be valid, it is expected that a fairly constant fall-off rate of Blue Mountain debitage frequencies, as distributed on the surface of sites, will sharply decline in the area of the boundary. This hypothesis assumes that the Kokiwas were the sole controllers of the source and brought this material with them to use for subsistence purposes. Thus a closed border is also presumed, since the Pit River groups would have had indirect access to this source through trade or, possibly, no access at all. Blue Mountain obsidian procurement is assumed to have involved the least effort for the area's inhabitants, for whom obsidian was the preferred lithic choice in the manufacturing of tools. In fact, it is the only accessible obsidian on the Devil's Garden.

A second hypothesis will also be tested by use of distributional surface debitage frequencies in conjunction with obsidian hydration analysis. This hypothesis is proposed to address ethnographic and environmental data indicating that slave-raiding of some Pit River groups by Modocs had increased with acquisition of the horse by Modocs and that a regional drought had occurred around the same time. Territorial expansion into new areas of the Devil's Garden by Modocs could have been an answer to the economic need for slaves and the more basic need for a larger resource base at a time when Pit River people were suffering population attrition as a result of contact with non-Indians and their diseases.

At the same time, it is hypothesized that Pit River groups would have vacated areas they formerly utilized if, as indicated by placement of the northern-most boundary line, they once held or shared this part of the Devil's Garden. If such was the case, a rather sharp discontinuity in Blue Mountain surface debitage would be expected south of the overlapping area along with recent occupations of sites, as indicated by thin micron bands on debitage samples subjected to hydration analysis. Obsidian debitage found on sites north of the boundary zone in areas occupied over longer periods of time by the Modocs and their precursors should have a wider span of micron readings. Named villages should be of Kokiwas rather than Pit River origin, also reflecting the supposed boundary shift.

An alternate hypothesis does not consider this tendency for increased aggression by Modocs to be relevant in Blue Mountain obsidian debitage distributions because no one group would have possessed control of the source. Social interchange and an open border area would be indicated by a mixture of obsidian hydration readings in the southern border area as well as in Mococ territory to the north. Wide hydration spans would show that sites in this area were occupied during various time periods. Also, the sharp debitage discontinuity should not occur because

Pit River groups would have had access to the Blue Mountain obsidian source as well as to other resources in this part of the Devil's Garden; a normal fall-off rate would be expected in the boundary zone as well as in other areas surrounding Blue Mountain.

For the purpose of the present research, the primary units of study are to be three of the Pit River tribelets sharing a border with the Modoc: the Hewisedawi, Astariwawi, and Atwamsini, for whom the village formed the main sociopolitical unit. Also considered is the Kokiwas tribelet of the Modoc Indians. It is the territorial systems of these groups with which this study deals.

This project does not propose to address the exchange system of Blue Mountain obsidian, for such a study would entail discovery of the spatial distribution of artifacts other than debitage. Such a project would necessitate finding finished artifacts and non-utilitarian/ceremonial items in areas far removed from the Devil's Garden. Blue Mountain obsidian debitage is thought to be the best available means to delimit the territorial systems being studied.

METHODS

Obsidian Hydration and Surface Collections

The Blue Mountain obsidian source, providing a grainy, resinous obsidian, has been largely ignored in reports which discuss the glassier and widely-sought Medicine Lake

Highland and Sugar Hill obsidian sources. Jack (1976:184) has stated that "...only those extrusions composed almost wholly of glass of uniform physical properties and nearly free of inclusions were suitable for prehistoric weapon manufacture." To test this assumption, an experienced flintknapper, Curtis Fair, made replicas of projectile points of several types commonly found in northeastern California. He reports that Blue Mountain obsidian is, in his opinion, as easily flaked and worked as other, glassier obsidians. Such a view seems reasonable given the numerous Blue Mountain obsidian tools found not only within and near the Devil's Garden, but in surrounding areas far from the source.

Because this investigation is concerned with temporal control of sites on the Devil's Garden, obsidian hydration analysis is discussed as it pertains to surface materials. Obsidian is an extrusive igneous rock, having resulted from a "chemically homogenous supercooled liquid...of rhyolitic composition" (Laux 1970:2). Obsidian hydration analysis was made practicable by the discovery that this volcanic material absorbs water which forms a hydration layer at varying rates and resultant thicknesses. A "weathering process," obsidian hydration is actually the decomposition of obsidian, whose surface forms these hydration layers, or bands. The bands are measureable in microns, depending on the obsidian's chemical composition and other variables such as temperature, prior burning, recent breakage, and reflaking of tools by the aboriginal users. Every time a new break occurs--whether accidentally or purposely made--the hydration band begins again at the new fracture point (Clark 1964:145-149).

Considerable attention has been given the effects of temperature on obsidian hydration rates. Friedman and Smith (1960:483) found that exposure to the sun increases the hydration rim in a short time. Northeast California is subject to extremes in temperature, with summer ranges often exceeding 100 degrees F. on the Devil's Garden. However, the relative dating of chemically similar obsidian from a single site is still possible (Friedman and Trembour 1983:545), and it is the relative dating of surface obsidian lacking chemical variation with which the present research is concerned. Blue Mountain obsidian flakes are deemed useful in discovering a "hydration span" for sampled materials from selected sites on the Devil's Garden (Fredrickson 1984:7).

The expected spans from obsidian hydration analysis should range from no visible band to 1.5 microns, indicating recent habitation of sites in areas where a Modoc expansion and concomitant boundary shift may have occurred. A wider time span is expected at sites in the northern portion of Kokiwas territory occupied over a longer period of time, as indicated by a range of less than 1.0 microns to equal to or greater than 4.0 microns, suggesting periods of use in archaic times. These micron spans are derived from information provided by Gates (personal communication 1990), who studied late period projectile points from the Warner Mountains which had been subjected to hydration analysis. Similar spans are indicated by Nilsson's (1985) hydration results for late period projectile points from the boundary zone area of the Devil's Garden.

Reliance on surface debitage and tools poses further problems which were considered before this project was undertaken. First is the problem of spatial control of materials on the ground, necessitating avoidance of haphazard grab sampling of materials. For this reason, sampling within discrete 1 x 1 meter-square units was undertaken, and the sampling was biased by selection of areas within sites with numerous flakes in order to provide an adequate sample of flakes to quantify. If single component sites were not sampled, at least a single component of a multi-component site was more likely to be collected from, noting that "horizontal overlapping of sequent occupations" can still occur (Lewarch and O'Brien 1981:314).

Results can also be skewed by post-depositional processes resulting in the differential exposure of obsidian materials. One such process is pedoturbation affecting archaeological materials from the churning of soils. The effects of great seasonal temperature differences on soil moisture, along with the freeze-thaw conditions of cryoturbation, are largely responsible for artifact mixing within the top 40 centimeters of the Devil's Garden surface. Whatever the post-depositional consequences, it is kept in mind that similar processes affected materials now buried and that they also began as "superficial exposures" (Lewarch and O'Brien 1981:312). Despite potential problems from soil churning and site mixing, these problems are "universal for archaeologists in making any interpretations about anything, so they should not prevent attempts at utilizing obsidian dating" (Meighan 1976:114).

A precondition for selecting the 30 sites for use in this study was that they contain temporally 'late' style projectile points noted in the site record forms in order to sample sites where recent habitation could be inferred. Sites contained projectile points which were collected when they were first recorded, as well as those taken during intensive surface collections of lithic materials for this study. Projectile points considered to be of recent enough origin to be useful in selecting the sites were taken from Gates (1978) <u>Projectile Point Type Guide</u> for Modoc National Forest: Desert Side-Notched series (A.D. 1100-1200 to historic times), Rose Spring series (A.D. 500 or older to historic times), Gunther Barbed series (A.D. 1100-1200 to historic times), and Cottonwood series (A.D. 900 to historic times). Considered is the fact that such points alone do not always indicate the presence of a late site; however, it is reasoned that they are still the best means available to indicate possible late sites and therefore to avoid indiscriminate site sampling.

Field Methods

Data collection in the field involved sampling 30 archaeological sites, mostly on the Devil's Garden, but also south of the Garden and along the western shore of Goose Lake (Figure 8). The sites were sampled in each of three areas encompassing known Modoc territory, Pit River territory, and the boundary area between the two ethnolinguistic groups. Non-random sampling was employed in order to gather debitage from the densest portions of the sites, where two 1 x 1 meter-square units were placed and all surface materials within those units were collected and bagged. The northwest corner of each unit was measured by compass bearing and distance in meters to site datums.

The 30 sites were chosen on the basis of an extensive search of the Modoc National Forest site atlas and site record forms. Also chosen were some unrecorded sites cited in ethnographic sources by Kniffen (1928), Merriam (1926), and Ray (1963). Permission was granted to investigate these sites, located on Native American lands, private property, and Bureau of Land Management lands.

Laboratory Analysis

Lab analysis involved quantification of lithic materials, all of which were collected from within the

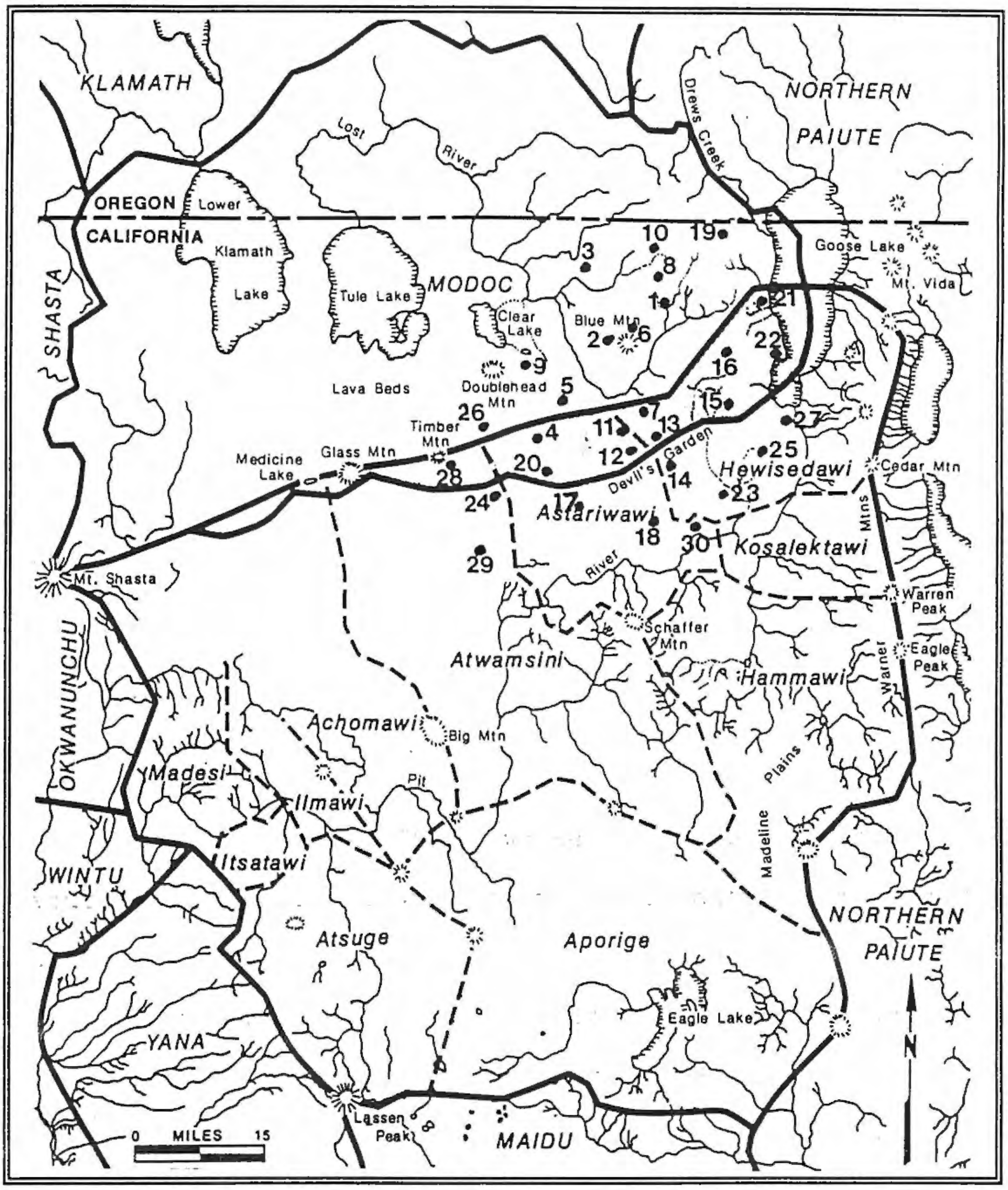

Figure 8. Locations of sites sampled. Numbers are keyed to tables.

meter-square surface units. Lithic materials were sorted according to the type of rock or mineral from which they were formed--obsidian, basalt, or other cryptocrystalline (mostly chert). Altogether, 6,555 specimens were quantified, including 3,215 Blue Mountain flakes, 2,836 other obsidian flakes, and 504 flakes of other lithic materials. Percentages of Blue Mountain obsidian were figured by comparing debitage from this source with other obsidian flakes (Table 1; Figure 9). Also shown are percentages of lithics other than obsidian (Table 2).

Data used in this analysis were generated from flakes, flake fragments and chunky, angular pieces of obsidian. Definite tools were excluded from quantification.

Visual Sourcing

Monetary constraints imposed the use of visual sourcing on this study. It is noted that visual sourcing cannot replace the exactitude of chemical sourcing, which enables materials to be "fingerprinted" and matched to their parent sources. Blue Mountain, earlier known as the Steel Swamp source (Ericson, Hagan, and Chesterman 1976:228), can be accurately identified when artifacts are viewed macroscopically. Contrary to its name, this material is a translucent green color when held up to the light; some larger chunks do appear opaque and black until this is done and light is seen through their edges. The green color can vary from light to dark and from dull to

Table 1. Blue Mountain Obsidian Debitage Percentages and Distance from Source.

N	SITE NUMBER	DISTANCE	BM vs OBS	BM vs TL
#	FS-05-09-	MILES	%	%
01	55-701	8.0	99.0	99.0
02	Chiwulha'	1.0	99.0	99.0
03	56-1011	10.0	99.0	98.0
04	55-928	9.5	96.0	96.0
05	56-1377	4.5	91.0	91.0
06	55-59	3.0	91.0	87.0
07	55-201	5.0	79.0	76.0
08	55-697	9.0	79.0	73.0
09	56-1037	8.5	74.0	73.0
10	55-521	11.0	73.0	66.0
11	55-671	8.0	58.0	52.0
12	55-428	11.5	52.0	48.0
13	55-615	12.0	47.0	44.0
14	55-679	15.0	30.0	28.0
15	55-151	12.5	19.0	17.0
16	55-158	12.5	16.0	13.0
17	55-07	18.5	13.0	11.0
18	55-233	18.5	10.0	9.0
19	55-362	18.5	8.0	2.0
20	55-703	13.5	7.0	7.0
21	Usi'na'dzi'wa	20.0	3.0	2.0
22	Lu'kmtsis	21.5	2.0	2.0
23	55-85	21.0	2.0	1.0
24	55-721	20.0	1.0	1.0
25	55-88	21.0	1.0	1.0
26	56-1190	17.0	0.5	0.5
27	Kue's	23.0	0.5	0.5
28	56-1135	24.0	0.0	0.0
29	55-915	26.0	0.0	0.0
30	Dalmo'ma	24.5	0.0	0.0

Note: BM = Blue Mountain obsidian; OBS = other obsidian; TL = total lithics.

Figure 9. Site debitage percentages.

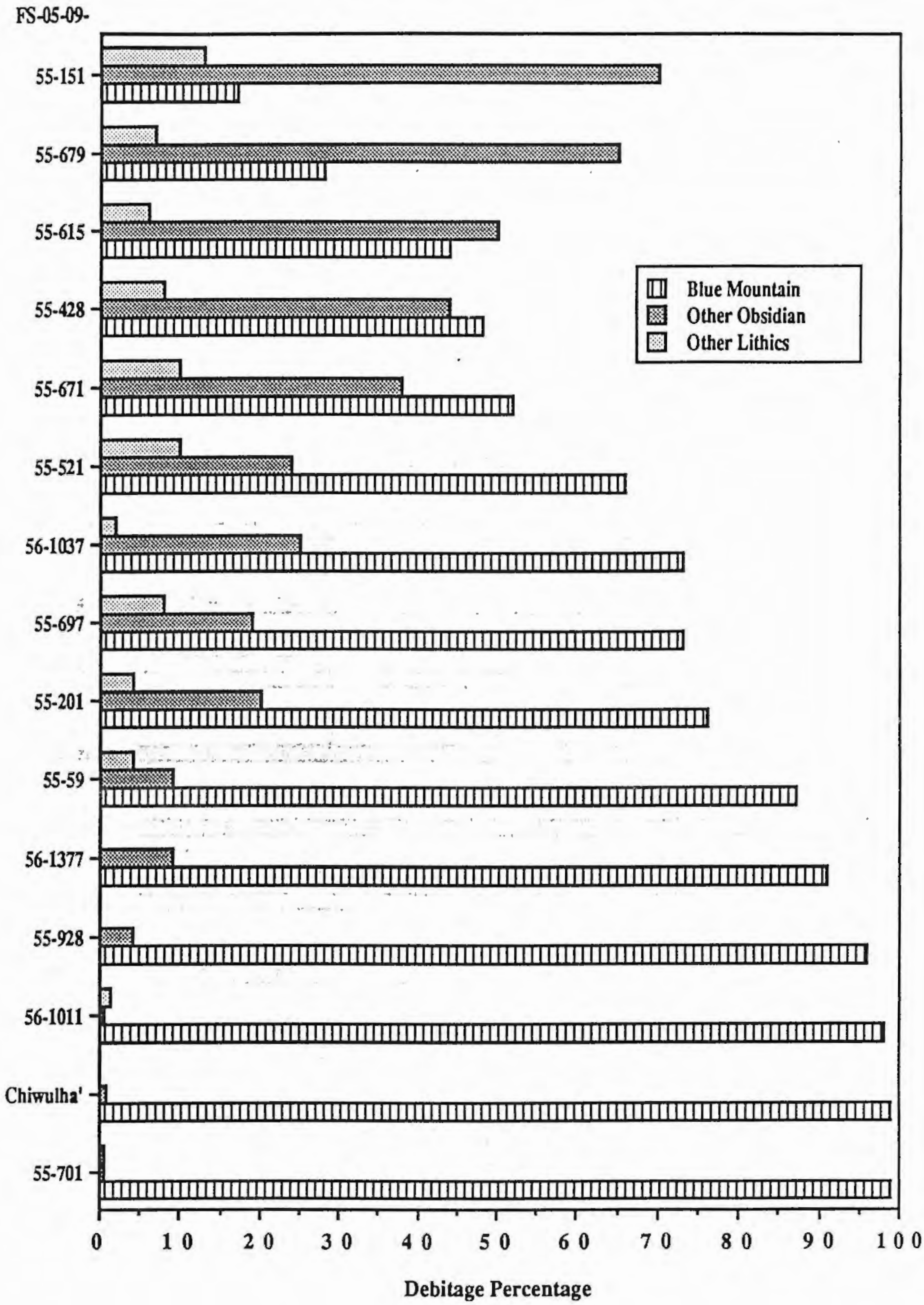

Figure 9 (continued). Site debitage percentages.

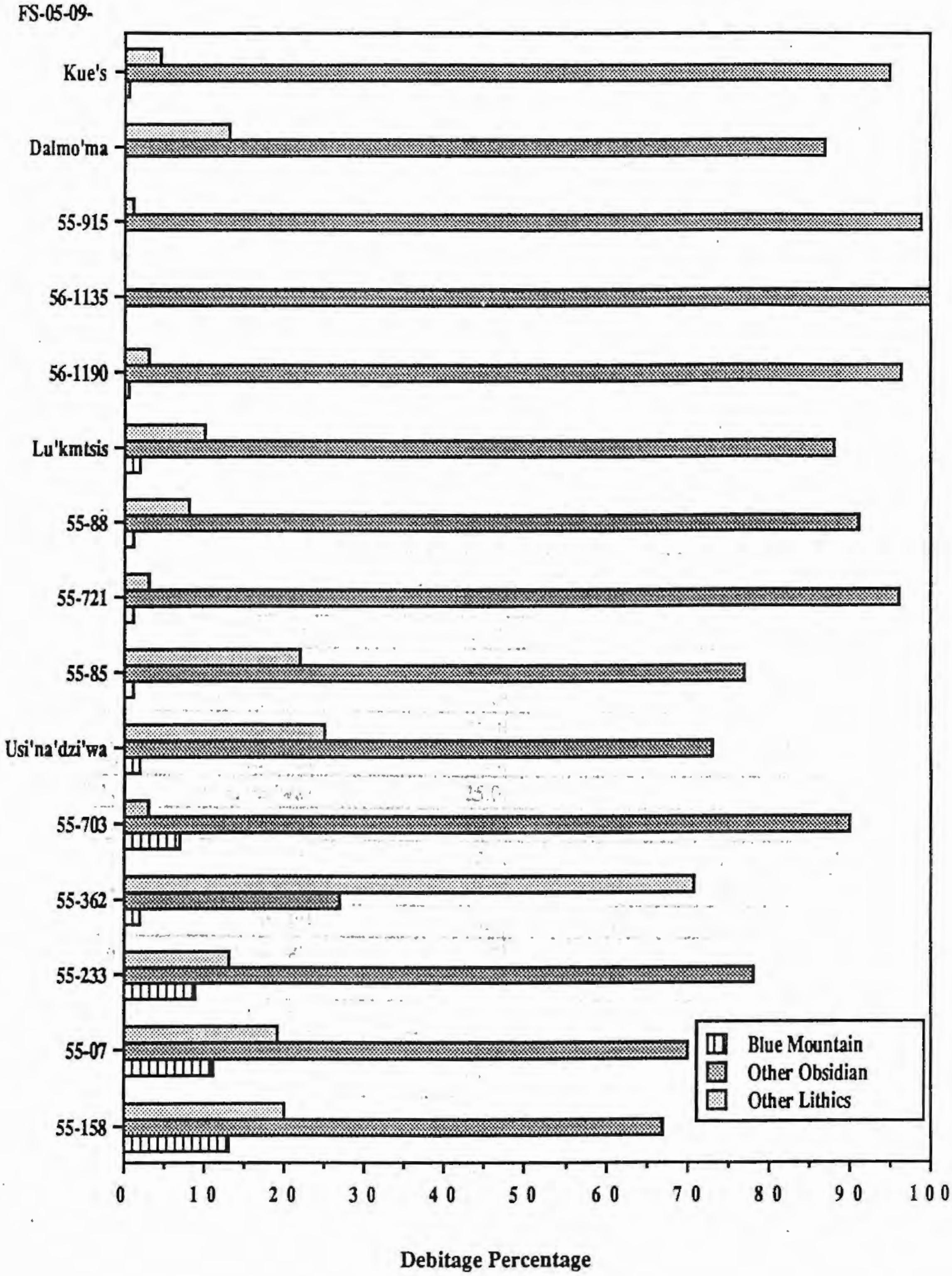

Table 2. Non Obsidian Lithics.

N #	SITE NUMBER FS-05-09-	NON OBSIDIAN PERCENT	BASALT NUMBER	CRYPTO NUMBER	OTHERS NUMBER
01	55-701	0.5	1	-	-
02	Chiwulha'	0.1	1	-	-
03	56-1011	1.5	1	4	-
04	55-928	-	-	-	-
05	56-1377	-	-	-	-
06	55-59	4.0	4	-	2
07	55-201	4.0	14	-	4
08	55-697	8.0	5	-	-
09	56-1037	2.0	3	1	-
10	55-521	10.0	12	-	-
11	55-671	10.0	42	4	-
12	55-428	8.0	5	2	-
13	55-615	6.0	35	27	-
14	55-679	7.0	1	1	5
15	55-151	13.0	9	2	5
16	55-158	20.0	8	-	16
17	55-07	19.0	17	2	1
18	55-233	13.0	12	6	-
19	55-362	71.0	72	16	-
20	55-703	3.0	-	-	5
21	Usi'na'dzi'wa	25.0	49	-	20
22	Lu'kmtsis	10.0	1	2	8
23	55-85	22.0	11	8	12
24	55-721	3.0	1	2	-
25	55-88	8.0	6	3	3
26	56-1190	3.0	6	-	-
27	Kue's	4.5	10	1	1
28	56-1135	-	-	-	-
29	55-915	1.0	-	1	-
30	Dalmo'ma	13.0	7	7	-

Note: CRYPTO = cryptocrystalline.

brilliant, but the color of Blue Mountain obsidian is always green. In addition, flakes exhibit phenocrysts, or inclusions, and appear granular to the naked eye. These three criteria of distinctive color, translucency, and texture were used to distinguish Blue Mountain obsidian from other sources.

A possible problem was suggested by Hughes (personal communication 1988), who indicated that Blue Mountain obsidian might be confused with obsidian from the Silver Lake/Sycan Marsh source group evincing the same visual characteristics of "a dark resinous textured black with a green hue when held to the light" (Hughes 1986:313). The author went to Sycan Marsh in southeastern Oregon, which is over 80 miles north of Blue Mountain, and retrieved some nodules from that source. Upon flaking, the Sycan Marsh obsidian superficially appears to look like obsidian from Blue Mountain because of their similar grainy texture; however, in every case, Sycan Marsh obsidian appears gray. Given the difference in color between the two sources, it is felt that confusion between Blue Mountain and Silver Lake/Sycan Marsh obsidians has not occurred.

Further, it is expected that Blue Mountain obsidian debitage will occur in much higher frequencies near the source and diminish with increasing distance from it. The same is expected of Silver Lake/Sycan Marsh obsidians. A test conducted on visual sourcing of Fish Springs obsidian in eastern California resulted in similar expected findings of diminished debitage frequencies with increased distance from that source (Bettinger, Delacorte, and Jackson 1984:64). Thus the Blue Mountain and Oregon sources' distinctive colors, the distance separating them, and the several obsidian sources between them reduce possible confusion.

The validity of visually sourcing Blue Mountain obsidian was tested when the author looked at 1,026 flakes collected for analysis by Basin Research Associates during the OTH-B Radar Project on the Devil's Garden and subjected to sourcing analysis at Sonoma State University. Of the 1,026 flakes, 24 were designated as having originated at Blue Mountain. All of these flakes were examined by the author, and all 24 Blue Mountain flakes were correctly identified. Likewise, no flakes assigned to other obsidian sources were incorrectly identified as Blue Mountain. This test indicated that the correct identification of Blue Mountain flakes collected during the course of the present investigation was statistically probable and that the high cost of obsidian sourcing analysis was not justified, especially in light of limited funding.

Such constraints were not imposed on obsidian hydration analysis. Funding provided by Sonoma State University, Modoc National Forest, and Modoc County Historical Society enabled the analysis of 110 specimens from 11 sites in order to gain temporal control. Only Blue Mountain obsidian flakes were analyzed to reduce the possibility of differential hydration rates of other obsidians. An exception was made for the two sites tested along Goose Lake because little Blue Mountain obsidian debitage occurs in this area. Results of obsidian hydration analysis and debitage quantification are given in Chapter 8.

CHAPTER 4

CULTURAL AND HISTORICAL BACKGROUND

This chapter provides an abbreviated synopsis of Modoc and Pit River cultural and historical backgrounds, discussing obvious differences as well as similarities. Tribelet territorial systems operated within the much wider milieu of Modoc and Pit River Indian cultures.

Different researchers over the years have assigned the region to different culture areas based on cultural traits shared with surrounding populations. Kroeber (1925; 1936:102; 1939:51) suggested a succession of cultural designations when he first placed the Modoc and Klamath Indians into his "Lutuami", or Klamath Lakes subarea, while tying the Pit River groups to central California. He later reassigned both ethnolinguistic groups to the Northeastern subarea, following which he placed them within a portion of the Great Basin subarea. Heizer (1978a:3) agrees with Kroeber's placement of Pit River and Modoc groups into the Northeastern subarea. Nonetheless, the Modocs are viewed more than the Pit River groups as being the "heaviest borrowers" because of living in a more transitional area, as attested by Columbia Plateau, Great Basin, northwestern/ central California, and even later Plains influences (Gates 1983:96-97; Ray 1963:xi).

Despite many shared cultural traits and similar archaeological assemblages, the Modoc and Pit River tribes are separate ethnolinguistic groups. The Pit River people formed the Palaihnihan branch of the Hokan speakers. The Achomawi, or Pit River Indians spoke one form of it; the Atsugewi to the south spoke another. As the commonly-used Achomawi term given Pit River bands along that river actually refers to the Ajumawi band, or tribelet, the term Pit River will refer to combined Pit River tribelets. The Atsugewi were themselves divided into two tribelets, the Atsuge, or "pine-tree people" of the west and the Apwaruge, or "juniper-tree people" of the east (Garth 1978:236).

The Modoc spoke the isolated Penutian language of Klamath/Modoc (Moratto 1984:534), classified as divergent Sahaptian by Ray (1963:xiv), and as part of the separate Lutuamian stock by early researchers (Gatschet 1890; Kroeber 1925:318).

PIT RIVER TRIBELETS

The Pit River population was divided into nine socially and politically autonomous tribelets (Figure 5). They knew only informal leadership and were centered around villages scattered in discrete natural areas, for instance, certain valleys (Kroeber 1925:306). The tribelets were: the westernmost Madesiwi in the big bend area of the Pit River; the Itsatawi, located in a steep Pit River canyon between the Madesiwi and the Ilmawi; the Ilmawi south of the Pit River and opposite Fort Crook; the Ajumawi on Fall River north of Fall River Mills; the Atwamsini in Big

Valley; the Hammawi at the south fork of the Pit River in the southeast portion of Pit River territory; the Astariwawi east of Canby in the hot springs area; the Kosalektawi on the Alturas plain; and the Hewisedawi around the southern part of Goose Lake and on part of the Devil's Garden (Gates 1983:101-102).

With their Atsugewi neighbors to the south the Pit River bands were generally on good terms (Garth 1978: 238). To the east of the Warners were the Gidu'tikad, or Northern Paiutes of Surprise Valley, with whom the eastern Pit River tribelets both traded and disputed hunting rights (Kelly 1932:151, 185). The crest of the Warners is the commonly-accepted boundary between them.

The Pit River tribelets inhabited two distinct zones. Such a dichotomy places the southwestern, or 'down-river' tribelets into a mountainous zone with access to acorns and salmon which were traded to the up-river people to the east (Gehr 1982:107). The eastern sagebrush-plains zone contained its own diverse resources, and many of these were obtained from the Devil's Garden. Here were plentiful stores of the epos root and the camas bulb along with tubers, seeds, berries, and pine nuts. Fish such as suckers and trout were obtained along with waterfowl and other birds and their eggs. Hunting of game such as deer and antelope also took place on the Garden (Dixon 1908:211-212; Olmsted and Stewart 1978:226-229). This study is concerned primarily with three of those eastern

Pit River tribelets who shared a border on the Devil's Garden with the Modocs and whose seasonal rounds counted heavily on many of the same resources (Figure 10). The eastern groups were: the Hewisedawi, the Astariwawi, and the Atwamsini. To a lesser extent, the Ajumawi are also mentioned.

Life during the region's cold, snowy winters centered around semisubterranian houses in protected areas near the Pit River, where villagers utilized sweat houses and ate cached stores of food (Masten 1985:98, 107). Of note along the Pit River were the many deep grass-covered pits dug to trap unwary deer, and even cattle in later years (Powers 1877:269). Utilized by these groups were the sinew-backed bow and arrow, obsidian implements, fishing equipment, a simple dugout canoe, twined baskets, mortars, pestles, manos, and millingstones, to name only a few of their most basic tools (Olmsted and Stewart 1978:228-229; Raven 1984:438).

Pit River cosmology centered on the living nature of things--"There is life everywhere, even in the rocks and in the trees . . . the Achumawi Indian finds himself in a state of direct mystical connection with the universe that surrounds him . . ." (de Angulo 1928:154). Each person acquired his or her own guardian spirit, or _tinihowi_, though shamans had a stronger spirit called a _tamakomi_ (Olmsted and Stewart 1978:232).

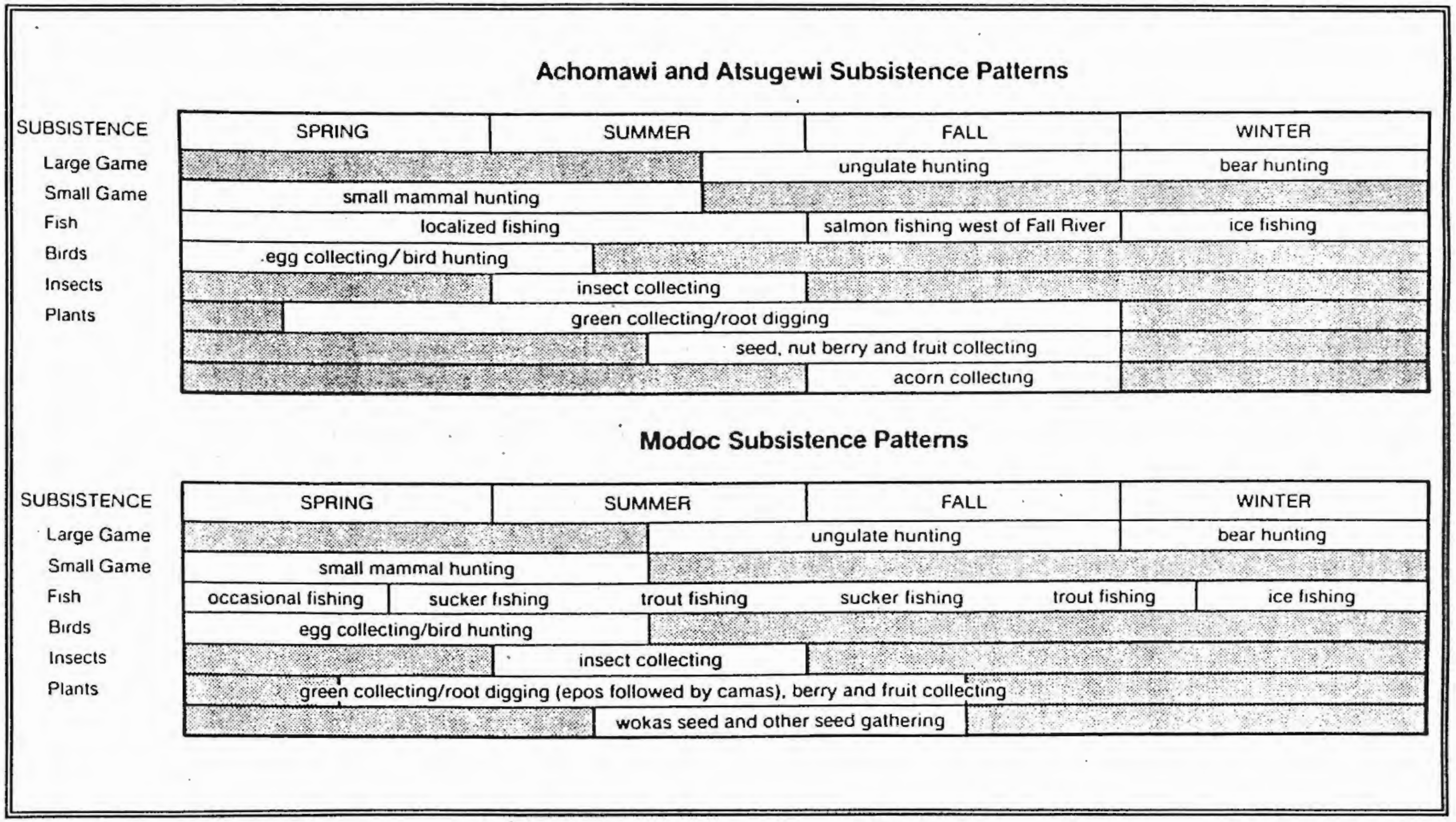

Figure 10. Pit River and Modoc seasonal rounds (from Masten 1985: Figure 6.1).

MODOC TRIBE

As opposed to the riverine orientation of the Pit River tribelets, the Modocs led a lacustrine existence, that is, one of lakeside and marshland adaptation in the areas around Klamath Lake, Tule Lake, and Clear Lake basins. They lived in semisubterranian dwellings during winter months and made use of sweat houses. They dispersed in the spring to wide-ranging parts of their territory to gather and hunt the same basic resources as the Pit River groups utilizing the Devil's Garden (Ray 1963:146, 158).

The Modocs were divided into three tribelets based on geographic differences in their respective territories: the Paskanwas "river people" in the Lost River Valley area, the Gumbatwas "people of the west", and the Kokiwas "people of the far out country" (Ray 1963:202-203). It is the Kokiwas group with which this investigation deals, as it was in Kokiwas territory that the Blue Mountain obsidian source lay.

To the north of the Modoc were the linguistically-related Klamath, with whom the Modoc were on good terms for the most part and with whom they shared numerous cultural traits (Ray 1963:xii).

That the Modocs shared with their Pit River neighbors a similar tool kit has long been a difficulty for archaeologists attempting to attribute artifacts to either group, especially on the Devil's Garden where the boundary overlap exists. Barrett (1908:259) mentions such similarities as twined basketry as well as the exploitation of the same basic resources. Like the eastern Pit River tribelets, the Modocs lacked acorns and salmon, being forced to trade for them. Differences are still noted, however, starting with the use of the two-horned muller by Modocs to prepare wokas, or yellow water lilies. This tool is not found in Pit River sites since they did not exploit this resource to any great degree. A concentrated utilization of marsh resources such as tules and reeds required the use of a dugout canoe, similar to that made by some of the Pit River groups, but more extensively used in the Modocs' marshier habitat.

The Modoc practice of head deformation was another characteristic not shared by Pit River Indians. Other differences in social and religious practices are evident (Ray 1963:xiii, 3, 113, 176), for example, the Modocs are said to have possessed a greater feeling of tribal solidarity and their leaders appear to have exerted more authority than their southern counterparts. Further, the leaders did not direct warfare, as a war chief had that responsibility. Similarities in religion are evident, though guardian spirits of Modocs were thought to rise from dreams. The Modocs are universally cited as having cremated their dead, whereas disposal of the dead by Pit River groups through burial or cremation is unknown for some of the Pit River bands (Silver and Hunt 1980:14-17).

HISTORICAL BACKGROUND

The preceding section has provided a non-comprehensive overview of basic Modoc and Pit River lifeways from ethnographic information provided by early informants and White explorers and settlers. Their accounts include a distressing description of the region's aboriginal occupants as they were forced to deal with Whites and their diseases. Results of this contact are evident in population numbers; for instance, the most commonly-cited population statistic for the combined aboriginal Atsugewi and Pit River groups is 3,000 persons, having decreased by 1910 to 1,000, according to U.S. Census data (Kniffen 1928:318; Olmsted and Stewart 1978:234).

Hudson's Bay Company trappers were the first recorded visiters to Modoc territory in 1825, initially led by Finan McDonald (Murray 1959:11). They were also the first to see Pit River territory in 1827, at that time led by Peter Skene Odgen. Exploration and trapping expeditions were followed by prospecting ventures and eventual settlement around the start of the 1850s. Many of the region's immigrants had traversed the Warner Mountains on the Lassen-Applegate Trail and faced Indian raids in retaliation for this trespass (Wheeler-Voegelin 1974:15).

Following increased skirmishes between Whites and Indians, combined groups of Atsugewi and Pit River Indians were sent to the Round Valley Reservation in Mendocino County in the late 1850s, only to return home within a decade (Wheeler-Voegelin 1974:15-16). During ensuing years, many of them worked for Whites and eked out an existence as best they could. In 1906 came the beginning of land allotments to the Indians and eventual rancherias upon which a number of individuals reside today (Macgregor 1930:7-9).

The Modocs were faced with their own problems, having been placed on the Klamath Reservation following an 1864 treaty. A faction of Modocs led by Captain Jack (Chief Kintpuash) left to return to their Lost River home. In 1872-1873 a greatly outnumbered band of Modocs fought off soldiers and volunteers in the rough terrain of the Lava Beds. The final outcome saw Captain Jack hanged, along with several of his followers. Survivors and a portion of the rest of the tribe were sent to the Quapaw Agency in Oklahoma where, by the early 1900s, they reportedly numbered 56 persons (Hodge 1912:918-919).

This brief historical background cannot adequately underscore the dire situation in which the region's native inhabitants found themselves following contact with Whites. The following chapter considers the Devil's Garden boundary in relation to earlier historical events which affected Modoc and Pit River Indians prior to White settlement of northeastern California.

CHAPTER 5

BOUNDARY CONSIDERATIONS

MODOC AND PIT RIVER BOUNDARY

Across the Devil's Garden, roughly west to east, is the boundary overlap zone between the Modoc and Pit River tribes. The 1920s boundary drawn by Merriam and Kniffen differs in Merriam's straight line and Kniffen's use of topographical features. Extending east from Mt. Shasta through the middle of Goose Lake, the boundary ends at Willow Ranch or the mouth of Fandango Creek at the western slopes of the Warner Mountains. Some sources give Sugar Hill, five or six miles farther south, as the eastern terminus (Merriam 1926:31).

In 1963 Ray placed the boundary several miles south of the location given by earlier Pit River informants. A line starting at Mt. Shasta is seen to cut through the south end of Goose Lake. This boundary was said to be "precisely defined . . . and transgression meant war" (1963:xii, 201). Barrett (1908:241) ended Modoc lands "somewhat east of Clear Lake and around the head of Lost River. The southern boundary was probably the divide between the drainage of Klamath and Rhett lakes [Tulelake] and that of Pitt river." The Pit River/Lost River watershed divide generally coincides with his placement, being located in the southern portion of the Devil's Garden.

Other researchers have spoken of a sort of vague "no-man's land" regarding the area between the two groups. Most accounts of the Pit River people place them in close proximity to villages along the river or nearby streams and only in the region's far reaches for procuring obsidian, gathering plants, or hunting game. Concomitant with this view is a picture of the boundary area as being an uninhabited Devil's Garden "wasteland" (Dixon 1908:208; Kniffen 1928:318; Macgregor 1930:1). Kroeber (1925:318) went so far as to say that the "Achomawi territorial limits are particularly vague and immaterial."

Such ambiguity is prevalent in literature concerning the boundaries of hunters and gatherers. Some researchers argue that the California culture area in general had well-defined territories. For instance, Heizer and Treganza (1972:298-299) saw the State's indigenous groups as bounded and using the resources within their territories or those of friendly neighbors. Jack (1976:187), however, takes another view when seeking reasons for natural resource exploitation (such as obsidian procurement) cutting across ethnolinguistic lines. He adds that, as plotted on maps, such boundaries were insignificant to those who seldom ventured into their borderlands, a sort of frontier where control was subject to "conflicting claims and modification with time." Ericson and Meighan (1984:143) agree that "boundaries in California have a weak political connotation," citing intermarriage across boundaries as one reason for obscure borders.

"Social interchange" is stressed by Benson and Buckskin (1985:134, 140), who investigated what they consider to be both Pit River and Modoc design elements on petroglyph panels at archaeological site CA-Mod-75, located in Modoc territory. They believe the site would have made an ideal campsite for Pit River people when collecting or trading for Blue Mountain obsidian, around seven miles to the east.

Benson and Gates (1990) discuss another site near Mowitz Butte, also situated in the border area, where over 130 late-style projectile points were found. They think the site might represent social interchange in the form of a ceremony or game; a battle site is also conjectured.

The view taken here is that the boundary between the Modoc and Pit River tribes was not a static construct but a phenomenon which changed through time as the result of late prehistoric and historical events, both social and environmental. Fredrickson (1990:98) states that "any shift in boundary location can be taken to mark a major shift in local sociopolitical organization." Modoc expansion may have caused a boundary shift to occur, following which the Devil's Garden and its valued resources became a sort of frontier to Pit River people, or "outlying areas which are both a source of danger and a coveted prize" (Kristof 1959:271). Perhaps placement of a boundary between two such similar groups as the Pit River and Modoc tribes will not be possible; and perhaps such a designation is not even important if there was no such construct in the lives of hunters and gatherers. Aptly put by Netting and still true in 1990: "The question of whether hunter-gatherer groups have bounded, defended territories to which they claim exclusive exploitation rights is still a thorny issue among anthropologists" (1977:21).

SOCIAL AND HISTORICAL CONSIDERATIONS

Adding interest to the boundary problem on the Devil's Garden is the possibly exaggerated Modoc practice of raiding some of the more unfortunate Pit River bands for slaves. Certainly access to horses by the more aggressive Modocs near the end of the eighteenth century greatly increased their mobility. Although sources debate the actual scope of slave-taking by the Modocs, its existence is not disputed. Accounts such as those given by Dixon (1908:215) and Kniffen (1928:309) appear to consider slave-raiding as particularly devastating. Davis (1961:8) goes so far as to say that Modoc exploits as warriors equalled those of the fierce Mohave in southern California. Wheeler-Voegelin (1974:16) states that Pit River bands were raided on an annual basis until 1867, a contention no doubt concurred with by Ray, who writes: "The cultural economy was firmly based on the taking and selling of slaves, and the tribal ethos involved concepts of Modoc nationalism, cultural superiority, and the glory of war . . ." (1963:139).

Macgregor (1930:6) mentions "half-starved, wretched individuals, the dregs, which the slave-raiders thought not worth carrying off." Perhaps the most distressing observation was made by Powers (1877:268), who said of the Pit River Indians in Hot Springs Valley: "Never in my life have I seen so saddening and so piteous a spectacle of the results which come from seizing out into bondage year after year all the comeliest maidens and bravest youths of a people."

Kroeber (1925:319-320) had a dissimilar view of what he termed an "overstated" phenomenon. Like others, however, he thought that slave-taking increased after acquisition of the horse by the Modocs. Their greater mobility would certainly have expedited economic pursuits, the taking of slaves included. Ray (1963:145) states that "the taking of slaves had always been a tribal practice."

The Modocs were not the first to raid for slaves, having been impelled to do so by their northern neighbors, the Klamath Indians who, in turn, had been raided by other groups from the middle Columbia River region (Minor, Beckham, and Toepel 1979:116). That such groups as the Walla Walla Indian traders of that region knew of California and its resources is claimed by Heizer and Treganza (1972:298), who report a long journey to the San Jose area of California by some Walla Walla individuals.

Heizer (1978b:691-692) states that Columbia River Indian expeditions to the Sacramento Valley lasted from around 1800 to 1848. Gehr (1982:62) adds that eventually they drove horses through Modoc lands, leaving some on their way home (Gehr 1982:62-63). Thus was California's slave-raiding phenomenon set in motion as the need for slaves to trade at The Dalles on the Columbia River grew.

Also reported is the existence of another, smaller trade center called Yainax Butte in the heart of Modoc territory east of Klamath Lake near the California-Oregon border (Layton 1981:127-128), further attesting to an apparent economic need for slaves.

These depredations did not include all the Pit River bands. It appears that those most directly affected shared a common border with the Kokiwas, specifically the Hewisedawi, Astariwawi, and Atwamsini tribelets. According to Kniffen (1928:308), the eastern-most of these groups, the Hewisidawi, occupied the plains area around the southern portion of Goose Lake as well as the southeastern section of the Devil's Garden, including the area around Big Sage Reservoir. He adds that the area around Goose Lake is not amenable to placement of a boundary because confusion exists as to its use by Pit River, Modoc, and Northern Paiute Indians, an assessment no doubt accepted by Powers (1877:252), who reports "bloody battles" in the area. This confusion is apparent when looking at claims to the Sugar Hill obsidian source in the Warner Mountains, most often placed in Hewisedawi territory, but also said to have been claimed by Modocs and Northern Paiutes (Garth 1953:54; Heizer and Treganza 1972:300, 305; Kniffen 1928:297, 306). In her study of Pit River avoidance of the Devil's Garden, Cross (1981:53) states that informants recalled the Hewisedawi band as having had a better relationship with the Modocs before they acquired the horse.

Just west of the Hewisedawi, the Astariwawi in the hot springs area near Canby were subjected to slave raids. Originally, their territory extended up onto the Devil's Garden north of Mowitz Butte (Merriam 1926:27).

The Atwamsini people of Big Valley are also said to have frequented the "mesa to the north" (Kniffen 1928:310), ranging north of Mowitz Butte on the Devil's Garden (Merriam 1926:27). As reported by Gatschet (1890:128), this band suffered severely from raids along with the Canby area people to the east. However, both Kniffen (1928:311) and Powers (1877:267) felt that the Atwamsini fared somewhat better in the face of Modoc hostilities.

The Ajumawi lived farther west and claimed part of the Lava Beds, the southern portion of Medicine Lake, and Glass Mountain, which was also claimed by the Modocs. The Ajumawi and Modocs are reported to have been bitter enemies (Kniffen 1928:312; Merriam 1926:24). Benson (personal communication, 1990) cites a Pit River claim by elders that their 'old' northern boundaries encompassed Horse Mountain, located west of Clear Lake, and Mount Dome, located south of Lower Klamath Lake (within designated Modoc territory).

The vast Glass Mountain source, unlike the Sugar Hill obsidian source, is most often placed within Modoc territory (Heizer and Elasser 1980:17); yet most researchers say that it was accessed by a number of tribal groups, including western Pit River bands, Atsugewi, Shasta, and Wintun groups (Heizer and Treganza 1972:305; Kniffen 1928:306; Voegelin 1942:191). Hardesty and Fox (1974:4-5) suggest that the southern Klamath Basin was first exploited by Pit River Indians and then largely abandoned because of Modoc aggressiveness. At the very least, Pit River obsidian procurers would likely have been disinclined to stay long.

As evidence of a Pit River Indian lifestyle concentrated around their riverine-based villages, Van Bueren and Moratto (1985:4.28) cite a dearth of lithic reduction sites south of Glass Mountain toward Pit River territory. They state that such sites do occur to the north, west, and east in Modoc territory.

Modoc raids on the other Pit River bands are reported, but to a much lesser extent for the Kosalektawi and not at all for the Hammawi and Ilmawi, according to information given Kniffen (1928:304, 312, 315-317). He reports that both Atsugewi tribelets were raided by the Modoc. Garth reports the possibility of slave-raiding forays on the Atsugewi by Paiutes in 1725 (1978:238).

From information provided by these sources, it appears incontrovertible that some Pit River bands were at some risk and possibly considerable risk from Modoc incursions. Thus they may have had to abandon an important resource base on the Devil's Garden and conceptualize the Garden as a profoundly frightening and dangerous place, as illustrated in Cross' study (1981:47) and concurred with by Gehr (1982:63): "At least by the 1840s, the Achumawi were forced to abandon their camps near the frontier border with the Modoc on Devil's Garden and around Goose Lake."

CLIMATIC CONSIDERATIONS

The proposal by Van Bueren and Moratto (1985:4.28) for a "focal adaptation" to a comparatively sedentary riverine existence by the Pit River Indians is tenable in light of environmental evidence that a drought occurred during the same years the Modocs were thought to be expanding their territory. Certainly if a drought had been severe enough to dry up many of their lacustrine habitats, they would have been forced to seek resources over a wider area, a "diffuse adaptation" to more far-reaching parts of the Devil's Garden.

A recent study of regional precipitation from tree ring growth (Graumlich 1987:19) provides evidence for a drought in northeastern California during the first half of the nineteeth century. Data from this study coincide not only with ethnographic information, but with historic accounts about the level of Goose Lake. A significantly lowered water table prior to 1860 is reported by early settlers, and Harding (1965:29-30) cites the presence of numerous "chips" and arrow points where Goose Lake had once stood.

Nightfire Island data fit nicely with other information about the drought. The final date for a cool-wet period is given as A.D.1800 (Sampson, Mack, and Aikens 1985:43), after which Nightfire Island was abandoned prior to contact with Whites (Aikens 1985:528).

DEVIL'S GARDEN SETTLEMENTS

Site types as defined for Modoc National Forest on the Devil's Garden are: 1) permanent/seasonal summer villages with midden, rock rings, house pit depressions, numerous lithic tool types, and groundstone assemblages located near permanent water in a protected area; 2) seasonal base camps, smaller than villages and indicated by the presence of midden and rock rings or other structural remains, groundstone, numerous lithic tool types, and general similarities to village sites except for being located in unprotected locations near seasonal as well as permanent water courses; 3) temporary camps, as indicated by the absence of structures and midden, and the presence of lithic debitage, tools, and groundstone; 4) lithic scatters in the form of ubiquitous single component sites, often found at the edges of meadows in open areas, evincing waste flakes and, sometimes, projectile points; 5) rock shelters with flakes and/or tools; 6) hunting blinds, circles, and alignments constructed of stacked rocks; 7) milling/mortar sites for plant processing; 8) burial/crematory sites; 9) quarry sites with associated core reduction activity; 10) rock art sites; and 11) cairn sites, as indicated by constructed piles of rocks. As stated by Gates (1983:87-89), "the greatest diversity and density of sites occur on the Devil's Garden, and represent seasonal activities of both the Modoc and the Achumawi and their ancestors."

The present investigation examines 30 archaeological sites (Figure 8), most lying on the Devil's Garden, except for 4 sites located south in the Pit River Valley and east around the western and southern shores of Goose Lake.

Of the 30 sites, 12 are ethnographic villages in both territories (Table 3). Five are Pit River villages, and include Dalmo'ma, an Astariwawi site near the hot springs south of the rim of the Devil's Garden (considered by Merriam [1926:32] to be Kosalektawi), Kue's at the southern tip of Goose Lake in Hewisedawi territory, and Hatsana'i, also on land claimed by the Hewisedawi. This village, now partly under Big Sage Reservoir, was said to have been visited by people from the Astariwawi band during root-gathering expeditions (Kniffen 1928:308, 310). Another site sampled in this study is Hewisidoo, located at Raker and Thomas Reservoirs and said by Cross (1981:29) to

Table 3. Site Type and Tribal Affinity.

N	SITE NUMBER	VILLAGE NAME	SITE TYPE	TRIBE	BAND
01	05-09-55-701		Temporary Camp	Modoc	Kokiwas
02		Chiwulha'	Permanent Village	Modoc	Kokiwas
03	-56-1011		Permanent Village	Modoc	Kokiwas
04	-55-928		Seasonal Base Camp	?	?
05	-56-1377		Seasonal Base Camp	Modoc?	Kokiwas?
06	-55-59		Seasonal Base Camp	Modoc	Kokiwas
07	-55-201	Tsktya'm	Summer Village	Modoc	Kokiwas
08	-55-697		Temporary Camp	Modoc	Kokiwas
09	-56-1037	Chala'ks	Summer Village	Modoc	Kokiwas
10	-55-521		Temporary Camp	Modoc	Kokiwas
11	-55-671	Tanka'i	Summer Village	Modoc	Kokiwas
12	-55-428	Ka'umpwis	Summer Village	Modoc	Kokiwas
13	-55-615		Seasonal Base Camp	Modoc?	Kokiwas?
14	-55-679		Temporary Camp	Pit River?	Astariwawi?
15	-55-151	Chalklo'ki	Summer Village	Modoc	Kokiwas
16	-55-158		Seasonal Base Camp	?	?
17	-55-07		Temporary Camp	Pit River?	Astariwawi?
18	-55-233		Seasonal Base Camp	Pit River?	Astariwawi?
19	-55-362		Temporary Camp	Modoc	Kokiwas
20	-55-703		Temporary Camp	?	?
21		Usi'na'dzi'wa	Village	Pit River	Hewisedawi
22		Lu'kmtsis	Permanent Village	Modoc	Kokiwas
23	-55-85	Hatsana'i	Village	Pit River	Hewisedawi
24	-55-721		Seasonal Base Camp	Pit River?	Astariwawi?
25	-55-88	Hewisidoo	Ruling Village	Pit River	Hewisedawi
26	-56-1190		Seasonal Base Camp	Modoc	Kokiwas
27		Kue's	Village	Pit River	Hewisedawi
28	-56-1135		Seasonal Base Camp	?	?
29	-55-915		Seasonal Base Camp	Pit River	Astariwawi
30		Dalmo'ma	Village	Pit River	Astariwawi

be the former Hewisedawi ruling village from its designation as an "old Indian village" on an 1871 U.S. General Land Office survey map. Usi'na'dzi'wa, located along the western shore of Goose Lake (Kniffen 1928:321), is the only Pit River village found in the boundary zone area.

Named Modoc sites include the two villages of Chala'ks, a summer village, and Chiwulha', a permanent village with a "cremation place" west of Blue Mountain at Pot Hole Spring (Ray 1963:209). An unnamed village site is located near Warm Springs northeast of Clear Lake and contains at least 26 house pit depressions. In that area where the boundary is seen to overlap, five Modoc village sites are included in the study. These are Ka'umpwis, said to be a permanent village utilized each summer, Tanka'i, Tsktya'm, and Chalklo'ki, all summer Modoc villages. Lu'kmtsis, on the western shore of Goose Lake, is the only permanent Modoc village reported in that area, interestingly located seven miles south of the Pit River Hewisedawi village of Usi'na'dzi'wa (Kniffen 1928:321).

Three of the village sites named as having been sampled are actually satellite sites to, or actual portions of, the larger sites. Other site types used in this study include ten seasonal base camps and seven temporary camps spread throughout what has been designated Modoc and Pit River territory as well as that area of overlap between the two groups (Table 3).

It is apparent from Ray's (1963:204) sources that the border area contained known Modoc ethnographic villages, and most of them were reported as summer villages around the mid-1800s or later. Named Pit River sites are lacking in the boundary overlap area; however, a "power place" is mapped in this area near Rimrock Valley not far from Goose Lake by Olmsted and Stewart (1978:226). South of the boundary zone they map two more of these power, or sacred places at Jacks Swamp and Antelope Plains. Another is located at Medicine Lake.

Also apparent from information provided by Native Americans (Wirth Associates 1981) is that the area south of Ray's boundary line and not far north of the southern rim of the Devil's Garden was extensively utilized by Pit River people for hunting and gathering activities, notably in the area around Big Sage Reservoir.

By studying the ethnographic data concerning sites on the Devil's Garden, it has become obvious that except for Pit River power places and the site along the western shore of Goose Lake, <u>Usi'na'dzi'wa</u>, no Pit River villages exist in that zone claimed for both Modoc and Pit River bands, at least as known to informants in the 1920s. A southern Modoc expansion could explain the paucity of Pit River sites in the border area.

CHAPTER 6

PHYSICAL ENVIRONMENT

As hunters and gatherers, Modoc and Pit River groups would have been intimately familiar with their physical surroundings. Environmental factors undoubtedly influenced efforts to make optimal use of the Devil's Garden and its resources.

MODOC PLATEAU AND ADJACENT AREAS

The Modoc Plateau geomorphic province is the region in which the Modoc and Pit River Indians lived. To the south lie the Madeline Plains and the Sierra Nevada. The volcanic Cascade Range physiographic province lies to the west. To the east is the Great Basin, or Basin and Range province, which includes Surprise Valley just west of Nevada. Volcanic flows of basaltic lava overlie much of the Modoc Plateau upon which are scattered inactive cinder cones. A prominent shield volcano centered on the Devil's Garden is Blue Mountain, the focus of the present study (Figure 11).

Although the term 'plateau' is associated with northeastern California, the terrain is not level, and elevations actually range from 3,000 to 10,000 feet in the region's mountains. The north-south trending 90-mile-long Warner Mountain Range (Lantis, Steiner, and Karinen 1963:9) is lithologically part of the Modoc Plateau by virtue of

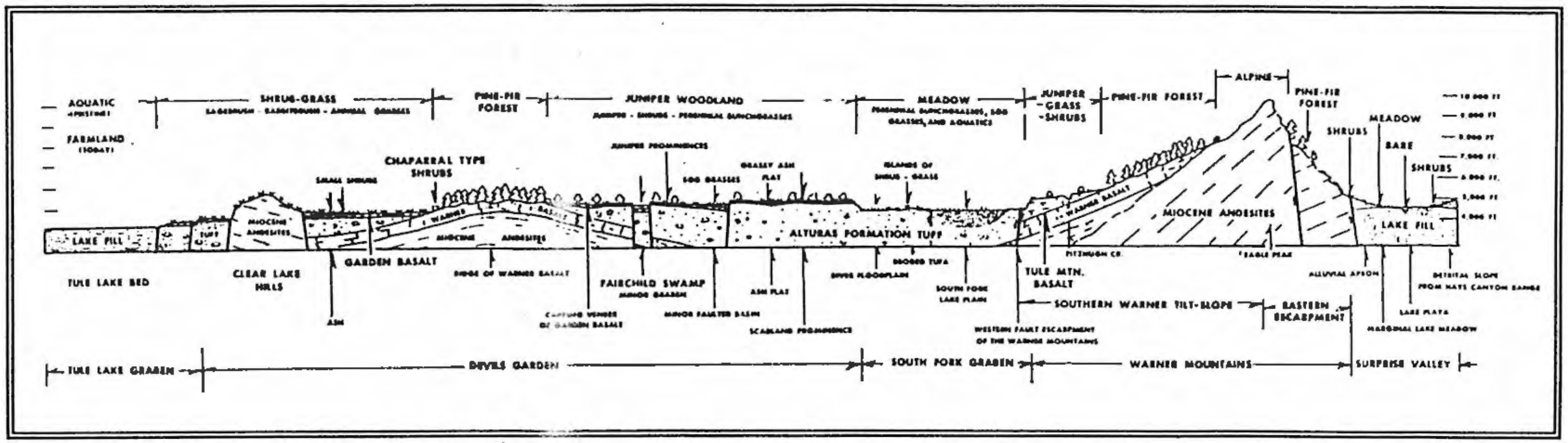

Figure 11. Cross section of Devil's Garden (from Pease 1960: Figure 2.8).

its basaltic rocks but structurally similar to the Great Basin (Macdonald, Gay, Stewart, and Ross 1968:131), which is characterized by fault blocking. The Pit River, which cuts through the Modoc Plateau in a southwesterly direction, begins in the western slopes of the Warners.

The climate in northeastern California consists of generally warm, dry summers and cold, sometimes frigid winters, with 15-20 inches of precipitation occurring primarily as snow (Gates 1983:19).

THE DEVIL'S GARDEN

The Devil's Garden lies in the approximate center of the Modoc Plateau and continues northward into Oregon, while bounded on the south by an escarpment. The Pit River flows south of this rim through the Pit River Valley. Below another scarp, Goose Lake lies to the east of the Garden. To the west, some 50 miles away, is the Medicine Lake Highland shield volcano, the western terminus of the Devil's Garden and the eastern extension of the Cascades.

The Devil's Garden Lava Platform (Pease 1960:22) is actually a continuous lava field of late Miocene and early Pliocene basalts, older than the more recent Medicine Lake Highland lavas. As measured by potassium argon dating, ranges from six to nine million years (older than the commonly cited Pleistocene age) are given the Devil's Garden basalts, with older basalts occurring in the eastern portion of the Garden (McKee, Duffield, and Stern 1983:292, 296).

Hydrology on the Devil's Garden consists of the major drainages of Boles, Fletcher, and Willow Creeks emptying into Clear Lake, then into Lost River in the northern portion of the Garden. Natural basins containing marshes, meadows, and lakes occur in its interior. Such areas were favored by prehistoric hunters and gatherers for numerous resources.

Fauna

Fauna on the Devil's Garden include diverse large mammal, small mammal, and avian species. Mule deer winter there and forage in the sage and juniper areas. Antelope are found in the summer months as well. Other species include coyote, bobcat, mountain lion, badger, striped skunk, porcupine, jack rabbit, weasel, raccoon, fox, gopher, cottontail rabbit, groundhog, and several ground squirrel species. In the past roamed white and black-tailed deer, black bear, grizzly bear, Canadian elk, and wolf; bighorn sheep were also known in the region, as attested by petroglyphs (Gates 1979:10; 1982:25; Pease 1965:43).

Avian species have always been plentiful on the Devil's Garden. One reason for their presence is the Pacific Flyway for birds annually migrating north and south with the seasons. The area also provides an ideal breeding and nesting ground for birds. Waterfowl such as crane, duck, goose, pelican, and gull are found along with species of sagehen, mudhen, and quail, to mention only some of the many species inhabiting the Devil's Garden at different times of the year. Also known in the area are the Bald Eagle, Golden Eagle, osprey, Cooper's Hawk, and several falcon species (Gates 1983:23-24).

Vegetation

Resource-rich basins forming meadows, lakes, and marshes comprise a major ecozone on the Devil's Garden. Because the main California acorn food staple is not found in this region, root crops and aquatic plants were heavily relied upon for food. Wokas, or water lily provided the Modocs, and to a lesser extent the Pit River Indians, with a preferred bulb. The camas root was another commom plant food favored by both groups. Pit River bands utilizing Garden resources favored the epos root, found throughout the widespread sagebrush/grassland plant communities (Baumhoff 1978:19; Olmsted and Stewart 1978:227).

Coniferous forested zones are still seen on the Devil's Garden, albeit in a much thinned state from past logging for yellow pine (ponderosa and Jeffrey species). Primary stands are in the western and northeastern portions of the Garden (Pease 1960:124). Juniper woodland makes up the most recent vegetation type. In fact, most of its expansion is a twentieth century phenomenon, having occurred as the result of historical exploration, conquest, and settlement of northeastern California.

Environmental Changes

Paleoenvironmental reconstruction of the Devil's Garden has not been accomplished. However, historical accounts provide some insight into its past environment.

Pease's 1960 Ph.D. dissertation and subsequent writing on the geography of the Modoc Plateau stand as the definitive sources of information about the area's paleo-environment. Pease (1965:42) theorizes that Indians facilitated hunting by burning the forest floor to reduce shrubs and increase the grass cover (a consideration during survey for prehistoric archaeological sites, since sites may have been located in once grassy areas now covered with shrubs). He reports:

> The most widespread pristine vegetation type consisted of a scattered cover of xerophytic evergreen shrubs . . . between which grew a fairly luxuriant stand of . . . perennial bunchgrass tussocks. Today this vegetation type still prevails over much of the eastern part of the Volcanic Tableland, but the bunch-grasses have been reduced by grazing of livestock and partially replaced by introduced annuals . . . (1960:118).

Pease also mentions meadows "so severely trampled by grazing livestock that the meadow sod has virtually disappeared, and has been replaced by mud or sagebrush flats . . ." (1965:43).

Although the effects of historical land use patterns such as cattle grazing, fire suppression, and logging have altered the Devil's Garden, associations between today's vegetation and locations of sites on the Devil's Garden are possible, especially in ecotone areas between meadows and woodlands (Boynton, Gates, and Wilburn 1980). Wirth Associates (1981:10) notes that "the topographic and hydrological conditions still preserve certain characteristics of the habitat that may have attracted the aboriginal population."

CHAPTER 7

ARCHAEOLOGY IN NORTHEASTERN CALIFORNIA

The Devil's Garden has experienced little concentrated archaeological study, most efforts having been determined by the needs of agencies in fulfilling legal mandates such as the 1969 National Environmental Protection Act, the 1966 National Historic Preservation Act, and Executive Order 11593. Thus the Garden's archaeological role is largely inferred from the results of investigations in the Great Basin, the Lower Klamath Lake Basin, and areas even farther removed from its vicinity.

Since the mid-seventies, Modoc National Forest and other agencies such as the Bureau of Land Management have strived to meet their legal obligations, mostly by conducting project-related surveys to locate archaeological sites and then avoiding those sites during the course of land-modifying activities. Few excavations other than limited testing for mitigation of adverse affects to archaeological sites have occurred. A broadly-defined research design for the northeastern corner of the State has been outlined by Kowta (1975) as a guide to archaeological research. Although some wide design gaps remain in 1990, they are narrowing as varied projects address questions of regional significance.

An important corpus of data has been provided by work undertaken in areas peripheral to the Devil's Garden, notably in Surprise Valley east of the Warner Mountains (O'Connell 1975). In the Goose Lake Basin just east of the Devil's Garden, Hughes conducted surveys and excavated several sites in the 1970s. Of importance to the area's antiquity from an archaeological standpoint was the discovery of Lind Coulee and Alberta projectile point types, indicating that populations may have inhabited the area as long ago as 9,000 years B.P. (Hughes 1972; Thodoratus 1979:48-50).

Earlier archaeological efforts were aimed at establishing a regional chronology for the northern Great Basin and providing descriptive narratives about sites and their artifacts. Luther Cressman (1943; 1956) completed some of the first major projects in southeastern Oregon, suggesting the area's initial chronology in the 1940s and successfully tying northeastern California to the northern Great Basin with his work in the Klamath Lake Basin. From the 1930s through the 1960s, intensive work was completed at Lava Beds National Monument by Canfield and Crouch (1936), Squier and Grosscup (1952), and Swartz (1964). A survey by Hardesty and Fox (1974) near the Lava Beds and in the Medicine Lake Highland resulted in the addition of 768 new sites to the region's archaeological record.

However, not only northern Great Basin affinities have been postulated; work at the Iron Gate Site on the Klamath River south of Oregon uncovered apparent California ties in house forms and the hopper mortar complex (Van Bueren and

Moratto 1985:2.12). Other research in the Lower Klamath Lake Basin has been completed at the Kawumkan Springs site (Hughes 1986:180) and at Mod-151, a winter village site (Manuel 1987).

An ambitious study of Klamath/Modoc lakeside adaptation at Lower Klamath Lake in the 1960s and 1970s was undertaken at Nightfire Island, where stratification from 4000 B.C. to late prehistoric times was accomplished by cross-dating projectile points and radiocarbon results (Sampson 1985).

Further expressions of a northwestern Great Basin as well as a California orientation are seen south of the Devil's Garden in the Eagle and Honey Lake Basins of California, where Great Basin projectile point styles and the coincidence of Early Horizon (ca. 6000 B.P.) central California trade beads occur (Wirth Associates 1981:42). In the 1950s, Riddell (1960:1) excavated the Karlo Site in Lassen County, the first open (non-cave) site in the Great Basin, where he confirmed a Great Basin-central California affinity.

That northeastern California is related to interior portions of the State is indicated by results from investigations undertaken for the construction of reservoirs starting in the 1940s. More recently, numerous prehistoric sites have been recorded along the Pit River in the Lake Britton area between the upper Sacramento Valley and northeastern California (Wirth Environmental Services 1987).

A catalyst for ongoing research and debate was work done by Baumhoff and Olmsted (1963:280-281) at the Lorenzen Site in the southwestern portion of Modoc County, where they looked at artifactual data in conjunction with the relatedness of the languages spoken by the Achomawi and Atsugewi Indians. They theorize that a split had occurred between the Achomawi and Atsugewi around 2000 B.C. When the hypothesized Hokan populations were dispersed to the "fringes" of California by Proto-Penutians reaching central California, some Hokan groups are thought to have entered northeastern California, eventually splitting into the nine Pit River and two Atsugewi tribelets.

Archaeological information about the Devil's Garden is scarce, despite the fact that over 3,000 sites have been recorded on that upland within Modoc National Forest. When the forest is completely surveyed, the Garden is projected to contain between 18,000 and 20,000 sites (Gates, personal communication 1989). Survey and excavation conducted for a United States Air Force radar installation by Basin Research Associates (1987; 1990) and Modoc National Forest provide new data for the study of groups inhabiting the Devil's Garden. Other projects specific to the Garden are a contract survey for a transmission line (Wirth Associates 1981), Masten's thesis research on subsistence and settlement on the the Modoc Plateau (1985), and a 1981 study by Cross, which focuses on use and abandonment of the Devil's Garden by Pit River groups.

CHAPTER 8

RESULTS

QUANTIFICATION

Quantification of debitage collected from the 30 sites included in this study was the initial step completed in order to arrange the sites spatially. Plotted as isopleths on a map (Figure 7), lines unite Blue Mountain debitage frequency percentages of equal value as they radiate outward from the source. Blue Mountain obsidian percentages are plotted as they compare only with other kinds of obsidian (although percentages of Blue Mountain debitage are also compared with all other lithics combined in Table 1).

Asymmetrical and oblong in shape, the greatest isopleth extension is in a southerly direction through the border zone. The isopleths indicate lateral compression in the west, east, and most notably in the southwest, where they sharply discontinue in the proximity of a seasonal base camp (Figure 8, No. 26), located approximately half way between the Glass Mountain and Blue Mountain obsidian sources. The larger Glass Mountain source, 35 miles to the west, and the Sugar Hill/Buck Mountain sources, around 30 miles to the east, were likely exerting their influence in these areas.

To the east, the isopleths decrease well before reaching Goose Lake. They also discontinue in the southeast, where a drop-off occurs northwest of Big Sage Reservoir, now covering most of the Hewisedawi village site Hatsana'i (Figure 8, No. 23). This Pit River village, along with Hewisidoo and Kue's (Figure 8, No.s 25, 27), shows little evidence of Blue Mountain obsidian debitage. Kue's contains mostly obsidian debitage from other sources presumably located in the Warners. As sites continue north along the western shoreline of Goose Lake, lithic materials other than obsidian increase to 10 percent at Lu'kmtsis and 25 percent at Usi'na'dzi'wa (Figure 8, No.s 22, 21).

Near the California-Oregon border, a temporary camp (Figure 8, No. 19) contains little Blue Mountain obsidian debitage, with 71 percent of the surface collection for this site being comprised of other lithics, primarily basalt. Farther west, other lithics drop to 10 percent and Blue Mountain debitage increases markedly, indicating that other materials than obsidian were playing a role in the extreme northeastern portion of the Devil's Garden. Any one or a combination of three factors could have been responsible for the dearth of obsidian debitage: Goose Lake acting as a barrier to eastern sources in the Warners, the Northern Paiutes acting as a similar deterrent, and the presence of other lithic sources in this area.

The isopleths extend well south of the overlap zone. Two sites near the southern rim of the Devil's Garden (Figure 8, Nos. 17, 18) contain 13 and 10 percent Blue Mountain debitage. The southern terminus of Blue Mountain obsidian debitage thus appears to coincide with the southern edge of the Garden rather than with the southern edge of the boundary overlap area.

Since sites were not sampled north of the California-Oregon border, percentages of Blue Mountain obsidian debitage have been inferred from the location of the Drews Creek/Butcher Flat obsidian source, located 32 miles north of Blue Mountain, and from information provided by John Kaiser (personal communication 1989), Forest Archaeologist for Fremont National Forest. Kaiser says that debitage from the Oregon source is found throughout the area north of the State line and that Blue Mountain obsidian debitage occurs within the Buckhorn Timber Sale project area immediately north of California. In the report for that timber sale, Hemphill, Nelson, and Hemphill (1989) state that "the most frequently utilized obsidian . . . was a gray-green translucent form . . . ", accounting for 50 to 75 percent of debitage seen during the survey. They also cite this obsidian as being present just north and northeast in adjacent timber sale areas, but not elsewhere north of the State line. Flakes randomly collected during the Buckhorn Timber Sale survey were examined by the author and appear, from their grainy texture, translucence, and green color, to be Blue Mountain obsidian.

Within the Blue Mountain source core area, 90 to 100 percent of debitage extends to the southwest, northwest, and, to a lesser degree, to the northeast. However, the core area does not extend to the southeast, where the Modoc summer village Tsktya'm (Figure 8, No. 7) contains 76 percent Blue Mountain obsidian debitage.

Alternate lithic types are seen south of Blue Mountain at the Kokiwas villages of Tanka'i and Ka'umpwis (Figure 8, No.s 11, 12), where they average nine percent of the debitage. Sourcing analysis completed for obsidian from Tanka'i for Nilsson's (1985:187) study reveals a predominance of Blue Mountain obsidian, followed by Buck Mountain obsidian from the Warners and then by obsidian from Medicine Lake Highland sources. Thus, in this part of the Devil's Garden eight miles south of Blue Mountain, other sourcss of obsidian as well as non-obsidian lithic materials were being used.

OBSIDIAN HYDRATION ANALYSIS

Hydration analysis was performed at Sonoma State University on 90 Blue Mountain obsidian flakes from nine sites (10 from each site) located north of, south of, and within the border zone to gain temporal control of the sites. While exact time periods cannot be ascertained from hydration analysis, readings from these sites range from 1.0 to 2.2 microns, indicating relatively recent occupations (Figures 12-20). As previously stated, all these sites contained late period projectile points, including Gunther, Desert Side-Notched, Cottonwood, and Rose Spring series.

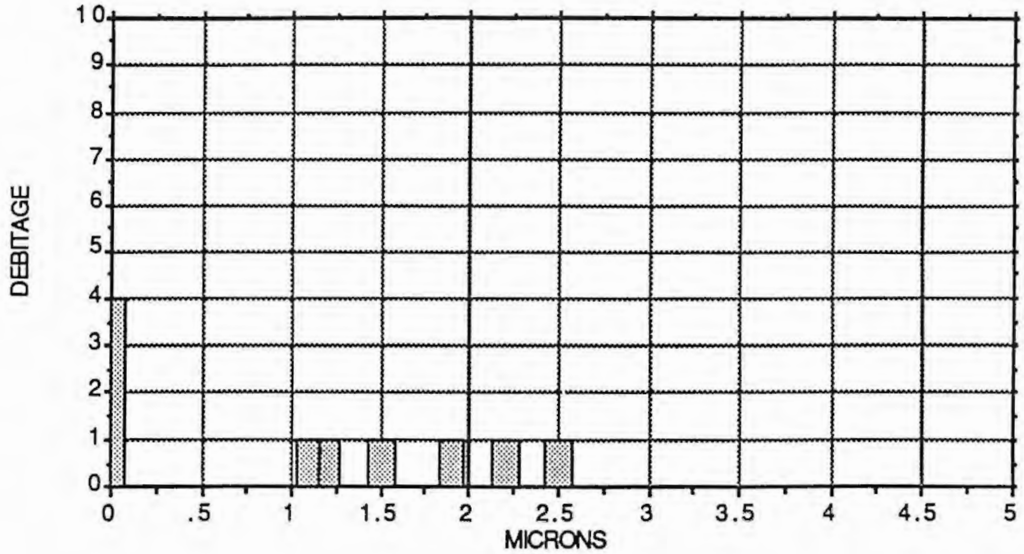

Figure 12. Blue Mountain obsidian debitage hydration readings from FS-05-09-55-07. Hydration mean = 1.0 microns. N = 10

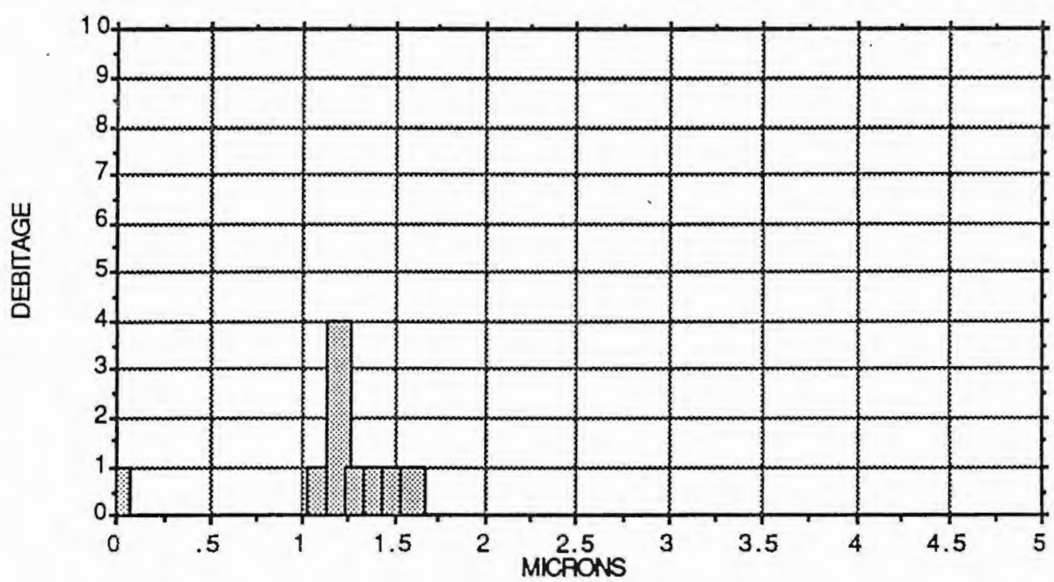

Figure 13. Blue Mountain obsidian debitage hydration readings from FS-05-09-55-679. Hydration mean = 1.2 microns. N = 10

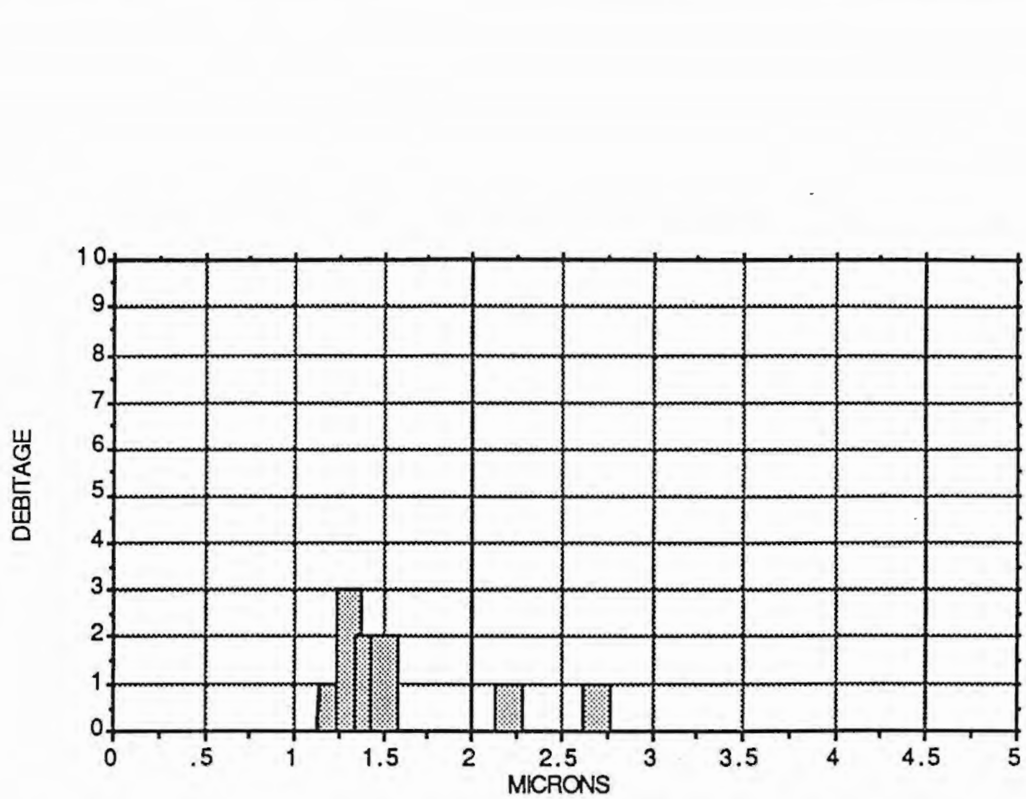

Figure 14. Blue Mountain obsidian debitage hydration readings from FS-05-09-55-928. Hydration mean = 1.6 microns. N = 10

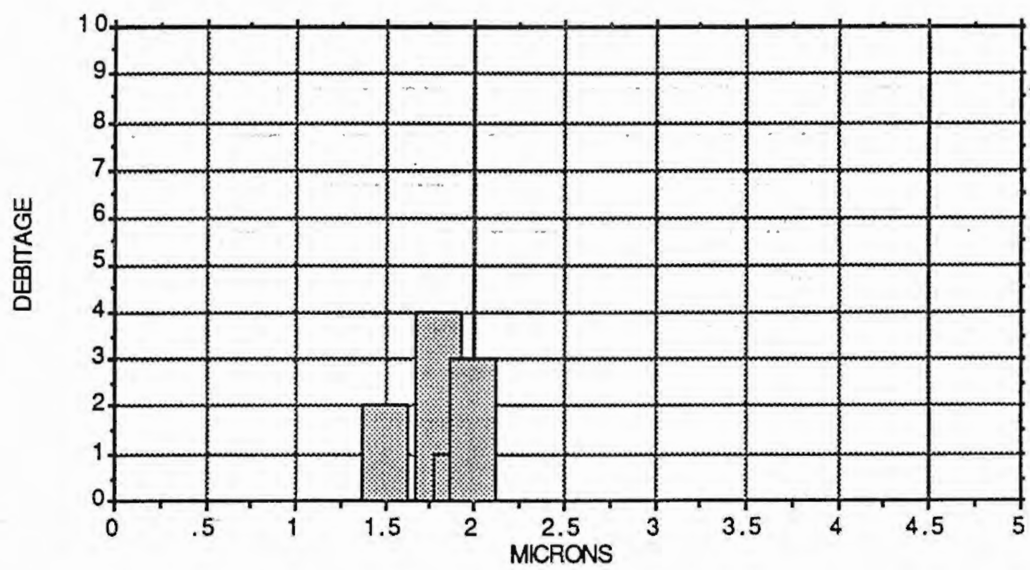

Figure 15. Blue Mountain obsidian debitage hydration readings from FS-05-09-56-1377. Hydration mean = 1.8 microns. N = 10

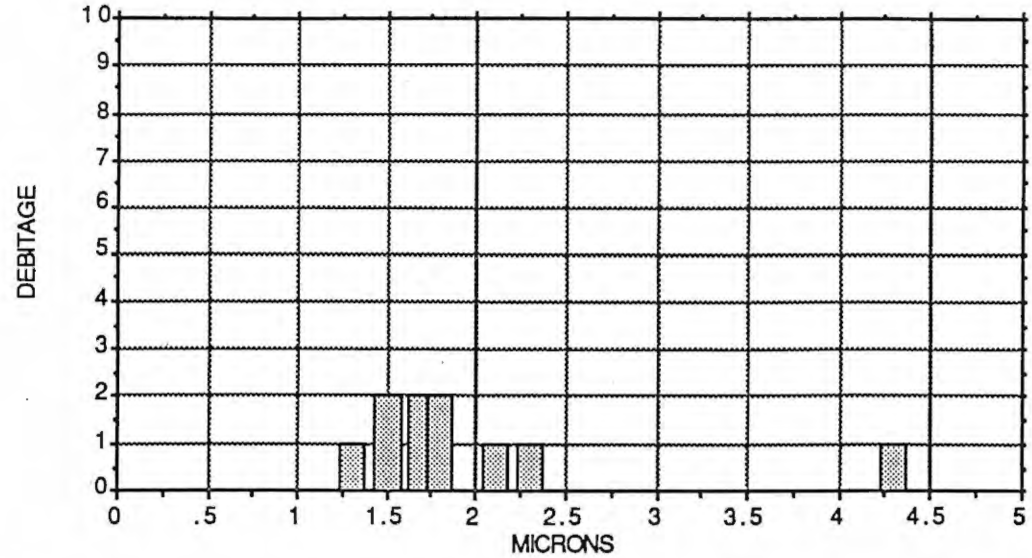

Figure 16. Blue Mountain obsidian debitage hydration readings from FS-05-09-55-233. Hydration mean = 2.0 microns. N = 10

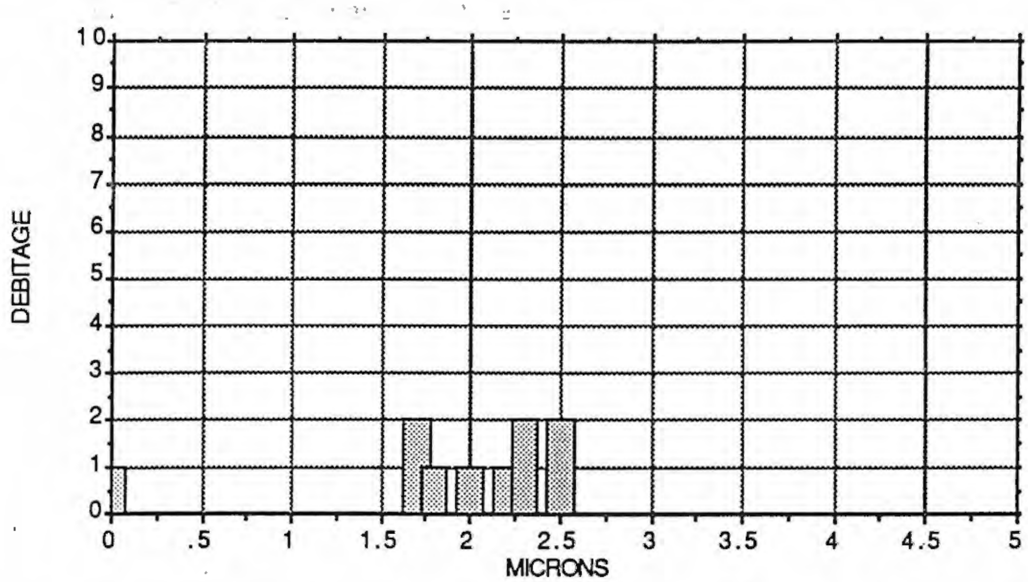

Figure 17. Blue Mountain obsidian debitage hydration readings from FS-05-09-56-1037. Hydration mean = 1.9 microns. N = 10

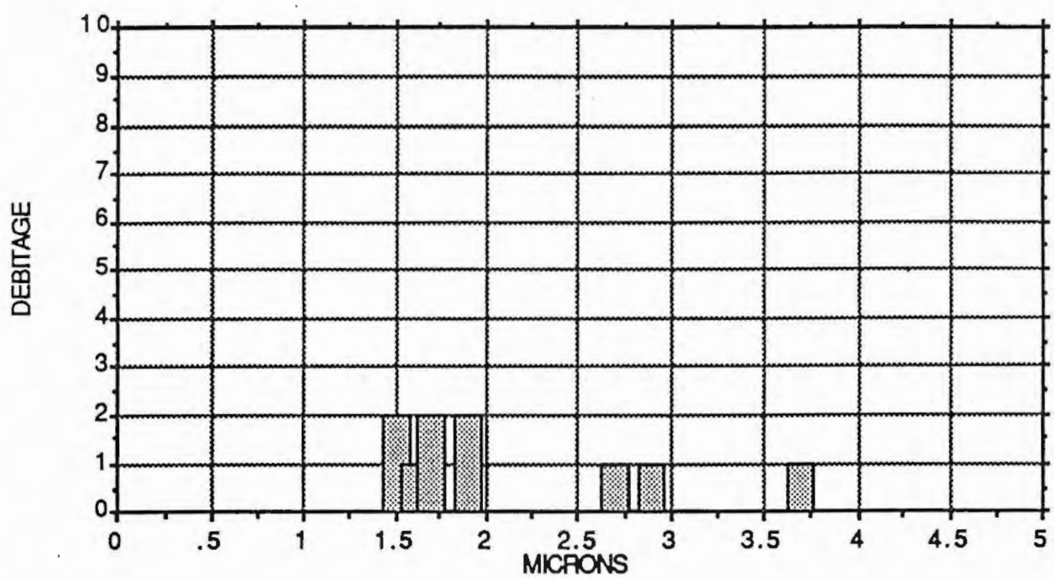

Figure 18. Blue Mountain obsidian debitage hydration readings from FS-05-09-55-428. Hydration mean = 2.1 microns. N = 10

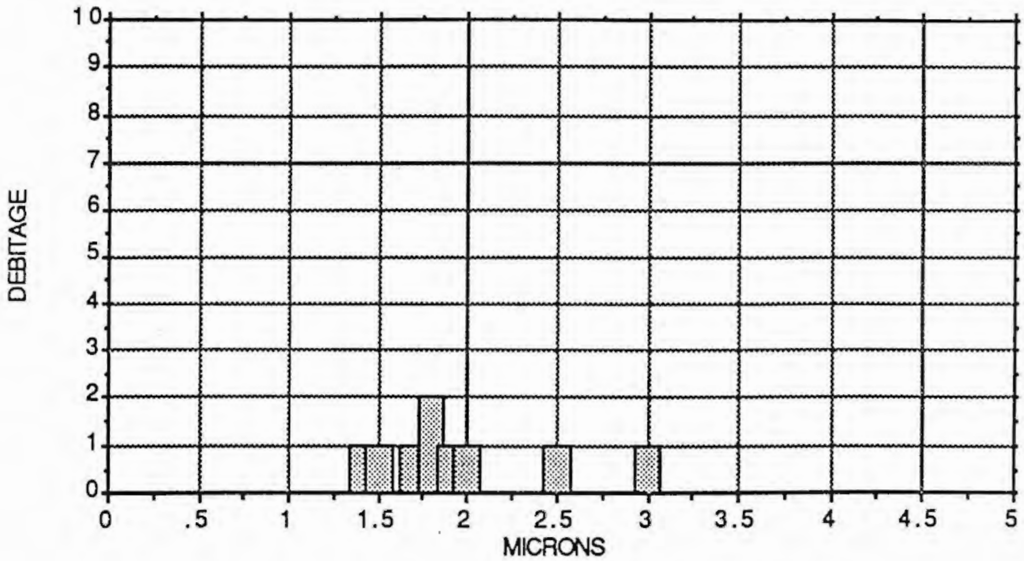

Figure 19. Blue Mountain obsidian debitage hydration readings from FS-05-09-55-151. Hydration mean = 2.0 microns. N = 9

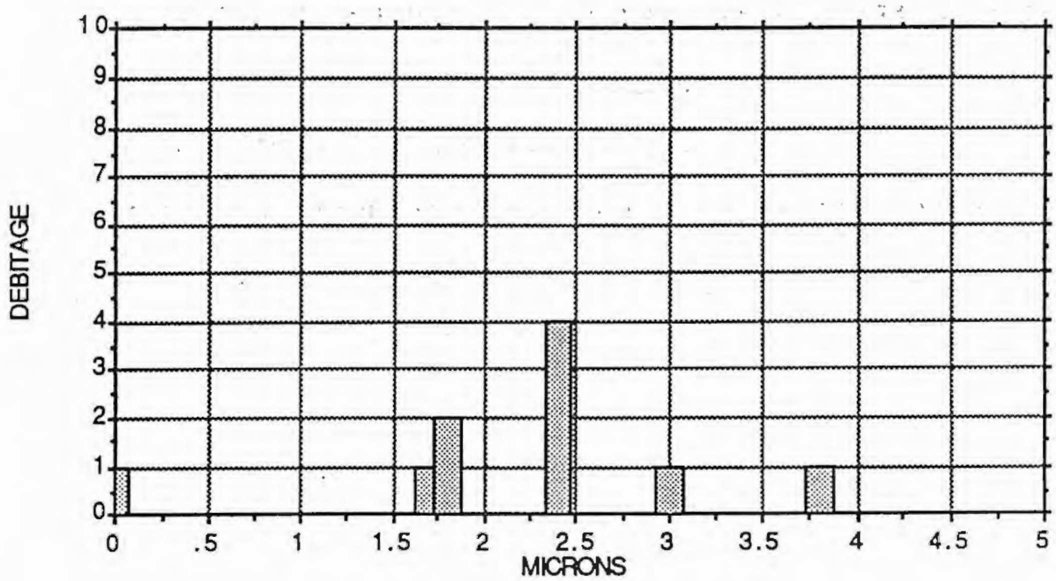

Figure 20. Blue Mountain obsidian debitage hydration readings from FS-05-09-55-201. Hydration mean = 2.2 microns. N = 10

Although a hydration rate for Blue Mountain obsidian has not been established, the previously discussed variables of differential exposure from the churning of soils on the Devil's Garden, high surface temperatures, and the chemical composition of the source can create problems with hydration analysis. The hydration rims are nevertheless regarded as a result of the same factors acting on all surface debitage, and resultant micron spans are still useful. At the same time, Blue Mountain obsidian appears porous, possibly contributing to faster hydration and consequently older time spans. An analysis of obsidian flakes from other sources could shed light on this potential problem by comparing how they hydrate next to Blue Mountain debitage from the same surface collection units.

Obsidian debitage from the Kokiwas village <u>Lu'kmtsis</u> and the Hewisedawi village <u>Usi'na'dzi'wa</u> along Goose Lake was also subjected to hydration analysis. Owing to a paucity of Blue Mountain debitage, flakes from other obsidian sources were analyzed. Results indicate a greater occupation span for these sites (Figures 21, 22).

Following survey and excavation for the OTH-B Radar Project, Basin Research Associates (1987; 1990) analyzed data collected from 33 sites on the Devil's Garden. A seasonal base camp included in the present study (Figure 8, No. 26) is located within the Radar Project area. A problem suggested by Basin Research Associates (1990:13-4)

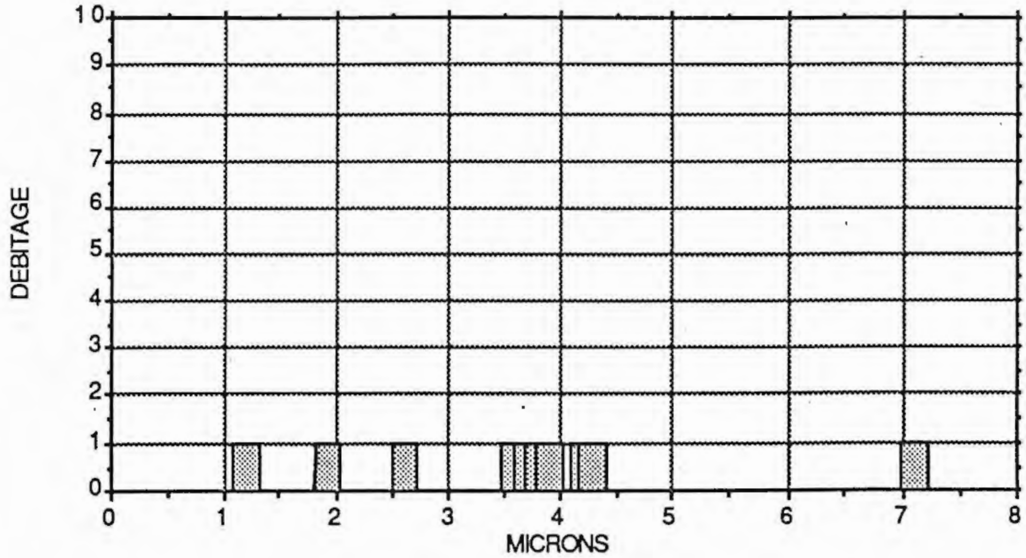

Figure 21. Blue Mountain obsidian debitage hydration readings from Lu'kmtsis. Hydration mean = 3.6 microns. N = 10

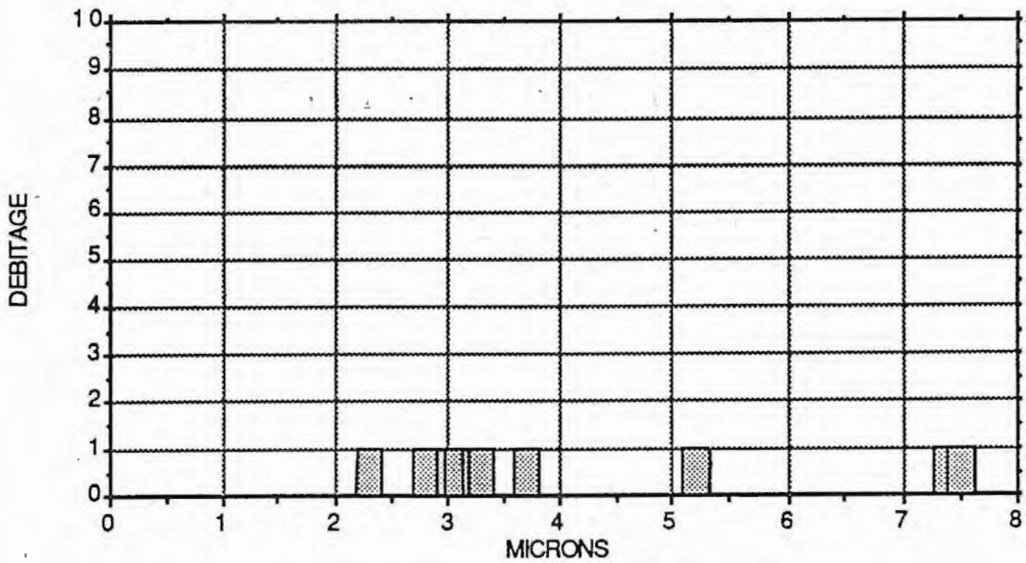

Figure 22. Blue Mountain obsidian debitage hydration readings from Usi'na'dzi'wa. Hydration mean = 4.3 microns. N = 9

is that "cycling" of artifacts from turbational soil churning causes a high variation in micron readings from materials within the top 50 centimeters of sites on the Devil's Garden. While mentioning the possibility of misclassification of some projectile point types, they reason that the problem of considerably thicker micron readings for 19 Desert Side-Notched projectile points may be the result of cycling processes. The points in question average 4.4 microns, far greater than is expected for these late period points (1990:13-6).

Projectile points collected from Ka'umpwis and Tanka'i and subjected to hydration analysis for Nilsson's (1985) study do not pose the same problem, where late period points ranged from no visible hydration rim to 2.0 microns, indicating that these sites had relatively recent occupations. Hydration analysis results from the present study conform with her findings.

Preliminary data provided by Basin Research Associates in 1989 have applicability to the present study. Micron readings from surface debitage collected from 28 units excavated during the OTH-B Radar Project were averaged by the author (ranging from 5 to 20+ surface flakes per unit). Hydration means were then compared with means from sites subjected to hydration analysis for the present study. Radar Project ranges from 2.9 to 5.5 microns were averaged in this manner, and indicate considerably older sites than are found in the boundary overlap zone. The objective was to see if site mixing within the top 40 or 50 centimeters of sites on the Devil's Garden greatly alters the results obtained by analyzing surface specimens.

While attributing micron readings to absolute time spans is not possible and has not been done, inferences can still be made as to whether or not sites exhibit relatively recent or older periods of occupation. Recent occupations are inferred for sites tested in this study which occur in and around the boundary zone on the Devil's Garden.

CHAPTER 9

CONCLUSIONS

The results of quantification and obsidian hydration analysis are both promising and complex as they apply to the hypotheses of Kokiwas expansion to more southern parts of the Devil's Garden or to access to the Blue Mountain obsidian source by Pit River tribelets. Conclusions about ethnographic boundaries on the Garden are complicated by the physical barriers of Goose Lake and topographical escarpments, especially the Garden's southern rim. Other sources of obsidian from Glass Mountain and the Warner Mountains may have proved more cost efficient in terms of the energy needed to procure them, at least as indicated in some of the peripheral portions of the Devil's Garden where other obsidian types are found.

Apparent from ethnographic information citing named Modoc villages is that the Kokiwas were utilizing the boundary zone area. Also apparent is the almost total lack of Blue Mountain obsidian debitage in any named Pit River village on the Devil's Garden or elsewhere.

The sharp discontinuity of Blue Mountain obsidian debitage in the southwest near the half-way point to Glass Mountain indicates a decided preference for obsidian from the Medicine Lake Highlands. However, the Modoc boundary between the Kokiwas and Gumbatwas tribelets is located in the general area farther west (Figure 3), posing the possibility that this intra-tribal boundary affected procurement of Blue Mountain obsidian by the Gumbatwas, especially if its actual location is farther east.

Along Goose Lake, a predominance of other obsidians and lithic types is found. This observation is substantiated by Gates (1981), who found that six sites around 12 miles northeast of Blue Mountain contained other lithic types and obsidian from sources in the Warner Mountains. The apparent antiquity of the Modoc and Pit River villages along the western shoreline of Goose Lake poses questions that will need additional study to resolve. However, Blue Mountain obsidian, for whatever reason, was not an important resource along Goose Lake and, in fact, sharply diminishes around 12 miles east of Blue Mountain.

The northeast section of the Devil's Garden evinces a preponderance of other lithic sources, particularly basalt and cryptocrystallines such as chert. Given the assumption that people in this area would have preferred obsdian as the best material with which to fashion tools, the decrease in obsidian may be attributed to difficult access to the Warner sources owing to the physical barrier of Goose Lake and/or proximity to the Northern Paiutes. Utilization of this area by the Northern Paiutes is yet another possibility.

South of the Blue Mountain source where the sharp discontinuity was expected, such is not the case. Despite the 'young' dates indicated by obsidian hydration analysis, Blue Mountain debitage appears to diminish at a fairly constant rate toward the southern escarpment of the Garden, after which it is rarely seen. One reason may be that the Kokiwas were indeed expanding their territory southward and bringing this obsidian with them. Another could be access to Blue Mountain by Pit River people through trade. The possibility of access by the Hewisedawai and Astariwawi cannot be dismissed. Greater social interchange through intermarriage and trade have been cited for the Hewisedawi and Modocs in recent times, and may be the cause of an obscure boundary in this area. Nevertheless, percentages of Blue Mountain obsidian debitage are not high south of the border zone, ranging from 0 to 40 percent (Figure 7).

On the other hand, Blue Mountain obsidian debitage found north of the source occurs in frequencies considerably greater than expected given a normal fall-off rate (Figure 6). Sites were not sampled north of the California-Oregon border; thus additional research to investigate the importance of the Drews Creek/Butcher Flat obsidian source in the Modoc/Northern Paiute border area could address this issue (Gates 1981).

The author subscribes to a southern Modoc expansion into areas once utilized and possibly even shared by Pit River and Kokiwas tribelets. Certainly no great occupation spans have been indicated for sites within and south of the overlapping border zone, as evidenced in fairly thin obsidian hydration micron readings. Information regarding the scope of actual slave-raiding practices by the Modoc differs; and the harmful extent of the drought during the same time that slaving practices are said to have increased cannot be ascertained at this time. However, to whatever degree, both processes were at work along with Pit River population attrition from disease and other conditions resulting from increased interaction with Whites. It is reasoned that any journey to Blue Mountain during these times would have been formidable, if not disastrous for Pit River people. Blue Mountain obsidian could not have been a widely-sought commodity in the face of these deterrents.

IMPLICATIONS FOR FUTURE RESEARCH

Paramount to any temporal study of Blue Mountain obsidian is the need to establish a source-specific hydration rate. The problems of dealing with surface materials and the porous nature of this type of obsidian have been discussed. The possibility of mixing prehistoric data and historic events certainly would be lessened with establishment of this rate.

Another profitable focus of research could follow the example set by Fredrickson (1990) on the interrelatedness of localities. The Kokiwas are rarely discussed as separate from the other Modoc tribelets. Even if greater tribal solidarity can be presumed for the Modocs, the rugged terrain on the Devil's Garden must have been a deterrent to a high degree of social relatedness. Most of the Modoc villages cited in this study are seasonal, owing to extreme and harsh winter conditions. However, discovery of the social distance between them and other sites in the Kokiwas area would be an important addition to current knowledge about settlement and subsistence on the Devil's Garden. Possbibly, rather than looking at the Kokiwas tribelet, it would be useful to examine village alliances on the Devil's Garden, and these may be evident in the distribution of obsidian.

To further validate the proposal for a southern Modoc expansion from inferred 'recent' dates for Kokiwas sites within and south of the boundary zone, more Blue Mountain obsidian debitage dates are required for northern Modoc sites, and these should indicate longer occupations.

Also useful would be a study of the interface of Medicine Lake Highland and Warner Mountains obsidian sources on the Devil's Garden, namely south of the core area in which Blue Mountain obsidian debitage predominates.

The study of obsidian lithic reduction technology with distance from Blue Mountain is another avenue to explore, along with research on its role as a quarry workshop. To date, no such study has been initiated for the Blue Mountain quarry.

A look at finished tools on the Devil's Garden could prove important for the study of ethnicity to discover whether or not certain projectile point types can be attributed to specific groups. Gates (personal communication 1989) has noticed more Gunther series points in Modoc areas and more Rose Spring series types in Pit River areas to the south; however, a systematic study of projectile point styles found on Modoc National Forest has not yet been completed, and some refinement of currently used subjective designations would be helpful.

A study of finished Blue Mountain tools on the Devil's Garden and elsewhere could shed light on the exchange system of Blue Mountain obsidian. Additionally, an examination of Blue Mountain obsidian tools compared with tools made from exotic materials would show the degree to which Blue Mountain obsidian is represented in tools as opposed to debitage.

Mentioned are some possibilities for future research in the Devil's Garden region. Whether through more concentrated study of the Blue Mountain source or through investigations into more intangible areas such as rock art, the Devil's Garden offers almost unlimited research potential for those interested in the archaeology of northeastern California.

APPENDIX

Table 4. Obsidian Hydration Results.

SITE NUMBER	CATALOG NO	ARTIFACT	HYD MEAN	SOURCE
FS-05-09-55-07	09-1921-01	Debitage	2.5	Blue Mtn.
#17	-02	Debitage	NVB	Blue Mtn.
	-03	Debitage	NVB	Blue Mtn.
	-04	Debitage	1.2	Blue Mtn.
	-05	Debitage	2.2	Blue Mtn.
	-06	Debitage	1.1	Blue Mtn.
	-07	Debitage	1.5	Blue Mtn.
	-08	Debitage	NVB	Blue Mtn.
	-09	Debitage	NVB	Blue Mtn.
	-10	Debitage	1.9	Blue Mtn.
FS-05-09-55-151	09-1922-01	Debitage	1.5	Blue Mtn.
#15	-02	Debitage	1.7	Blue Mtn.
	-03	Debitage	DH	Blue Mtn.
	-04	Debitage	1.4	Blue Mtn.
	-05	Debitage	1.8	Blue Mtn.
	-06	Debitage	1.9	Blue Mtn.
	-07	Debitage	3.0	Blue Mtn.
	-08	Debitage	2.5	Blue Mtn.
	-09	Debitage	1.8	Blue Mtn.
	-10	Debitage	2.0	Blue Mtn.
FS-05-09-55-201	09-1668-02	Debitage	1.7	Blue Mtn.
# 7	-03	Debitage	2.4	Blue Mtn.
	-04	Debitage	1.8	Blue Mtn.
	-05	Debitage	2.4	Blue Mtn.
	-06	Debitage	3.8	Blue Mtn.
	-07	Debitage	3.0	Blue Mtn.
	-08	Debitage	NVB	Blue Mtn.
	-09	Debitage	2.4	Blue Mtn.
	-10	Debitage	1.8	Blue Mtn.
	-11	Debitage	2.4	Blue Mtn.

Table 4 (continued). Obsidian Hydration Results.

SITE NUMBER	CATALOG NO	ARTIFACT	HYD MEAN	SOURCE
FS-05-09-55-233	09-1815-01	Debitage	1.7	Blue Mtn.
#18	-02	Debitage	4.3	Blue Mtn.
	-03	Debitage	1.5	Blue Mtn.
	-04	Debitage	1.8	Blue Mtn.
	-05	Debitage	1.5	Blue Mtn.
	-06	Debitage	1.3	Blue Mtn.
	-07	Debitage	1.7	Blue Mtn.
	-08	Debitage	2.3	Blue Mtn.
	-09	Debitage	1.8	Blue Mtn.
	-10	Debitage	2.1	Blue Mtn.
FS-05-09-55-428	09-422-09	Debitage	1.7	Blue Mtn.
#12	-11	Debitage	2.7	Blue Mtn.
	-13	Debitage	1.5	Blue Mtn.
	-16	Debitage	1.6	Blue Mtn.
	-24	Debitage	2.9	Blue Mtn.
	-25	Debitage	1.9	Blue Mtn.
	-27	Debitage	3.7	Blue Mtn.
	-32	Debitage	1.7	Blue Mtn.
	-36	Debitage	1.9	Blue Mtn.
	-38	Debitage	1.5	Blue Mtn.
FS-05-09-55-679	09-691-03	Debitage	1.2	Blue Mtn.
#14	-04	Debitage	1.6	Blue Mtn.
	-05	Debitage	1.5	Blue Mtn.
	-10	Debitage	NVB	Blue Mtn.
	-11	Debitage	1.4	Blue Mtn.
	-12	Debitage	1.2	Blue Mtn.
	-13	Debitage	1.1	Blue Mtn.
	-14	Debitage	1.2	Blue Mtn.
	-19	Debitage	1.3	Blue Mtn.
	-20	Debitage	1.2	Blue Mtn.

Table 4 (continued). Obsidian Hydration Results.

SITE NUMBER	CATALOG NO	ARTIFACT	HYD MEAN	SOURCE
FS-05-09-55-928	09-1133-106	Debitage	1.2	Blue Mtn.
#4	-112	Debitage	1.3	Blue Mtn.
	-113	Debitage	1.3	Blue Mtn.
	-116	Debitage	1.3	Blue Mtn.
	-121	Debitage	1.5	Blue Mtn.
	-122	Debitage	1.5	Blue Mtn.
	-126	Debitage	2.7	Blue Mtn.
	-127	Debitage	1.4	Blue Mtn.
	-134	Debitage	1.4	Blue Mtn.
	-135	Debitage	2.2	Blue Mtn.
FS-05-09-56-1037	09-863-18	Debitage	2.2	Blue Mtn.
# 9	-19	Debitage	NVB	Blue Mtn.
	-20	Debitage	2.3	Blue Mtn.
	-21	Debitage	1.8	Blue Mtn.
	-22	Debitage	2.3	Blue Mtn.
	-23	Debitage	2.0	Blue Mtn.
	-24	Debitage	2.5	Blue Mtn.
	-25	Debitage	2.5	Blue Mtn.
	-26	Debitage	1.7	Blue Mtn.
	-27	Debitage	1.7	Blue Mtn.
FS-05-09-56-1377	09-1351-02	Debitage	1.5	Blue Mtn.
# 5	-03	Debitage	2.0	Blue Mtn.
	-05	Debitage	2.0	Blue Mtn.
	-08	Debitage	1.8	Blue Mtn.
	-10	Debitage	1.5	Blue Mtn.
	-16	Debitage	1.8	Blue Mtn.
	-19	Debitage	1.9	Blue Mtn.
	-25	Debitage	1.8	Blue Mtn.
	-27	Debitage	2.0	Blue Mtn.
	-28	Debitage	1.8	Blue Mtn.

Table 4 (continued). Obsidian Hydration Results.

SITE NUMBER	CATALOG NO	ARTIFACT	HYD MEAN	SOURCE
Usi'na'dzi'wa	09-2014-01	Debitage	5.2	?
#21	-02	Debitage	3.7	?
	-03	Debitage	2.3	Blue Mtn.
	-04	Debitage	3.0	Blue Mtn.
	-05	Debitage	7.4	?
	-06	Debitage	2.8	?
	-07	Debitage	DH	Blue Mtn.
	-08	Debitage	3.3	?
	-09	Debitage	3.1	?
	-10	Debitage	7.5	?
Lu'kmtsis	09-2015-01	Debitage	3.8	?
#22	-02	Debitage	1.2	?
	-03	Debitage	7.1	?
	-04	Debitage	2.6	Blue Mtn.
	-05	Debitage	1.9	Blue Mtn.
	-06	Debitage	3.6	?
	-07	Debitage	4.2	?
	-08	Debitage	4.3	?
	-09	Debitage	3.9	?
	-10	Debitage	3.7	?

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