Archaeological Investigations at

FS-05-09-56-2413 (CA-MOD-3745):

A Sparse Lithic Scatter

on the

Modoc Plateau

of

Northeastern California

June 2000

FOREST SERVICE U S DEPARTMENT OF AGRICULTURE

Sparse Lithic Scatter
Archaeological Research Project

Archaeological Investigations at **FS-05-09-56-2413** (CA-MOD-3745): A Sparse Lithic Scatter on the Modoc Plateau of Northeastern California

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A. L. Kroeber (1925) on the Pit River (Achomawi) territory....

...high and comparatively barren
as soon as the streams are left behind,
while a large part of it,
particularly to the north of the Pit River,
is pure waste lava.

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ACKNOWLEDGEMENTS

First of all I would like to thank the five participants of the inaugural *HERITAGE EXPEDITION* in the Pacific Southwest Region of the U.S. Forest Service - Melanie Beasley of Sacramento, George Buckingham and Lori Slicton of Alameda, and Dennis and Theodore Dingemans of Davis – without your support and participation this project could not have taken place. I hope you all enjoyed your experience on the Devil's Garden. Thank you all very much for being pioneers breaking new trails!

HERITAGE EXPEDITION is a fee demo experiment authorized by Congress in 1996 to give the U.S. Forest Service the opportunity to charge for certain programs and services to supplement their declining budgets. Fees that go to the Forests remain on the Forest to be used to preserve, enhance, and interpret prehistoric and historic sites for the public. The funds generated by this *HERITAGE EXPEDITION* are being used to facilitate the public interpretation of a prehistoric archaeological site on the Devil's Garden Ranger District known as "Sacred Spring". That site will interpret the Pit River (Achomawi) Tribe use of the Devil's Garden from the distant past to present-day continuing uses by these American Indian peoples.

The goals of the *Sparse Lithic Scatter Archaeological Research Project* are to enable a thematic evaluation of this class of common prehistoric archaeological site and to better understand the nature of the archaeological information present within them. This knowledge will facilitate better management of this class of site both in terms of practical day-to-day Forest Service land management activities and long term archaeological research.

I would also like to thank Carolyn Dillian for her work writing the lithic analysis portion of the report, editorial comments and many of the illustrations, and Russell Bevill for his faunal analysis report. John Fogerty, IV, was a valuable field assistant for all aspects of the archaeological field work and good humor on hot, dusty days.

It is hoped that this report will be of some value in identifying and interpreting the archaeological values of, what some folks informally call "stinkin' lithic scatters", or formally the "simple lithic scatter". Some of these, I believe, are truly mini "time capsules" of considerable archaeological value.

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June 2000

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ABSTRACT: Small sparse lithic scatters are ubiquitous on the Modoc Plateau and often prove to be the bane of other resource managers and the Forest Archaeologists who must recommend protection through flag and avoid methods. This protection is required if the properties are not evaluated for eligibility to the National Register of Historic Places (NRHP). Properties must be considered potentially eligible if unevaluated, and therefore subject to protection. This "Code d'Napolean" means properties are assumed eligible until proven otherwise. The Sparse Lithic Scatter Archaeological Research Project initiated on the Modoc National Forest in 1999 is an attempt to systematically examine the data potential of this class of archaeological resource to determine the nature of data present and to see whether these sites may be thematically evaluated for eligibility to the NRHP. The goal over five years is to examine a total of 10 such properties within a defined geographical area - the southwestern portion of the Devil's Garden - to acquire sufficient data for a thematic evaluation and determination of eligibility. This report presents the working research design for the project and the preliminary results of the excavation of the first site.

INTRODUCTION

This small Sparse Lithic Scatter Archaeological Research Project has as a goal the thematic evaluation of small, low density lithic scatters, a very common class of archaeological property. For over twenty years, this class of archaeological resource has vexed other resource managers when they must modify their project designs to protect these archaeological properties. Numerous project managers have asked: "Why do we need to protect that? It's just a few stinking chips! It can't have any value!" This research project tries to address that anguished response to our standard flag and avoid management approach. It is also an attempt to do justice to our legal mandate to evaluate archaeological properties for eligibility to the National Register of Historic Places (NRHP).

This research project is also designed to evaluate the effectiveness of our traditional methodology for testing this type of property for the NRHP. Generally, sparse lithic scatters are examined for information or research content by excavating from one to three 1-meter by 1-meter test units to recover a sample of the archaeological data present. At best if, for example, three test pits are placed in a site 1,000 square meters in size, then the sample size represents only a 0.3% sample! That is basically 1/3 of 1% - a far too small sample size to be statistically relevant! This research project is designed to recover a much larger, cost effective sample to better understand the nature of this class of archaeological property.

Upon the completion of this five-year research program, I propose to undertake a thematic evaluation for eligibility to the NRHP for this class of archaeological property. This evaluation will be based upon adequate samples from a minimum of 10 small sparse lithic scatters within the project study area.

Hopefully, we will then be able to adequately answer the question of "Why do we need to protect that?"

THE PROJECT STUDY AREA

The project study area (Figure 1) lies in the southwestern portion of the Devil's Garden Lava Plateau, or simply "The Garden," in an area halfway between Alturas and Tulelake, California, in Modoc County. This area covers portions of Township 43 North, Ranges 6 through 9 East, and Township 44 North, Ranges 6 through 9 East, which collectively total about 288 square miles, or 184,320 acres. The area contains portions of both the Long-Damon Fire Area and the Hackamore Analysis Area. Both of these areas will be the focus of many resource planning efforts in the first decade of the new century. One of the reasons for selecting this region for testing was the extensive archaeological inventory that has been done to date and its high archaeological sensitivity. Additionally, this area contains a variety of ecological settings.

The Devil's Garden lava platform is the single largest landform in Modoc County. It is an ash-filled basin with surface to near-surface basalt lava flows forming a summit platform and marginal escarpments (Pease 1965). Based on work conducted for the Tuscarora Pipeline Project (Mikkelsen and Bryson 1997), this area was termed the "Modoc Uplands". It extends from the base of the Medicine Lake Highlands eastward for 50 miles to the Goose Lake Valley. Geologically, the Modoc Uplands consist of a series of massive, locally block-faulted Cenozoic basalt flows interspersed with smaller shield volcanoes, such as Timber Mountain, and steep-sided rhyolitic domes (Mikkelsen and Bryson 1997; Bailey 1966; and Oakeshott 1978). The Uplands also include shallow seasonal lakes/wetlands, meadows, marshes and valleys, as well as fault zones in which silts, mudflows and ash have been deposited (Norris and Webb 1976). Average elevation of the plateau is 4,500 feet, with peaks and ridges projecting to over 6,000 feet above sea level. Lava rims or escarpments may range from a few feet in height to several hundred (Gates 1983).

The Devil's Garden includes the largest continuous lava flow of Plio-Pleistocene Garden Basalt (Pease 1965), which, in turn, is capped by slightly weathered Pleistocene basalts. Basins have developed that contain the alluvium of these basalts and older, more weathered basalts. Some volcanic ash deposition may be present. Soils of the area are primarily very stony clay loam soils over clay soils in low-lying areas. Scab rock with very minimal soil development is located near the edges of the lava rims or escarpments and in some of the other more elevated locations (Gates 1983). A thin veneer of Medicine Lake pumice covers a portion of the western periphery of the Devil's Garden, including the Northwest corner of the current study area.

Within the Devil's Garden are numerous seasonal lakes/wetlands. Drainage of surface water proceeds to several watersheds. Portions of the Devil's Garden drain into the enclosed Goose Lake Valley and southward into the Pit River, or northward into the Tule Lake Basin. In addition to these seasonal and perennial drainages, there are numerous natural ephemeral, seasonal and permanent springs throughout portions of the Devil's Garden. Within the present study area, the major seasonal lakes and meadows include Dry Lake, Whitney Reservoir, Henski Reservoir, Bucher Swamp, Dead Horse Flat Reservoir, and Reservoir F.

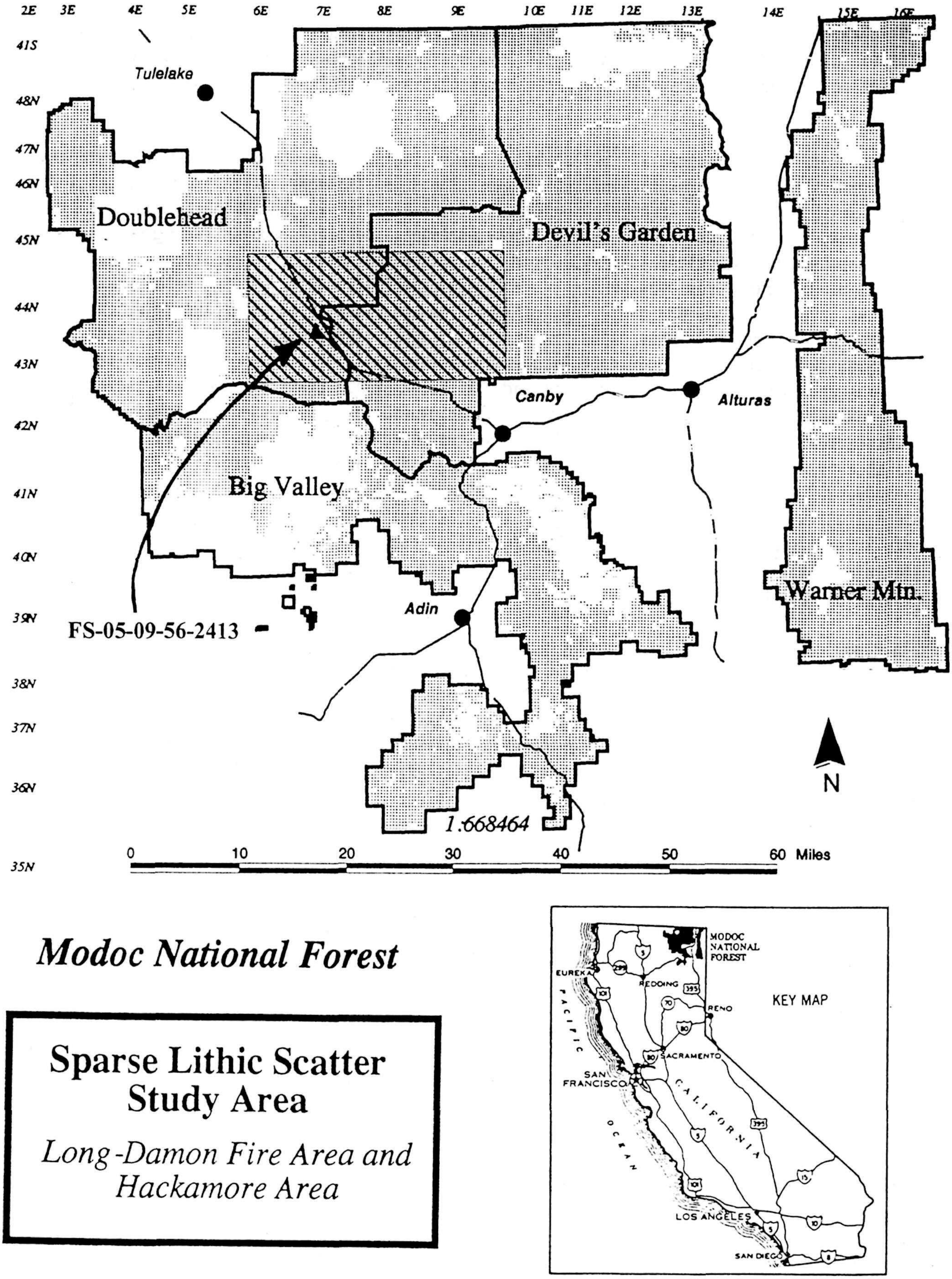


FIGURE 1. Sparse Lithic Scatter Study Area.

The general climate of the area consists of warm, dry summers followed by cold, snowy winters. Annual precipitation in the area averages between 15 to 20 inches. Storm patterns are such that most rainfall occurs between April and July, while most snow occurs between December and March (Gates 1983).

In the past, the ecozones of the Devil's Garden included coniferous forest, juniper woodland, sagebrush steppe, and meadow/marsh. Areas of coniferous forest consisted of stands of differing densities of pine and fir. Pristine forest stands were densest in the Adin Mountains to the south, with progressively thinner stands proceeding Northeast across the Devil's Garden fading into the sagebrush steppe and juniper woodland. Today, logging has considerably thinned these stands. Dominant timber species include Ponderosa and Jeffrey pines (Pinus ponderosa and P. jeffreyi) with mixtures of White and Red fir (Abies concolor and A. magnifica). Incense Cedar (Libocedrus decurrens) also occurs in the slightly higher elevations. Quaking Aspen (Populus tremuloides) and a few small Black Oak (Quercus kelloggii) occur in selected locales within this zone. Understory vegetation density and type depends upon the density of the timber stand. In dense stands there is a sparse understory of a few shrubs and forest grasses and forbs. Chaparral-like ground cover occurs in areas of open timber stands. Here the understory may consist of such a dense growth of vegetation as to inhibit timber growth. The common types of understory/chaparral shrub species today include Manzanita (Arctostaphylos patula), Snowbush (Ceanothus velutinus), Bitterbrush (Purshia tridentata), Mountain Mahogany (Cercocarpus ledifolius), and various species of Prunus, such as Bitter Cherry (P. emarginata), and various grasses and forbs. Sagebrush (Artemisia tridentata and A. cana) penetrates into the forest margins. The ubiquitous Wooly Mules Ears (Wyethia mollis) occur in most logged-over areas and forest clearings (Pease 1965; Gates 1983).

The sagebrush steppe ecozone was the most widespread of the pristine vegetation types on the Devil's Garden (Pease 1965). This consisted of scatterings of short xerophytic shrubs interspersed with fairly dense stands of native bunchgrasses. Today, most of the native grasses have been replaced by introduced annuals such as cheat grass or downy brome (Bromus tectorum) (Ibid.) Livestock grazing and Twentieth Century fire suppression activities have promoted an expansion of the juniper woodland into much of this zone. Various species of sage (Artemisia sp.) dominates the terrain. Big Sage (A. tridentata), often growing to three feet in height, favors well-drained sites, such as dunes and deep aeolian soils. Along the non-alkaline meadow margins, in poorly drained soils, and on scab rock outcrops, low sage (A. tridentata var. arbuscula) predominates. Silver sage (A. cana) commonly grows along coniferous forest margins.

Other shrubs in well-drained soils include Rabbitbrush (Crysothamnus sp.) and sometimes, Bitterbrush (Purshia tridentata) along forest margins. Saltbush (Atriplex sp.) and Spiny Hop-sage (Grayia spinosa) are found on dry and saline soils.

The juniper woodland is found on the shallow soils of the Garden Basalt surface, which is covered with coarse and angular scab rock. Juniper, preferring the higher and rockier prominences with good drainage, does not grow in the poorly drained ash-filled basins and meadows of the Devil's Garden. Throughout the Devil's Garden the numerous ash-veneered flats thus greatly fragment the continuity of the juniper woodland cover (Ibid.; Gates 1979 and 1983).

Juniper woodland in this area generally consists of an overstory of Western Juniper (Juniperous occidentalis), a stubby conifer that grows as much as 30 feet in height. The Devil's Garden exhibits one of the best woodlands of this plant type in the West, with tree spacings often close enough to give the appearance of an open timber stand (Pease 1965). Occasionally, a few sparse islands of Ponderosa pine (Pinus ponderosa) occur within this ecozone.

Since these woodlands tend to occur on scab rock areas, the understory plant cover is frequently a sparse scattering of small sagebrush and grasses. Along the talus slopes below the lava rims occur mountain mahogany and other woody shrubs. Generally, plant species common to this environment are Mountain Mahogany (Cerocarpus ledifolius), Silver sage (Artemesia cana), Low sage (A. arbuscula), Rabbitbrush (Crysothamnus sp.), Squaw Carpet (Ceanothus prostratus), and miscellaneous native and introduced grasses.

The meadow ecozone, for the most part, has been severely altered since the turn-of-the-century due to grazing activities and draining of the swamps. Pease (Ibid.) describes this type of environment in the following manner:

> In this land where short and comparatively cool summers combine with frozen winters to reduce evaporation greatly, points of seepage or water accumulation in the soil become natural meadow... On the Devil's Garden some probable meadows of pristine times have been so severely trampled by grazing livestock that the meadow sod has virtually disappeared, and has been replaced by mud or sagebrush flats...
>
> The floristic content of Modoc meadowlands is too diverse for all species to be mentioned. In the pristine state and on those meadows that today remain moist throughout the dry season, sedges (Carex sp.), rushes (Juncus sp.), tuffed hairgrass (Deschampsia caespitosa), water groundsel (Senecio hydrophilus) and cinquefoil (Potentilla gracilis) are important elements. Better-drained areas support Nevada bluegrass (Poa nevadensis), mat muhly (Muhlenberigia squarrosa), California hairy oatgrass (Danthonia californica), and a rush (Juncus balticus). In the drier meadow margins are bunchgrasses, such as sandberg bluegrass (Poa sandbergil), squirreltail, shorthair sedge (Carex exserta), and such forbs as buttercup (Ranunculas sp.) and biscuit root (Cogswellia sp.).

Avian life abounds in this environment. Numerous species of waterfowl include brant (several species), crane (several species), curlew, duck (several species), goose, gull, loon, mudhen, pelican, and civan. Other birds include sagehen, quail, and a multitude of songbirds and raptors, such as the bald eagle, golden eagle, osprey, prairie falcon, coopers hawk, red-tail hawk, etc. (Gates 1979). These wetlands are an important segment of the Pacific Flyway for migratory waterfowl who use the area's lakes and wetlands as breeding grounds. The abundance of waterfowl helped give Goose Lake its name.

Prominent lake environments on the Modoc Plateau include Goose, Clear, Tule and Lower Klamath Lakes. Today there is scarcely any presence of aquatic plant life in these lakes; however, aquatic plants were important vegetation types in the pristine environment. Aquatic vegetation of Tule Lake, for example, gave rise to its final name. Extensive growths of bulrushes or tules (Scripus sp.) and reeds grew from the shallow waters. The Indians utilized this vegetation to make bundled tule boats, woven shoes and mats. Of major importance as a food resource was a species of water lily (Nuphar advena), known as wokas by the Modoc and Klamath Indians.

Since the settlement of the area by white men, fauna and flora common to the Modoc Plateau have changed. As early as 1832, John Work, a trapper for the Hudson's Bay Company, crossed the plateau. Work and his men were forced to consume horseflesh due to a paucity of wildlife along the Pit River in the vicinity of Alturas through to Big Valley. He also noted few and poor quality beaver for the area. Work attributed this scarcity of game to hunting by the local Indians (Maloney 1943). Apparently, postulates Pease (1965), there was relatively little browse for deer in the northeastern corner of the state - and so, few deer. On the other hand, west of the Cascade-Sierra ridge deer were plentiful in the foothills surrounding the Sacramento Valley. Eventually, with settlement increasing in the Sacramento Valley deer herds moved into the less desirable ranges of northeastern California.

These herds were primarily black-tailed deer (Odocoileus hemionus colunbianus) and became quite numerous in the area until the severe winters between 1879 and 1900. In this century the deer population has again increased, only now the herds are mule deer (Odocoileus hemionus hemionus). Deer inhabit the forests and woodland areas.

Antelope (Antilocapra americana) inhabit the shrub-grass vegetation. Mountain sheep (Ovis canadensis califoriana) once occupied the rough lava country around Tule Lake, and the tablelands around and into the Warner Mountains. Also, in the past, the grizzly bear (Ursus horribilis) and possibly Canadian elk (Cervus canadensis) and bison (Bison bison) were found in portions of the Modoc Plateau. Wolves (Canis lupus) and mountain lion (Felis concolor) were also residents of the plateau.

Common fauna, in addition to the numerous waterfowl and other avian species listed previously include: coyote (Canis latrans), bobcat (Lynx rufus), badger (Taxidea taxus), striped skunk (Mephitis mephitis), porcupine (Erethizon dorsatum), cottontail (Sylvilagus audoboni), jack rabbit (Lepus californicus), several species of ground squirrel, numerous other rodents and reptiles and amphibians.

ETHNOGRAPHIC BACKGROUND

This portion of northeastern California lies in a border area between the Modoc tribe to the north and the Pit River or Achomawi tribe to the south. Figure 2 shows the rough ethnographic boundaries as gleaned from Kniffen (1928), Kroeber (1925), Merriam (1926), Olmstead and Stewart (1978), and Ray (1963). Specifically, the study area is within territory utilized by the Kokiwas band of the Modoc and the Atwamsini and Astariwawi bands of the Pit River tribe.

These groups are classified as hunters and gatherers or foragers, in that they relied on a semi-nomadic seasonal round to take advantage of the various foods (plant and animal) and other resources within their respective territories. Each group had one or more permanent winter villages where they stayed from about November through March or April. As the snows melted, the weather warmed, and plant and animal resources became more abundant in the spring, the groups broke up into smaller units, such as an extended family group, and spent the next six months systematically moving about their lands. They harvested plants as they ripened, hunted and trapped small, medium and large game, fished the river, streams and lakes, netted waterfowl, and collected abundant high-protein insects such as mayfly larva and locusts. Their land provided quite well if they could move to where the foods were. Mikkelsen and Bryson (1997) provide an excellent ethnographic summary of both the Modoc and Pit River in this area.

This seasonal round movement resulted in the creation of numerous sites where various activities took place. Thus, seasonal base camps were occupied for several weeks or months at a time and satellite to these were temporary camps occupied anywhere from overnight to several nights while people were harvesting resources in the area. These, in turn, may be ringed by numerous task specific sites where for example, a deer was butchered, a stone tool was made or sharpened, a hunting blind constructed, or a portable or bedrock mortars used to process plant foods. At each of these locations some evidence was left behind, which forms the foundation of archaeological deposits.

The descendants of these Native Americans still live in the area and seasonally harvest plant resources, such as epos for food and various medicinal plants. They still hunt game; and they still have special areas they go to for healing, for solitude, and for peace of mind.

The archaeological deposits within this study area tell the story, about 10,000 years of it, of these people, their ancestors, and the people before them. Current archaeological evidence suggests that the

Pit River have been in this area for at least 3,500 years (Baumhoff and Olmstead 1963 and 1964) and the Modoc, for perhaps as many as 7,000 years, or more (Sampson 1985).

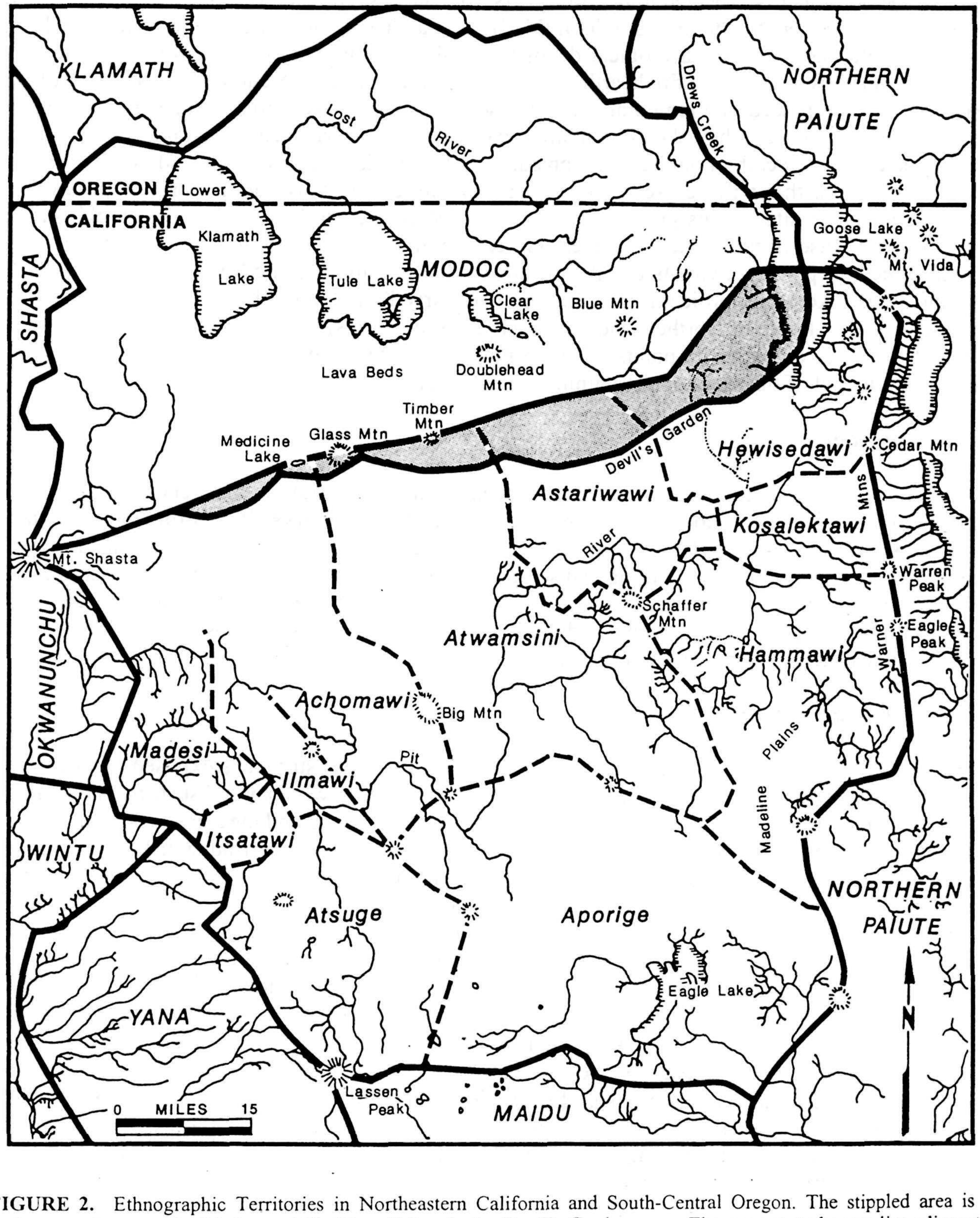


FIGURE 2. Ethnographic Territories in Northeastern California and South-Central Oregon. The stippled area is an overlap zone between the Modoc and Pit River Tribes in the Devil's Garden area. The current study area lies adjacent to the overlap zone where the territories of the Atwamsini and Astariwawi bands meet at the Modoc territory border, South and East of Timber Mountain.

GENERAL COMMENTS

This research project is expected to last five years and has as a goal the excavation of at least ten small Sparse Lithic Scatters to obtain a sample of this class of archaeological site. This research is designed to identify the nature of archaeological deposits and the information potential for these sites and to search for shallow, subsurface fire hearths. Since most of the lithics present on these sites are obsidian, each site may be placed in a temporal context based on obsidian hydration. If subsurface fire hearths are successfully located, they should contain burned organic material (charcoal and/or ash) that could be subjected to radiocarbon dating. The obsidian hydration data coupled with radiocarbon data may yield information that will be used to refine or calibrate obsidian hydration ratios to produce more accurate dates for sites. This project will examine two Late Period sites (Terminal Prehistoric/Late Archaic with Rose Spring series, Gunther Barbed/Guntheroid, Desert Side Notched, or Cottonwood series projectile points), two Middle Period sites (Middle-Late Archaic/Middle Archaic with Rose Spring series/Elko series projectile points), and two Early Period sites (Early Archaic with Gatecliff series, large Humboldt, or Northern Side notched projectile points) first, and then investigate four sites without the surface diagnostic points. This sample of 10 sites then will be examined to identify the research potential of this class of site within the study area.

What is obsidian?

Obsidian is a volcanic glass, a stone that is produced when rhyolitic lava with a very high silica content erupts from a volcano and cools rapidly, producing a rock with no crystalline structure. This natural glass makes a wonderful toolstone for making things such as projectile points (arrowheads, dart and spear points), knives, and other cutting and scraping tools. The process of making a stone tool is called "flintknapping". The waste debris from flintknapping is called "flakes" or "debitage" or "detritus", or even simply "chips". Flintknapping debris is the most commonly observed material on an archaeological site in the present study area.

What is obsidian hydration?

When a flake is broken off of a chunk, or core, of obsidian, a fresh surface is exposed. Once dropped on the ground or buried, water penetrates into the stone from its newly exposed surface. This moisture layer, or rind, creates a visually distinct layer, which can be observed and measured with a microscope. The longer the piece has been in the ground, the thicker the hydration rind will be. This layer is measured in microns. Thus, a flake or an arrowhead with a hydration layer that measures 1.5 microns is not as old as one that measures 4.0 microns. This provides a method of assigning a relative date to a site. However, not all obsidian hydrates at the same rate and so one needs to know what geochemical source a particular piece of obsidian came from. Further, the climate of the area also affects the rate of hydration. Generally, the warmer the average temperature, the more rapidly hydration occurs. Thus, if an obsidian tool was broken in half, and half of that tool dropped in the Devil's Garden at, the 4,500 foot elevation, and the other half transported to the upper elevations of the Warner Mountains and deposited at the 8,500 ft. elevation, the two halves would end up with different hydration rind thicknesses a thousand years later. The lower elevation half would have a much thicker hydration rind than the upper elevation half, even though they actually date to the same time. Because we can determine the average ambient temperature and humidity, as well as trace the geologic source of the obsidian, this method is an effective way of organizing sites into a relative timeline.

What is obsidian sourcing?

Obsidian sourcing consists of using an analytical method, usually X-Ray Fluorescence (XRF), to measure the amount of certain trace elements in the obsidian. Different volcanic magma pools have different finger print signatures, that is, certain percentages of key trace elements that are unique to a particular source. By comparing the trace element composition of an archaeological specimen to that of a sample from a known geologic obsidian source, we can determine the geologic origin of the prehistoric raw material. Therefore, we can tell if the obsidian used to make an arrowhead came from obsidian quarries such as Glass Mountain, East Medicine Lake (EML), or Sugar Hill.

Utilizing both obsidian hydration and sourcing data some archaeologists have attempted to develop hydration rates for certain obsidians in order to equate the hydration readings with a calendar year. For example, if we had an arrow point geochemically sourced to EML that measured 1.5 microns, then according to the hydration rate developed for EML (see Basgall and Hildebrandt 1989), the point would date to about 317 years ago, or roughly 1683 AD.

What is a small sparse lithic scatter?

In terms of this particular archaeological research project a small Sparse Lithic Scatter may be described in the following manner:

SIZE: Equal to or less than 1,000 square meters in surface area (length x width). This is roughly 0.25 acre in size.

COMPLEXITY: A site type generally lacking in any surfacially visible formed artifacts, although there may be one or two projectile points and/or utilized/retouched or edge-damaged flakes present. The primary surface evidence consists of a scatter of waste flakes, generally exhibiting an overall density of less than five flakes per square meter. However, there may be visible concentrations, or loci, of flakes that exceed this average density.

In identifying information potential in small Sparse Lithic Scatters, this type of site may be classified, based upon obsidian hydration data, into the following categories:

SINGLE Component: Obsidian hydration readings for obsidian from the same source areas show little range of variation in both surface and/or subsurface contexts. Average range of variation from the mean is generally equal to or less than +/-0.5 microns.

This is interpreted to represent a single event or use site, which is temporally distinct, and will lend itself to seriation based on hydration. The data present may be considered to be a single analytical unit, uncontaminated by other earlier or later occupations. In effect, this represents a time capsule site.

Moderate/High research value - NRHP eligible.

DOUBLE Component: Same as above, but with demonstrable variation either horizontally or vertically into two distinct temporal periods, as evidenced by hydration clusters.

This is interpreted to represent two occupations of the site at two distinct time periods, and representing two distinct analytical units.

High research value - NRHP eligible.

MULTI-Component: Same as above, but with three or more distinct temporal periods, as evidenced by hydration clusters identifiable horizontally and/or vertically.

This site is interpreted to represent multiple distinct occupations of the site through time and contains multiple, temporally distinct analytical units.

High research value - NRHP eligible.

MIXED Component: Obsidian hydration readings show a wide range of variation from both surface and subsurface contexts - apparently randomly mixed readings. It is not possible to separate out or identify discrete occupations or analytical units.

This is assumed to be due to a lack of integrity of the site caused by natural soil mechanics, or other disturbance, resulting in an intermingling of cultural material from various periods of occupation or use of the site, one on top of the other.

Low research value - not NRHP eligible.

RESEARCH QUESTIONS

Part of any research project in archaeology is the research design, a set of questions or hypotheses that a researcher is interested in addressing to assist in interpreting and understanding past human behavior. The nature of the research information potential is one of the criteria used to determine the significance of a site in terms of eligibility to the National Register of Historic Places. This particular research project is not designed to address or answer specific questions about prehistoric human behavior in this area. Rather, the thrust of this research, is to identify the nature of data contained within this class of site and the types of research questions this data has the potential to address. The research areas, or domains, are primarily taken from McGuire (2000), Mikkelsen and Bryson (1997), and Moratto (1994), as modified by the senior author and Chartkoff (1995). The six main areas of archaeological research interest of concern here deal are CHRONOLOGY, SITE FUNCTION, LITHIC TECHNOLOGY, SETTLEMENT PATTERNS, SUBSISTENCE PATTERNS, and POPULATION MOVEMENT.

An additional goal of this project is to test the value of current standard "test excavation" methodology versus the increased use of the shallow, broad area "surface scrape and screen" testing method.

Project-Specific Research Questions

As stated above this research project is not classic academic-oriented research, but rather a mangement oriented project designed to efficiently evaluate a specific class of prehistoric archaeological site. Therefore, we are not attempting to prove, disprove, or verify some lofty academic anthropological question dealing with hunter-gatherer societies. The goal is to simply identify the type of information present within a class of site and suggest the types of research questions that may be addressed. This knowledge will be valuable in formulating reasonable management options for this ubiquitous site type. Briefly, there are three major questions that are hoped to be addressed by this project:

<u>What is the nature of the archaeological values, or research potential, contained in small, relatively sparse lithic scatters?</u>

<u>Are present standard archaeological testing methods adequate to properly identify the actual archaeological information potential of this class of site?</u>

<u>Does this class of site contain sufficient archaeological values or information potential to qualify for the National Register of Historic Places?</u>

General Research Questions

I. CHRONOLOGY

GENERAL: Determination of the time span represented at each site and within the project area as a whole and aerial chronology (relative and absolute dates, culture changes, etc.)

PROBLEM: Need to establish a reliable chronological timeline into which sites may be placed.

METHOD: Use of existing chronological sequences as established for Surprise Valley (O'Connell 1975), Nightfire Island/Lower Klamath Lake (Sampson 1985) and the Modoc Plateau (PGT/PG&E and Tuscarora pipeline projects), as illustrated by temporally diagnostic projectile points or other artifact types.

Verify using C-14 dating where samples are available.

Verify using obsidian sourcing/hydration analyses. (Use data for seriation of single component sites and/or identification of multi-component sites.)

Are single component (occupation/use) sites present? Stratified multicomponent sites? Mixed component sites (i.e., no apparent stratigraphy w/mixing of temporally different materials)?

Can single component loci be identified within sites? Can these loci be seriated and placed in chronological perspective?

Can temporally diagnostic artifact types be successfully used to place most sites in chronological perspective? Can the use of obsidian sourcing/hydration verify or reinforce this chronological perspective?

Can sites without temporally diagnostic artifacts be seriated into chronological perspective based solely on obsidian sourcing/hydration of waste flakes/non-diagnostic artifacts?

Are C-14 datable materials present in this class of open-air archaeological sites in this environmental setting? (If not - why? Are soil and environmental conditions not conducive to preservation of organic materials?)

II. SITE FUNCTION (Relates to settlement and subsistence patterns)

GENERAL: Can one determine the different functional activities of each site through the identification and analysis of the cultural materials present at each site?

PROBLEM: Need to establish a functional site type identification method.

METHOD: Reconstruction of the functions of tools and weapons through wear pattern analyses and replicative experimentation.

> What activities were occurring on these sites? Tool manufacture/repair/maintenance? Tool use such as processing plant foods, butchering, etc.? Habitation/occupation sites including either task specific or temporary camps with multiple activities and/or functions represented?
>
> Are changes in activities identifiable through time?

III. LITHIC TECHNOLOGY

GENERAL: Techniques, use, and raw material procurement.

PROBLEM: What technological methods of stone tool manufacture are evident? Any changes in technology through time?

METHOD: Attribute analysis/replicative experimentation.

PROBLEM: Lithic procurement systems - where were the lithic materials obtained? Are any exotics present? Indications of trade? Are any changes evident of obsidian procurement through time?

METHOD: Obsidian sourcing/hydration analyses.

> How many sources of obsidian are represented? Where are they located?
>
> Are there any visually distinctive sources (i.e., Blue Mountain.)?
>
> Are any sources unique in any temporal period or within an ethnic territory?
>
> Are any changes observable through time?

IV. SETTLEMENT PATTERNS

GENERAL: Why are sites located where they are?

Are there any observable changes in site location through time?

METHOD: Look at a wide range of sites of this class across the landscape and place them in temporal perspective utilizing chronological indicators such as projectile point styles, obsidian hydration, and radiocarbon dating.

V. SUBSISTENCE PATTERNS

GENERAL: Are any faunal/botanical remains preserved to identify food remains? Are there any food processing tools present (e.g., groundstone for plant food processing, or chipped stone indicative of hunting/game processing)?

Are there any observable changes in these food remains and/or processing tools through time?

VI. POPULATION MOVEMENT

PROBLEM: Have there been any significant population movements/changes in the area through time? Have there been boundary fluctuations between the ethnographic Klamath/Modoc and the Pit River?

METHOD: Analyses of diagnostic artifact types and obsidian source areas through time. (obsidian sourcing/hydration)

Are there observable changes in diagnostic artifact types through time - are they slow or abrupt?

Are there observable changes in obsidian procurement systems through time - are they slow or abrupt? Can these be correlated with artifact changes?

Is it possible to assign occupation/use of the project area to an ethnographic group or groups based on artifacts and/or obsidian sources?

DATA COLLECTION METHODOLOGY

In order to classify small Sparse Lithic Scatters into either single, double, or multi-component categories, a systematic data collection/sampling procedure must be developed to obtain a sufficient sample of obsidian for hydration analysis from both surface and subsurface contexts. Therefore, the sampling plan should recover surface materials, possibly along a site's axis, or from discrete observable surface loci, and comparable subsurface materials through test excavations and/or large area surface scrape and screen.

For this project, each site will have a central base line established which bisects the site from North to South and will be crossed with an East-West base line near the perceived center of the site. This may be subject to modification, however, based upon the actual site orientation and terrain and vegetation.

A series of 2-meter by 2-meter squares will be set up along the long axes of the base line across the entire length of the site. These squares, or grid units, will be numbered according to a quadrant system of letters and numbers. Thus, the first row of units along the baseline will be numbered accordingly as illustrated in Figure 3.

The excavation methodology consists of using shovels, trowels and buckets to remove soil for screening through 1/8-inch and, possibly, 1/4-inch screens. The field crew will screen the majority of the soil from the units through 1/8-inch screens, and only a small sample through 1/4-inch screens, and will collect a small column sample for micro-screening, to recover a sample of micro-debitage. Soil will be screened onto tarps placed adjacent to the excavation units in order to minimize contamination of unexcavated portions of the site and to facilitate later backfilling. Excavation depth will be to a depth of 10 centimeters below the average ground surface of each unit. Unit floors should be flat, however if there are minor rises within a unit, those areas will be excavated to the average level of the unit even though this may mean excavating slightly more or less than 10 centimeters due to surface undulations.

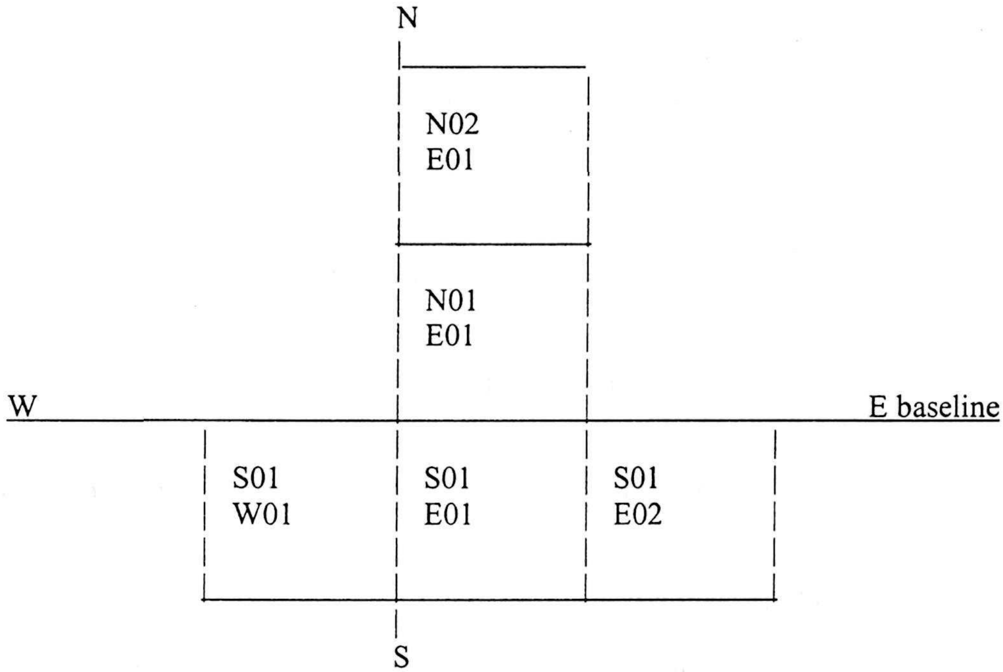


FIGURE 3. Basic Surface Scrape and Screen Grid Layout.

All debitage and artifacts will be collected and placed in appropriately labeled excavation level bags. An Excavation Level Record Form will be completed for each unit excavated. Formal flaked stone tools, such as projectile points and bifaces, which have not been touched by the excavator's hand, will be bagged immediately in plastic collection bags for blood residue analysis. A sample of all obsidian lithics will be selected for obsidian sourcing and hydration analysis.

Should the excavation yield a fire hearth, work in that feature will be done with trowel and whiskbroom and care will be taken to recover a sample of any identifiable charcoal and ash for radiocarbon dating.

In the unlikely event that any human remains are encountered, the excavation in that unit will halt immediately and the Forest will take the appropriate actions to comply with the provisions of the Native American Graves Protection and Repatriation Act.

1999 EXCAVATIONS AT FS-05-09-56-2413 (CA-Mod-3745)

This site was first recorded during the fire timber salvage archaeological inventory for the 1996 Long-Damon Fire. A contract archaeological field crew from Dames and Moore recorded the site in October 1996. The Dames and Moore crews inventoried over 8,000 acres and located and recorded nearly 400 archaeological sites and isolated finds. This site, recorded as FS-05-09-56-2413 (CA-Mod-3745), was described as consisting of a small, dense lithic scatter of obsidian waste flakes, two obsidian Guntheroid projectile points and one biface tip situated near the top of a small knoll in a brushy clearing within a pine/juniper woodland. See Figure 4 for an overview of the site.

FIGURE 4: Overview of the site looking to the NNW. The crew is laying out the grid baselines.

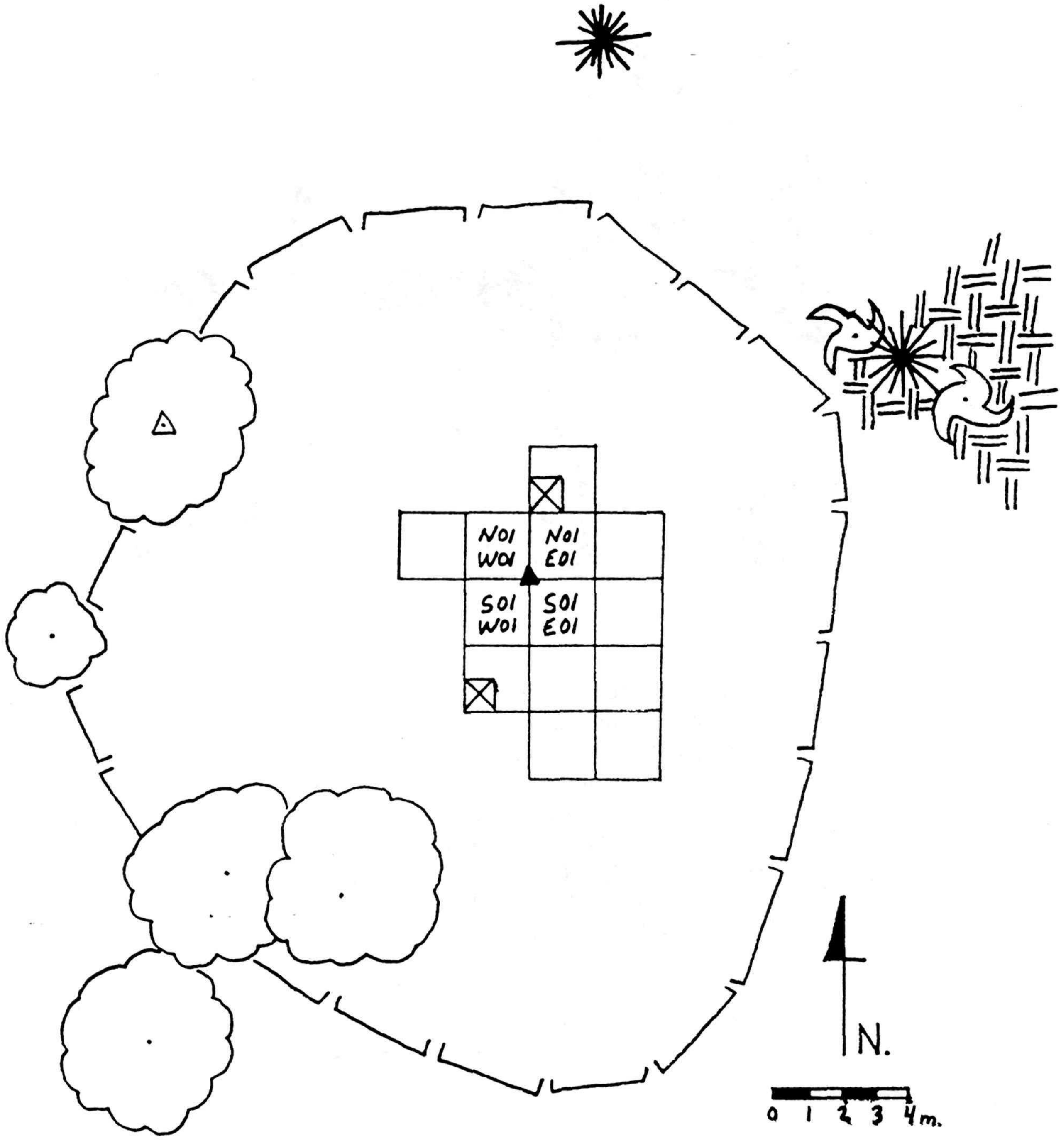
The observed cultural materials on the surface of the site consisted of the two points, a biface tip, and approximately 40 obsidian biface thinning and other waste flakes of black translucent banded, black translucent, gray translucent banded, and black transparent material. The size of the site was plotted at about 21 meters E-W by about 10 meters N-S, or roughly about 210 square meters. The elevation of the site is about 4,530 feet. The site had been burned over during the fire in August 1996, and the field crew noted that there had been vehicular traffic through the site (probably a fire suppression vehicle). Ground visibility was very good, and most surface vegetation was burned off. The trees on-site and adjacent to the site were all burned, but still standing. A metal site Datum tag was nailed to a juniper in the Northwest corner of the site.

A week prior to the 1999 excavations, the author visited the site to check site access and to verify its location. During that visit, the biface tip was still visible in the approximate location where it had been plotted, however, only 10 or 11 waste flakes of obsidian were visible including one very nice example of a classic biface-thinning flake (BTF).

The first day of the excavation, prior to setting up the grid baselines, the site was closely inspected and surface objects pin-flagged. The biface tip was still present, and this time fifteen waste flakes (including the BTF) were observed and flagged. However, the only items collected from the site surface at this time were those items that were within the surface scrape and screen units. A metal spike was placed in the ground to serve as the marker for the grid center-point.

Based upon the current surface indications, the size of the site was expanded to approximately 26 meters North-South by 22 meters East-West (see Figure 5). This increased the site size from the original 210 sq. meters to about 450 sq. meters.

Excavations were completed for 13 of the 2x2 meter excavation units utilizing the methods described previously (see Figure 6). A southwest corner quadrant, measuring 1x1 meter, from two of these units was selected to represent our traditional method of test excavation for this class of site. Each of these 1x1's was excavated in 10-centimeter levels to sterile soil. In each case the units bottomed-out at no



FS-05-09-56-2413
(CA-Mod-3745)

Legend:

- Site Datum
- Grid Center Stake
- Site Limits (approx.)
- 1x1 m. Test Unit
- Juniper
- Pine
- Scrape & Screen Unit
- Pine Stump
- Scabrock Outcrop

FIGURE 5: Site Map - FS-05-09-56- 2413

deeper than 30 centimeters, where fractured bedrock was encountered. One of these units was screened through ¼-inch mesh screen rather than the 1/8-inch mesh used for all other excavation units. The data collected from these two test units will be presented first.

The two Test Units were the southwest quadrants of units N02/E01 and S02/W01. The northern unit was selected for use of ¼-inch mesh screening. Table 1 below summarizes the artifact yields by level for these two 1x1 units. No diagnostic artifacts were recovered from either test unit.

As it is evident from the data in Table 1, if one was intending to conduct a determination of NRHP eligibility for this site based upon this data, it would be a quite simple task of stating that the site is clearly <u>not</u> eligible due to the paucity of its information potential. The two surface diagnostic projectile points indicate a Late Archaic period use of the site and could also yield obsidian sourcing and hydration information, as could a sample of the few waste flakes recovered. None of the bones recovered from N02/E01 were diagnostic beyond small or medium mammal.

FIGURE 6: Excavation of the first row of surface scrape and screen units. View is to the north.

Traditionally, that would be the extent of the information recovered from this site – at some point in the Late Archaic period a single hunter or small group of hunters stopped at this spot, discarded some arrow points, possibly sharpened or retouched some tools, and the charred bone may or may not have been associated with this event. One point (09-3143-01) was sourced to Buck Mountain with a hydration reading of 1.6 microns, while the second point (09-3143-02) was sourced to East Medicine Lake and yielded 2.3 microns. Obsidian sourcing of a single flake from the S02/W01 test pit may indicate the source of preference was the East Medicine Lake source. The two EML hydration readings of 1.4 microns for the flake and 2.3 microns for the point may not be indicative of a single event for this cultural deposit, but rather a mixed, two component site. Using the EML hydration rate formula (see Mikkelsen and Bryson 1997) this site would date to between 272 years and 760 years B.P., or between roughly 1728 and 1240 A.D. (with an average of about 1484 A.D.) The hydration rate for Buck Mountain obsidian is roughly similar to that of EML and grasshopper group obsidians (McGuire 2000). The 1.6 micron reading for a Buck Mountain obsidian sample yields a date of roughly 441 B.P., or about 1559 A.D. With this done, the site would be determined ineligible for the National Register of Historic Places, placed in the management category of "None" and would henceforth receive no protection from any planned Forest undertakings. This decision would be based on a 0.4% sample of the site.

	N02/E01 (1/4" screen)		S02/W01 (1/8" screen)		TOTALS	
	Detritus	Bone	Detritus	Bone	Detritus	Bone
Level 1: 0-10 cm.	5	10	5	0	10	10
Level 2: 10-20 cm.	3	6	6	0	9	6
Level 3: 20-30 cm.	3	0	1	0	4	0
TOTALS	**11**	**16**	**12**	**0**	**23**	**16**

TABLE 1: Summary of Archaeological Materials from Test Units.

As Paul Harvey would say, "Now, the rest of the story!" By looking at a much larger sample of the site through the 2x2 meter surface scrape and screen investigation, we are able to increase our sample size from 2 square meters to 52 square meters, or about 11.6%, albeit only to a depth of 10 centimeters. This provides us with a much clearer picture of the site and the activities that took place there at some point in time.

One major problem with the two 1x1 meter test units is that neither of them were situated within the major concentration area, or activity loci, which centers around unit S01/E01 and the units immediately to its north, east, and west. A distance of only a few meters dramatically changes the potential artifact yield. Figure 8 illustrates this by showing the distribution of obsidian waste flakes.

This patterning is also reflected in the distribution of projectile points, bifaces, utilized/edge-damaged flakes, and bones as illustrated in Figures 9, 10, 11, and 12 respectively. Collectively, this patterning illustrates the hazards of our traditional sampling methods including the miserably small sample size that could easily miss a concentrated loci, or activity area, such as the one encountered at this site.

Our surface scrape and screen units yielded a significantly larger volume of information, and a clearer picture of the prehistoric use this particular site and, possibly, a more refined placement in time than the traditional method would allow us to assign.

Now to present the data recovered from the "rest of the story", we will look at the flaked stone artifacts including projectile points, bifaces, utilized/edge-damaged flakes, and debitage; and the faunal remains. No ground stone tools (such as manos/metates or mortars/pestles) were recovered. This tends to suggest that plant food processing was not an activity conducted at this site. Rather, the data, as presented, will strongly suggest that FS-05-09-56-2413 (CA-Mod-3745) was a very short-term use, task-specific site most likely associated with the hunting related activities of a small group, probably of Pit River tribal affiliation.

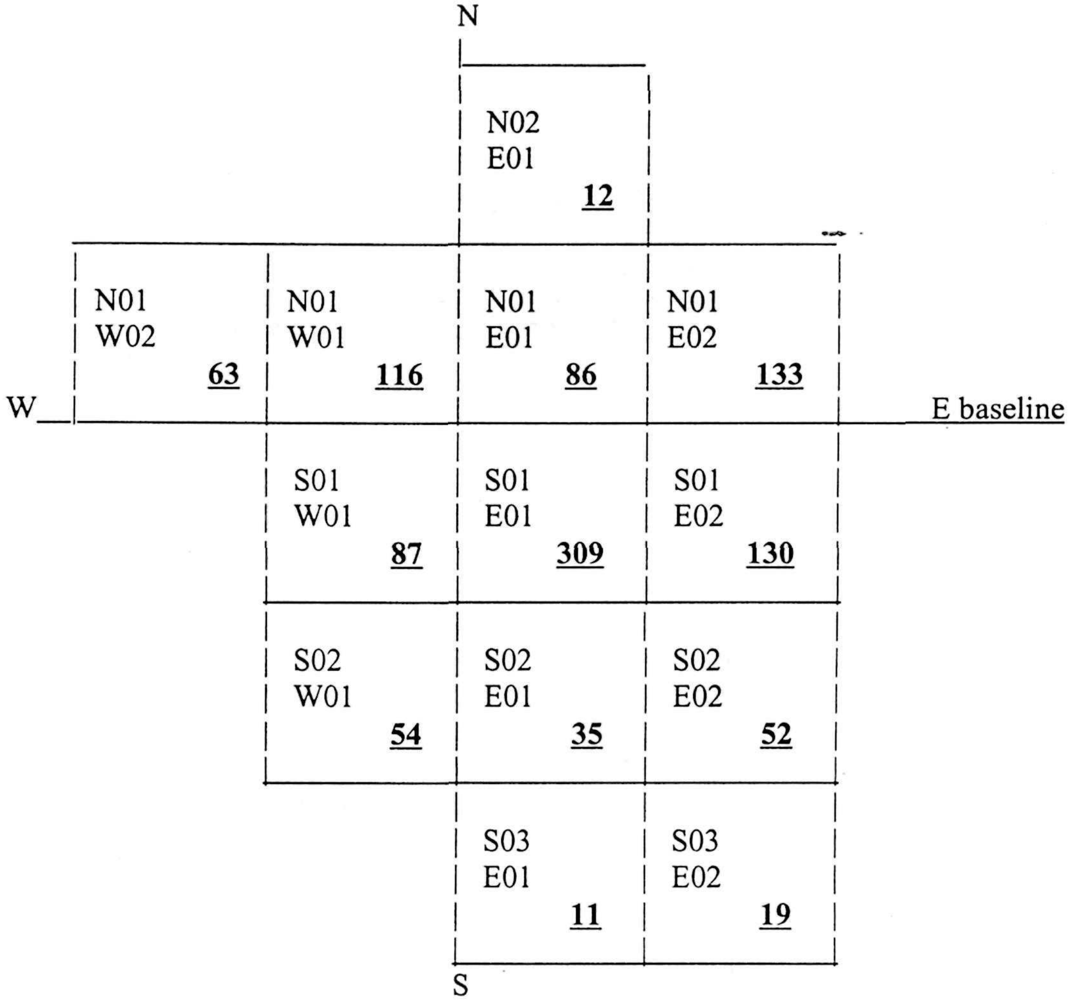


FIGURE 7: Distribution of Obsidian waste flakes (N = 1,136).

Projectile Points

Six diagnostic projectile points were recovered from the site. Two of these, both Late Archaic period Guntheroids were recovered from the surface of the site during its initial recording in 1996 (see Figure 8 a & b). Four additional points, also Late Archaic, were recovered from the surface scrape and screen units (Figure 7 c-f). Figure 9 shows the distribution of the points. Two Guntheroids (Figure 8a and 8b) were surface collected points from 1996.

The term "Guntheroid" is used in this area to denote a projectile point that is morphologically similar to a Gunther Barbed point, but has some dissimilarities as well. A classic Gunther Barbed has tangs, or barbs, that extend down to or even a little beyond its basal stem. The basal stem is usually tapered or contracting. In Guntheroids the tangs often do not reach the end of the basal stem, and the basal stem is more often parallel sided to slightly expanding. It is the author's contention that Guntheroids are a hybrid mix of Gunther Barbed and Rose Spring series points. Like the Gunther Barbed, the Guntheroids appear to extend in use all the way up to the proto-historic, and probably into the historic contact period as well. Four of the points are classified as Guntheroid. The other two points are classified as a probable Rose Spring Corner Notched point and a possible Rose Spring/Guntheroid (due to its fragmentary nature). Given the archaeological context and the obsidian hydration readings, it is evident that these points are all contemporaneous.

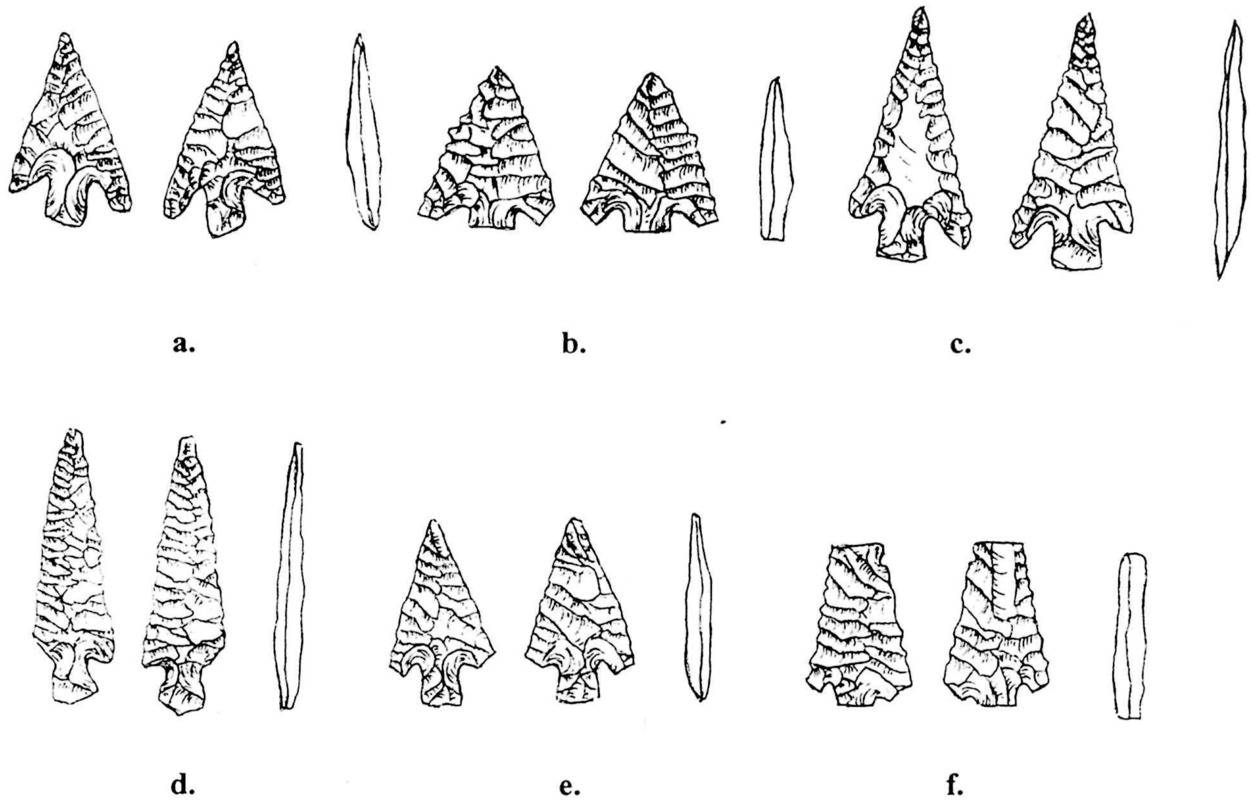


FIGURE 8: Projectile Points

a. Guntheroid (FSMA 09-3143-01; surface) b. Guntheroid (FSMA 09-3143-02; surface) c. Guntheroid (FSMA 09-3143-03; N01/W01) d. Rose Spring (?) Corner Notched (FSMA 09-3143-05; S01/E01) e. Guntheroid (FSMA 09-3143-83; S01/E01) f. Rose Spring/Guntheroid (FSMA 09-3143-118; S03/E02)

PROJECTILE POINT: Guntheroid; black banded translucent obsidian (XRF source: Buck Mountain; hydration: 1.6 microns). Length – 2.6 cm., Width – 1.6 cm., Thickness – 0.3 cm., Weight – 0.7 grams. Surface find – 11 meters @ 120 degrees from Datum. FSMA 09-3143-01 (Figure 7a)

PROJECTILE POINT: Guntheroid; gray banded translucent obsidian (XRF source: East Medicine Lake; hydration: 2.3 microns), missing portions of basal stem and both tangs. Length – (2.1 cm.), Width – (1.8 cm.), Thickness – 0.3 cm., Weight – (0.8 grams). Surface find – 13 meters @ 116 degrees from Datum. FSMA 09-3143-02 (Figure 7b)

PROJECTILE POINT: Guntheroid; black translucent, black and gray banded obsidian. Length – 3.37 cm., Width – 1.58 cm., Thickness – 0.32 cm., Weight – 0.9 grams. Unit N01/W01: 0-10 cm. FSMA 09-3143-03 (Figure 7c). Bagged for blood residue analysis.

PROJECTILE POINT: Rose Spring Corner Notched; black translucent, black and gray banded obsidian. Length – 3.57 cm., Width – 1.05 cm., Thickness – 0.3 cm., Weight – 0.9 grams. Unit S01/E01: 0-10 cm. FSMA 09-3143-05 (Figure 7d). Bagged for blood residue analysis.

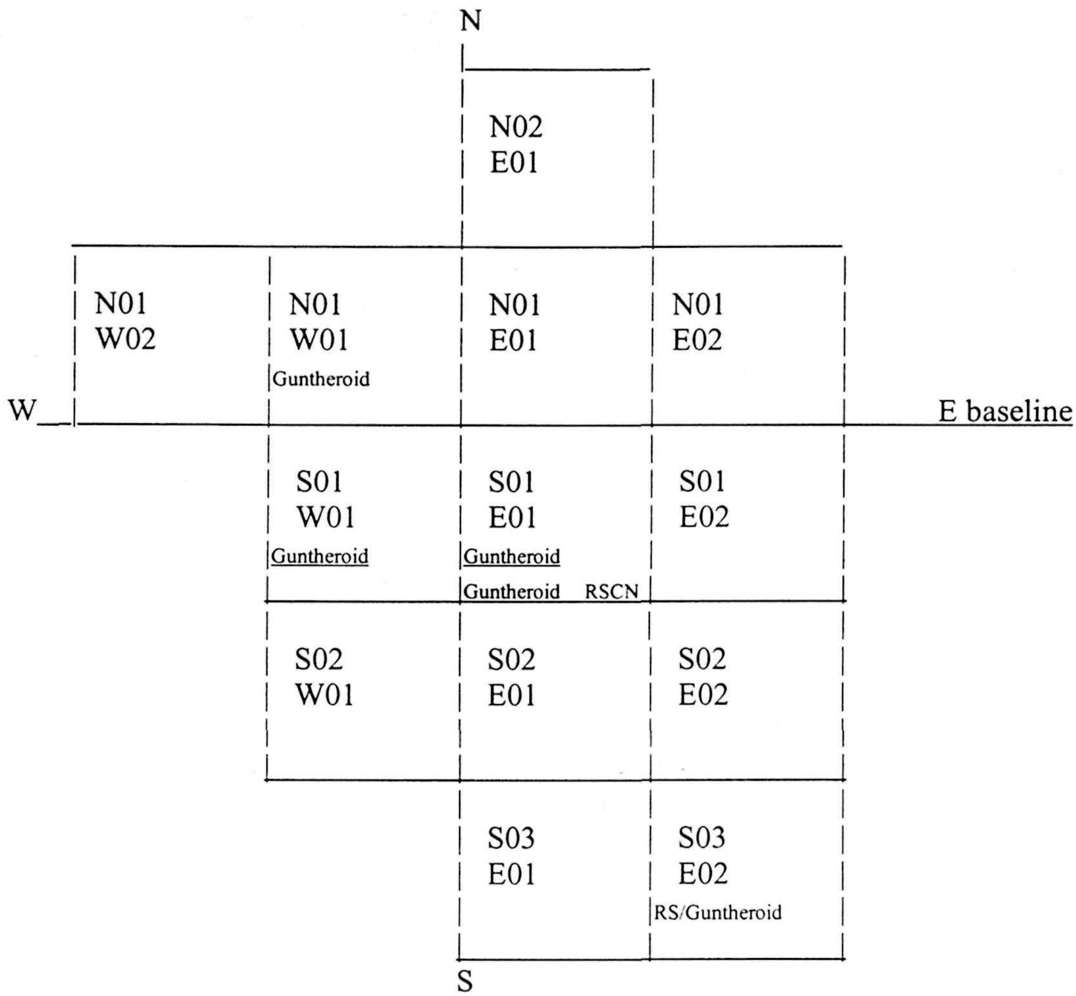


FIGURE 9. Distribution of Projectile Points (N = 6).

PROJECTILE POINT: Guntheroid; dark black/black banded translucent obsidian (XRF source: Spodue Mountain; hydration: 1.5 microns), missing portions of both tangs. Length – 2.37 cm., Width – (1.39 cm.), Thickness – 0.3 cm., Weight – (0.8 grams). Unit S01/E01: 0-10 cm. FSMA 09-3143-83 (Figure 7e).

PROJECTILE POINT: Rose Spring/Guntheroid (?); Black and gray banded, black translucent obsidian (XRF source: East Medicine Lake; hydration: 1.9 microns), missing portions of tip, basal stem, and both tangs. Fragmentary – no measurements. Unit S03/E02: 0-10 cm. FSMA 09-3143-118 (Figure 7f).

The obsidian sourcing and hydration data for the projectile points is interesting. It illustrates the diversity typical in most of the local archaeological sites, and shows multiple geochemical sources. The East Medicine Lake source lies in a border area between the Modoc to the north and the Pit River peoples to the south, while the Spodue Mountain source lies well within Klamath ethnographic territory. The Buck Mountain source is located in the Warner Mountains to the east within a border area between the Pit River peoples to the west and the Northern Paiute to the east. The distances from this site to these three obsidian sources are about 10-12 miles to the EML sources, 42-45 miles to Buck Mountain (although float obsidian nodules geochemically identifiable as Buck Mountain do occur much closer on the Devil's Garden to the east), and about 70 miles to the Spodue Mountain source.

The four hydration readings have a spread of only 0.8 microns, and include 1.5 (Spodue Mountain), 1.6 (Buck Mountain), 1.9 (EML), and 2.3 (EML). It is possible that the 2.3-micron reading may be the result of hydration rind expansion due to exposure to the heat of the wildfire (see Skinner et al. 1997).

Bifaces

A total of 12 biface fragments were recovered from the site, all from the surface scrape and screen units. Bifaces are defined as a flaked stone object that has been worked on both faces (Whittaker 1994: 178). Biface is a broad category, which can include projectile points, point fragments, point performs, knives, scrapers, and worked flakes. A biface can be made from either a flake or a core, but must be worked on both the dorsal and ventral surface in order to qualify for this category.

Diagnostic projectile points, usually considered separately by archaeologists and lithic analysts, are described in the previous section. Other bifaces and non-diagnostic projectile point fragments are described here.

One biface fragment (09-3143-18) was subjected to obsidian sourcing and hydration analyses. This piece was sourced to East Medicine Lake and yielded a hydration rind of 2.1 microns. This specimen is one of two pieces (w/09-3143-62) that fit together forming a portion of a large biface. Two additional biface fragments (09-3143-35 and -85) appear to be portions of the same broken biface. The pieces were recovered from different units, including N01/W01 (0-10 cm.), N01/E01 (0-10 cm.), S01/W01 (Surface), and S01/E01 (0-10 cm.). All four units are contiguous at the center of the site and, therefore, the four pieces may have actually been recovered from a fairly small area at the intersection of the four units. All of the pieces exhibit percussion flaking. It is possible that this biface was broken during manufacture, and discarded.

BIFACE/PREFORM: Black translucent obsidian. Manufactured on a flake, with multiple step fractures on one edge resulting from an unsuccessful attempt to remove a thick dorsal ridge. Overshot (otre passé) flake scar on ventral surface. Possible projectile point preform. Length – 4.94 cm., Width – 2.72 cm., Thickness – 1.03 cm., Weight – 11.4 grams. Unit N01/W01: 0-10 cm. FSMA 09-3143-17 (Figure 10a).

BIFACE FRAGMENT: Black translucent obsidian. Fragment of biface, possible base, with hinge fracture. Small section of heavily patinated/cortical surface remaining. Length – 4.32 cm., Width – 2.0 cm., Thickness – 0.75 cm., Weight – 4.0grams. Unit S01/E01: 0-10 cm. FSMA 09-3143-85 (Figure 10b).

BIFACE FRAGMENT: Black translucent obsidian. Edge fragment of larger biface. Percussion retouch along biface edge. Snap fracture. Length – 3.25 cm., Width – 1.87 cm., Thickness – 0.96 cm., Weight – 4.1 grams. Unit S01/W01: Surface. FSMA 09-3143-62 (Figure 10c).

PROJECTILE POINT TIP: Black translucent, black banded obsidian. Broken tip of a projectile point. Snap fracture. Serrated with parallel pressure flaking. Length – 1.55 cm., Width – 0.86 cm., Thickness – 0.2 cm., Weight – 0.2 grams. Unit S02/W01: 0-10 cm. FSMA 09-3143-69 (Figure 10d).

PROJECTILE POINT FRAGMENT: Grey translucent obsidian. Multiple fractures with minimal bifacially worked surfaces remaining. Length – 1.39 cm., Width – 0.98 cm., Thickness – 0.46 cm., Weight – 0.3 grams. Unit S01/W01: 0-10 cm. FSMA 09-3143-64 (Figure 10e).

BIFACE FRAGMENT: Black translucent obsidian. Very small fragment with slight working along edge. Length – 1.05 cm., Width – 0.64 cm., Thickness – 0.32 cm., Weight - 0.1 grams. Unit N01/E01: 0-10 cm. FSMA 09-3143-36 (Figure 10f).

BIFACE FRAGMENT: Black translucent, gray-banded obsidian. Small fragment with two hinge fractures. Length – 2.04 cm., Width – 1.15 cm., Thickness – 0.81 cm., Weight – 1.8 grams. Unit N01/E01: 0-10 cm. FSMA 09-3143-35 (Figure 10g).

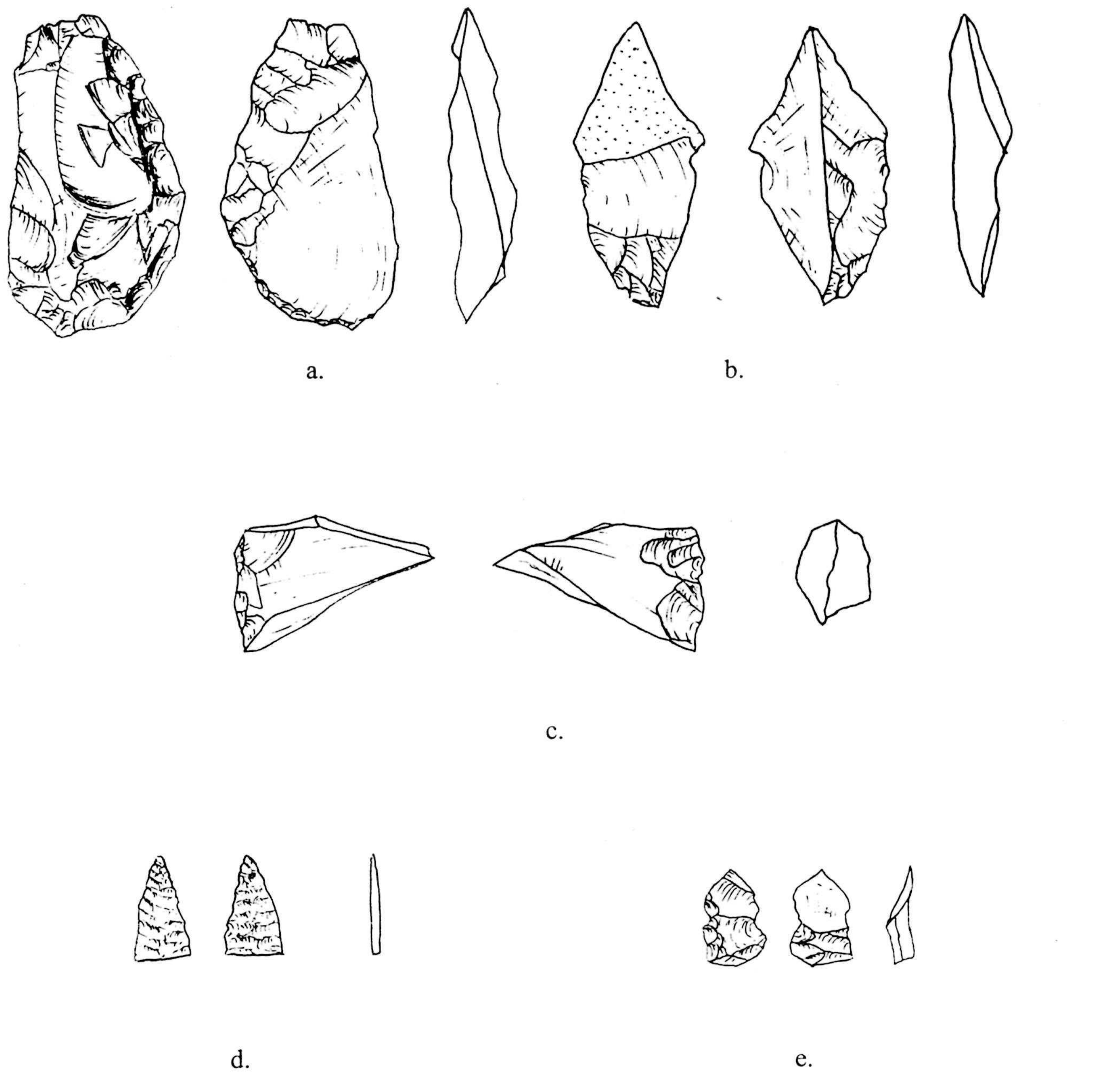
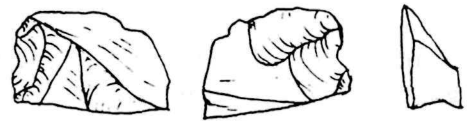


FIGURE 10: Bifaces

a. Biface/Preform (FSMA 09-3143-17; N01/W01), b. Biface Fragment (FSMA 09-3143-85; S01/E01), c. Biface Fragment (FSMA 09-3143-62; S01/W01), d. Projectile Point Tip (FSMA 09-3143-69; S02/W01), e. Projectile Point Fragment (FSMA 09-3143-64; S01/W01).



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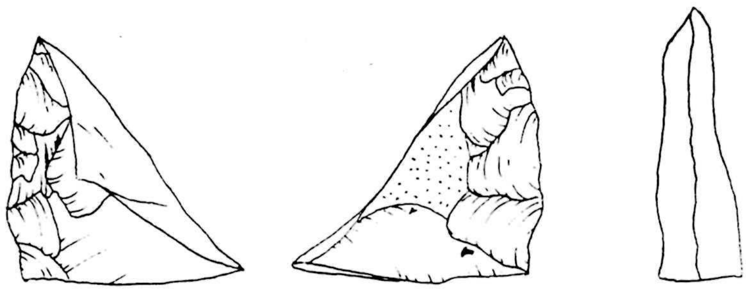

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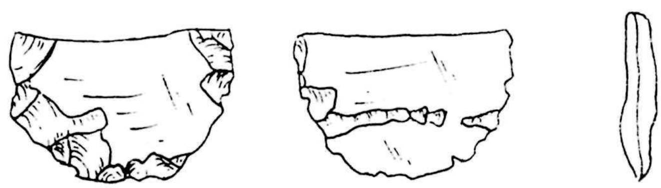

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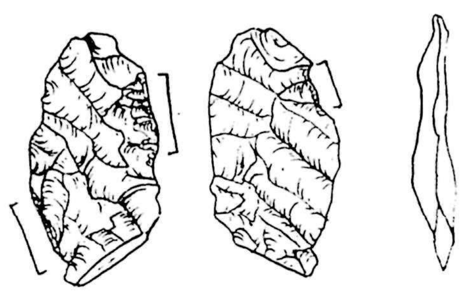
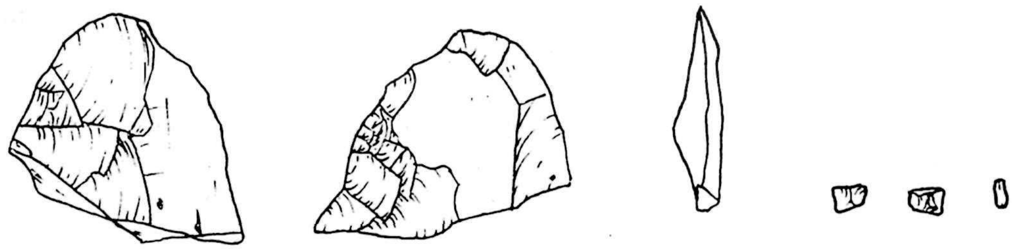


j.

FIGURE 10: Bifaces (continued)

f. Biface Fragment (FSMA 09-3143-36; N01/E01), g. Biface Fragment (FSMA 09-3143-35; N01/E01), h. Biface Fragment (FSMA 09-3143-18; N01/W01), i. Biface Fragment (FSMA 09-3143-86; S01 E01), j. Biface (FSMA 09-3143-84; S01/E01).



k. l.

FIGURE 10: Bifaces (continued)

k. Biface Fragment (FSMA 09-3143-97; S01/E02), l. Projectile Point Basal Stem Fragment (FSMA 09-3143-108; S02/E02).

BIFACE FRAGMENT: Black translucent obsidian. Fragment of large biface. Some cortex visible on one face. Multiple snap fractures. Length – 3.17 cm., Width – 3.12 cm., Thickness – 1.03 cm., Weight – 7.2 grams. Unit N01/W01: 0-10 cm. FSMA 09-3143-18 (Figure 10h).

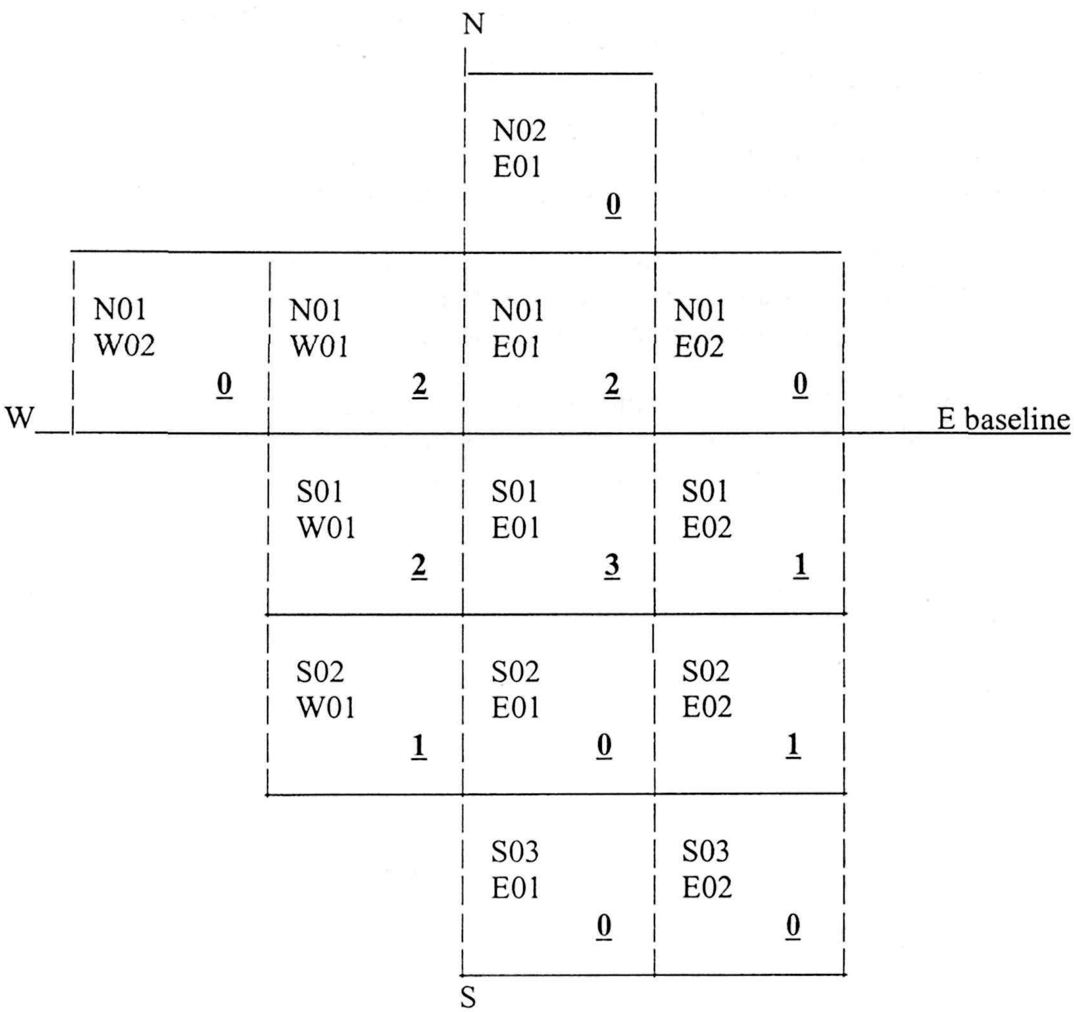


FIGURE 11. Distribution of Bifaces/Fragments (N = 13)

BIFACE FRAGMENT: Black translucent, black and gray-banded obsidian. Biface base with minimal retouch. Transverse fracture. Length – 2.95 cm., Width – 1.91 cm., Thickness – 0.36 cm., Weight – 2.5 grams. Unit S01/E01: 0-10 cm. FSMA 09-3143-86 (Figure 10i).

BIFACE: Black translucent, black banded obsidian. Bifacially worked piece with sub-parallel flaking. Fractured at one end. Some evidence of use wear on lateral margins. Length – 3.25 cm., Width – 1.72 cm., Thickness – 0.62 cm., Weight – 3.3 grams. Unit S01/E01: 0-10 cm. FSMA 09-3143-84 (Figure 10j).

BIFACE FRAGMENT: Black translucent, black banded obsidian. Made on a flake. Minimal retouch on both faces. Length – 2.83 cm., Width – 2.80 cm., Thickness – 0.5 cm., Weight – 3.9 grams. Unit S01/E02: 0-10 cm. FSMA 09-3143-97 (Figure 10k).

PROJECTILE POINT BASAL STEM FRAGMENT: Black translucent obsidian. Very small bifacially worked fragment, which may be the stem portion of a projectile point. Length – 0.52 cm., Width – 0.42 cm., Thickness – 0.21 cm., Weight – 0.1 grams. Unit S02/E02: 0-10 cm. FSMA 09-3143-108 (Figure 10l).

Utilized/Edge-Damaged Flakes

Utilized flakes are also commonly referred to as edge-modified pieces. This artifact category includes flakes or blades that exhibit alteration of their natural edges by minimal intentional flaking or, by use for scraping or cutting, resulting in edge attrition or nibbling. As Nilsson (1988) suggests, these specimens are classified as utilized/edge-damaged flakes only if they lack distinct morphological attributes, such as apparent intentional shaping, for inclusion into a more formal flake tool category. A total of 20 utilized or edge-damaged flakes were recovered from the surface scrape and screen units.

These items, or expedient tools, were classified based on the number of edges used and the type of edge shape. The number of edges used ranged from one to multiple and the edges were classified as either straight, concave, convex, or some combination of the three.

The one specimen (FSMA 09-3143-87) submitted for obsidian sourcing and hydration was sourced to East Medicine Lake and yielded a hydration rind of 2.3 microns. Again, it is possible that the hydration layer was altered (expanded) due to heat exposure during the wildfire.

UTILIZED FLAKE: Black translucent, black banded obsidian. Large flake with use wear on three margins: two straight and one concave margin. Length – 3.12 cm., Width – 2.45 cm., Thickness – 0.39 cm., Weight – 3.6 grams. Unit N01/E01: 0-10 cm. FSMA 09-3143-39 (Figure 12a).

UTILIZED FLAKE: Black translucent, black and gray banded obsidian. Flake with distal snap fracture, small notch and use wear on all three sides except fracture: two convex and one notched margin. Length – 2.16 cm., Width – 2.83 cm., Thickness – 0.41 cm., Weight – 2.4 grams. Unit N01/E01: 0-10 cm. FSMA 09-3143-40 (Figure 12b).

UTILIZED FLAKE: Black translucent, black and gray banded obsidian. Transverse snap fracture across the middle of the flake. Small notch with patches of use wear on all sides: straight and convex margins with notch. Length – 1.81 cm., Width – 2.32 cm., Thickness – 0.55 cm., Weight – 2.5 grams. Unit N01/E01: 0-10 cm. FSMA 09-3143-41.

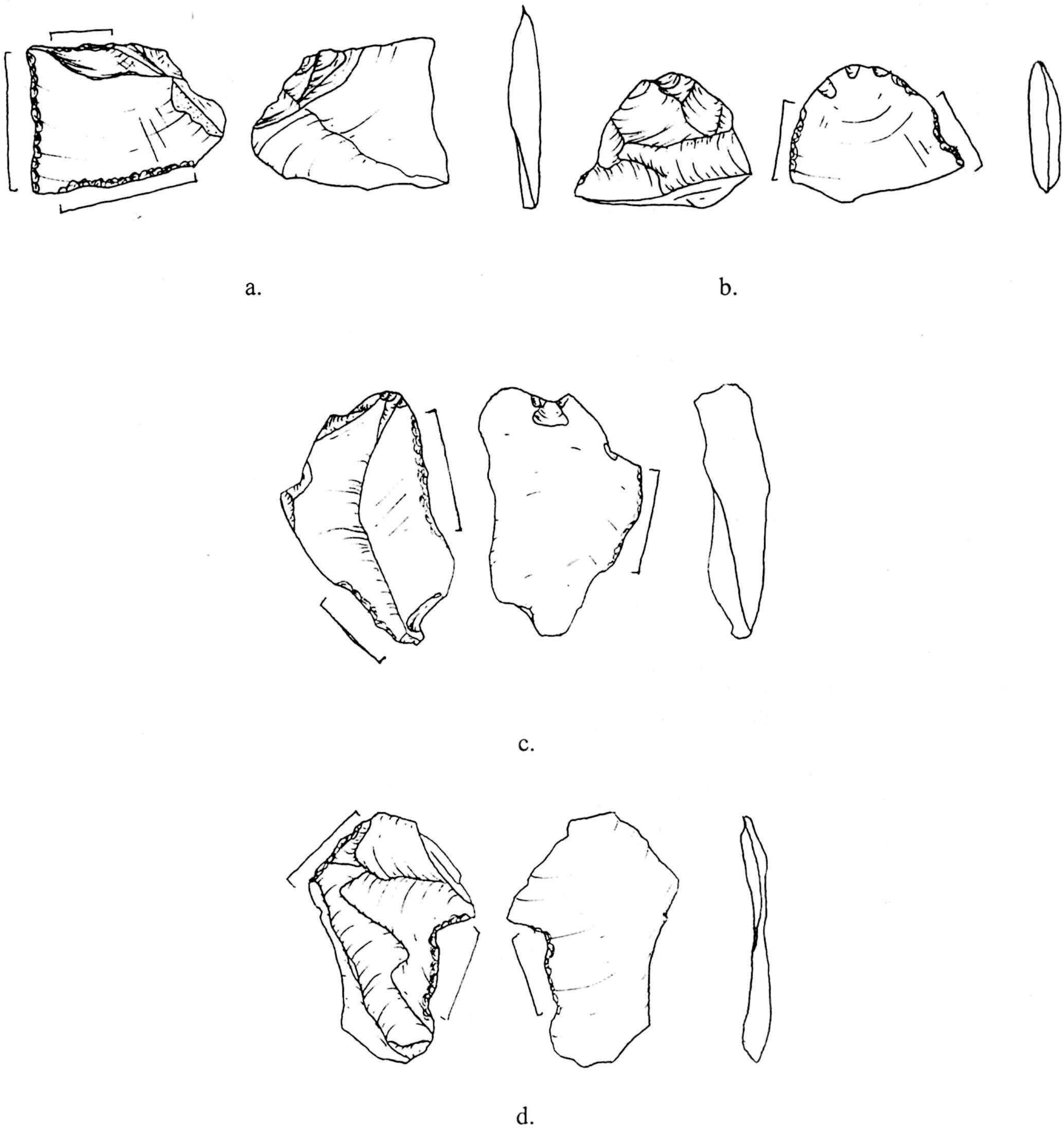


FIGURE 12: Utilized and Edge Damaged Flakes
Utilized Margins indicated by bracket.

a. Utilized Flake (FSMA 09-3143-88; S01/E01), b. Utilized Flake (FSMA 09-3143-40; N01/E01), c. Utilized Flake (FSMA 09-3143-39; N01/E01), d. Utilized Flake (FSMA 09-3143-37; N01/E01).

UTILIZED FLAKE: Black and gray mottled obsidian. Large flake with use wear on all edges: three concave and one convex margin. Length – 4.71 cm., Width – 2.65 cm., Thickness – 0.77 cm., Weight – 8.0 grams. Unit S01/E01: 0-10 cm. FSMA 09-3143-87.

UTILIZED FLAKE: Black translucent, black banded obsidian. Broken flake with use wear on two lateral margins: one straight and one concave margin. Length – 1.67 cm., Width – 0.94 cm., Thickness – 0.19 cm., Weight – 0.4 grams. Unit N01/W01: 0-10 cm. FSMA 09-3143-20.

UTILIZED FLAKE: Black opaque obsidian. Broken flake with two utilized margins: one straight and one concave margin. Length – 2.73 cm., Width – 1.31 cm., Thickness – 0.22 cm., Weight – 0.7 grams. Unit N01/W01: 0-10 cm. FSMA 09-3143-21.

UTILIZED FLAKE: Black translucent, gray banded obsidian. Proximal flake fragment with lateral and a transverse snap fractures and one straight utilized margin. Length – 2.13 cm., Width – 1.42 cm., Thickness – 0.51 cm., Weight – 1.5 grams. Unit N01/W01: 0-10 cm. FSMA 09-3143-19.

UTILIZED FLAKE: Black translucent obsidian. Distal flake fragment with transverse snap fracture and three utilized edges: two concave and one convex margin. Length – 1.24 cm., Width – 1.59 cm., Thickness – 0.21 cm., Weight – 0.3 grams. Unit N01/W02: 0-10 cm. FSMA 09-3143-29.

UTILIZED FLAKE: Black translucent obsidian. Distal flake fragment with a transverse snap fracture and three utilized edges: two undulating concave/convex and one straight margin. Length – 2.19 cm., Width – 1.50 cm., Thickness – 0.17 cm., Weight – 0.7 grams. Unit S01/E01: 0-10 cm. FSMA 09-3143-89.

EDGE DAMAGED FLAKE: Black translucent black banded obsidian biface thinning flake with a small concave section of edge damage/use wear on the distal margin. Length – 3.88 cm., Width – 2.68 cm., Thickness – 0.35 cm., Weight – 3.0 grams. Unit S01/E01: 0-10 cm. FSMA 09-3143-91.

UTILIZED FLAKE: Black translucent, black and gray banded obsidian. Two concave utilized margins. Length – 4.07 cm., Width – 2.56 cm., Thickness – 0.82 cm., Weight – 6.0 grams. Unit S01/E01: 0-10 cm. FSMA 09-3143-88 (Figure 12c).

UTILIZED FLAKE: Grey translucent mottled obsidian. Proximal flake fragment with transverse snap fracture. One concave utilized margin. Length – 2.40 cm., Width – 2.45 cm., Thickness – 0.40 cm., Weight – 2.0 grams. Unit N01/W02: 0-10 cm. FSMA 09-3143-30.

EDGE DAMAGED FLAKE: Black translucent obsidian. Proximal flake fragment. Edge damage, probably from platform preparation, is visible on one margin. Length – 1.85 cm., Width – 3.36 cm., Thickness – 0.85 cm., Weight – 3.0 grams. Unit S01/E01: 0-10 cm. FSMA 09-3143-92.

UTILIZED FLAKE: Black translucent, black and gray banded obsidian. Two utilized edges: one straight margin and one notch. Length – 4.10 cm., Width – 2.72 cm., Thickness – 0.23 cm., Weight – 2.5 grams. Unit N01/E01: 0-10 cm. FSMA 09-3143-37 (Figure 12d).

UTILIZED FLAKE: Possible drill. Black translucent obsidian. Utilized on all margins: two straight and one concave edge. Small notch also present near distal end. Triangular shape. May have been used as a drill, though tip is missing. Length – 3.71 cm., Width – 1.97 cm., Thickness – 0.59 cm., Weight 2.8 grams. Unit N01/E01: 0-10 cm. FSMA 09-3143-38.

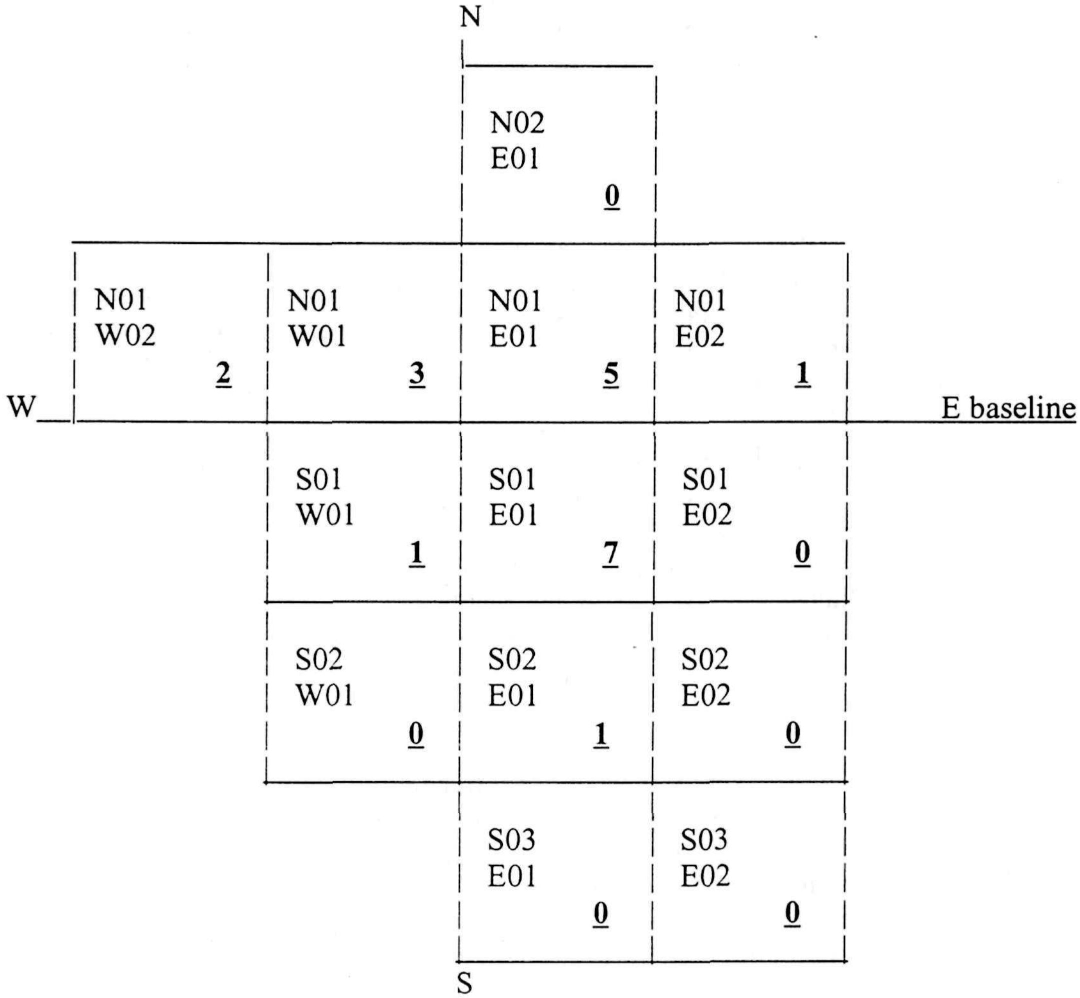


FIGURE 13: Distribution of Utilized/Edge-Damaged Flakes (N = 20).

UTILIZED FLAKE: Black translucent, black and gray banded obsidian. Triangular-shaped proximal flake fragment with transverse snap fracture. Utilized on all margins except fracture edge. One margin is heavily utilized with some unifacial retouch. Two concave utilized margins. Length – 2.42 cm., Width – 3.20 cm., Thickness – 0.40 cm., Weight – 2.3 grams. Unit S02/E01: 0-10 cm. FSMA 09-3143-103.

EDGE DAMAGED FLAKE: Black translucent obsidian. Flake fragment with edge damage/trampling on one convex margin. Length – 2.23 cm., Width – 1.26 cm., Thickness – 0.45 cm., Weight – 1.2 grams. Unit S01/E01: 0-10 cm. FSMA 09-3143-90.

NOTCH/UTILIZED FLAKE: Black translucent, gray banded obsidian. Biface thinning flake with one notch in distal end of flake. Length – 3.00 cm., Width – 3.85 cm., Thickness – 0.50 cm., Weight – 4.3 grams. Unit S01/E01: 0-10 cm. FSMA 09-3143-123.

UTILIZED FLAKE: Black translucent, black and gray banded obsidian. Proximal flake fragment with transverse snap fracture. Utilized on two convex margins. Length – 1.80 cm., Width – 2.51 cm., Thickness – 0.47 cm., Weight – 2.0 grams. Unit S01/W01: 0-10 cm. FSMA 09-3143-63.

UTILIZED FLAKE: Black translucent, black banded obsidian. Large biface thinning flake with one concave/convex utilized margin. Length – 4.82 cm., Width – 3.00 cm., Thickness – 0.33 cm., Weight – 5.0 grams. Unit N01/E02: 0-10 cm. FSMA 09-3143-47.

Debitage

The debitage was sorted into four size categories: large (≥ 1 inch [2.54 cm] diameter), medium (1 inch to ½ inch [2.54 cm to 1.27 cm] diameter), small (½ inch to ¼ inch [1.27 cm to 0.635 cm] diameter), and very small (≤ ¼ inch [0.635 cm] diameter). Sorting debitage by size grades yields information about the stage of reduction and type of reduction technique practiced by prehistoric peoples. Large percussion flakes, which often classify in the ≥ 1 inch diameter category, represent early and middle stages of core reduction. A prehistoric flintknapper would remove large flakes for initial shaping and reduction of a raw material nodule. Large flakes can also be made into other objects such as projectile points or knives, or employed in an unmodified form, resulting in utilized flakes. Small flakes, on the other hand, can be made during all stages of reduction. Pressure flakes, the final stage of projectile point manufacture, are very small in size and would classify in the ½ inch to ¼ inch, and ≤ ¼ inch categories. However, small flakes are not always the result of pressure flaking. Percussion flaking also can produce small flakes, which sometimes look very similar to pressure flakes. Small flakes are deliberately removed during early stages of stone tool manufacture as a way to prepare and stabilize the striking platform.

A brief statement can clarify the utility of size-sorting of archaeological debitage: large flakes almost always represent early and middle stages of core and biface shaping and reduction, while small flakes can be produced from any stage of reduction. If a site assemblage contains a full range of debitage sizes, it indicates that *at a minimum*, initial core or biface reduction occurred there. However, if *only* small or very small flakes are present, it is likely that only the final stages of tool manufacture or edge retouch were performed at the site. Unfortunately, site formation processes can always complicate the archaeological record.

The debitage analyzed from the surface scrape and screen units revealed that all size grades of debitage were represented in the archaeological assemblage. However, there was a high proportion of small (½

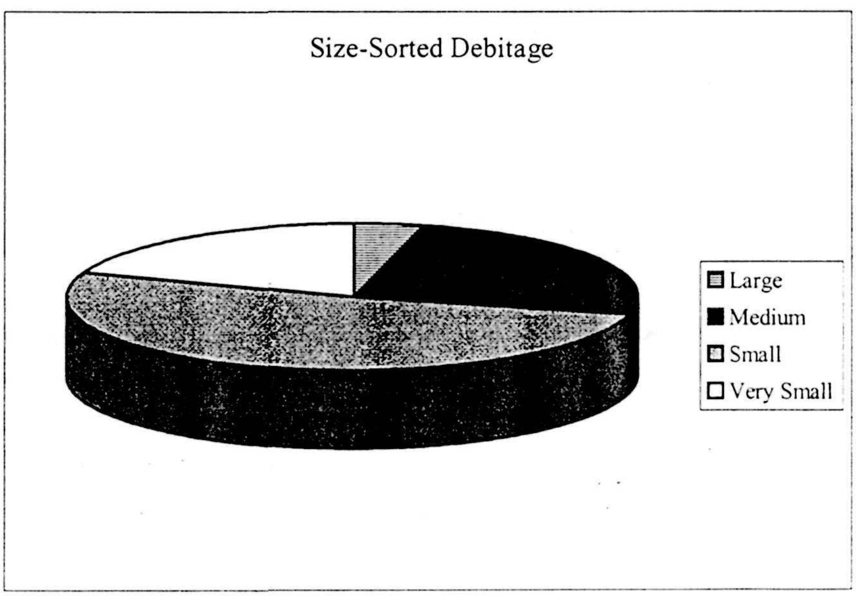


FIGURE 14: Size-sorted proportions in the lithic assemblage.

inch to ¼ inch diameter) debitage present (see Figure 14). This leads to the conclusion that most of the reduction activities taking place on site were late stage biface and tool production, involving edge modification, shaping, and bifacial retouch. However, the minimal presence of large flakes in the assemblage also indicates that early to middle stage shaping and reduction was also performed on site, although to a limited degree.

Another way of determining the stages of tool reduction present on a site is through analyzing the proportion of cortex visible on lithic debitage. If cortex is present, it means that the flakes were removed from the very outer surface of a raw material nodule. In this study, nearly all of the debitage failed to exhibit any cortex, indicating that nodules were reduced to some degree before being carried to the site. It is likely the debitage is the result of middle and late stage biface production or repair. Both pressure flakes, and hard and soft hammer percussion flakes were present on site.

Of special note, two large pressure flakes ($\geq$ 1 inch diameter) were recovered from Unit S01/E01 (0-10 cm.) that directly overlap, the natural banding of the obsidian making the match-up very clear.

One bipolar flake fragment (09-3143-109) was recovered from S02/E02 (0-10 cm.) that still retains a portion of the cortex of the small nodule from which it was struck. This piece is a very dark banded, almost opaque obsidian. It was probably an obsidian nodule picked up locally from the Devil's Garden or Pit River valley and most likely would come from the Buck Mountain obsidian source, located within the Warner Mountains over 40 miles to the east. A second bipolar example, a core remnant (09-3143-125) was recovered from N01/W01 (0-10 cm). Bipolar reduction is an efficient method for reducing small, rounded nodules of raw material. It yields small, flat flakes that can be made into small projectile points, scrapers, or utilized flakes.

In conclusion, based on the debitage assemblage from the site, late stage biface production and edge modification were the primary activities performed here by prehistoric flintknappers. In addition, some early to middle stage biface production was also performed, though to a lesser degree. Both the size-sorting analysis and lack of cortex on the flakes supports this conclusion.

Obsidian Sourcing and Hydration

The obsidian sourcing (X-Ray Fluorescence) data revealed that the raw material for the one or two cores reduced here was the East Medicine Lake (EML) geochemical source and, possibly, the Cougar Butte source (see Appendix 1). East Medicine Lake is actually two relatively close quarries/sources called "Yellowjacket" and "Stony Rhyolite Core" by Hughes (1986). It lies on the eastern flanks of the Medicine Lake Highlands and appears to be the primary source of obsidian used by two upriver bands of the Pit River Indians: the Atwamsini (Big Valley) and Astariwawi (Warm Springs Valley). Further east, the obsidian originates from various Warner Mountain sources, and to the west the primary obsidian quarries appear to be Grasshopper Group sources (Grasshopper Flat/Lost Iron Well/Red Switchback). It is not unusual for there to be a greater diversity in obsidian sources for formed tools as opposed to debitage. That is the case here. The five tools yielded three separate geochemical sources, while the 11 pieces of debitage yielded only two geochemical sources, with 10 of the pieces sourced to East Medicine Lake. The single piece of debitage sourced to Cougar Butte, located about two to three miles further west of the East Medicine Lake sources, appears to be a large percussion flake, possibly for trimming a core edge. A visual scan of all of the recovered flakes on a light table revealed a total of 30 additional waste flakes that appear to visually match this flake. This could be an indication of another core. However, visually identifiable Cougar Butte debitage makes up only about 2.6% of the total flake count from the excavated units. See Figure 16 for the location of these obsidian sources.

Unit/Depth		Catalog #	Type	Hydration	Source
From Datum	11m @120 deg	3143-01	Guntheroid projectile point	1.6	Buck Mountain
	13m @116 deg	3143-02	Guntheroid projectile point	2.3	EML
N01/W01	0-10 cm	3143-18	Biface fragment	2.1	EML
N01/E01	0-10 cm	3143-43(a)	Percussion Flake/Core Trim	2.2	Cougar Butte
		3143-43(b)	Percussion Flake fragment	1.8	EML
		3143-43(c)	Percussion Flake	1.3	EML
S01/E01	0-10 cm	3143-83	Guntheroid projectile point	1.5	Spodue Mountain
		3143-87	Utilized/Edge Damaged Flake	2.3	EML
		3143-93(a)	Percussion Flake	1.5	EML
		3143-93(b)	Percussion Flake	1.4	EML
		3143-93(c)	Percussion Flake	2.4	EML
		3143-93(d)	Percussion Flake fragment	1.8	EML
		3143-93(e)	Percussion Flake fragment	1.9	EML
S02/W01	10-20 cm	3143-77	Percussion Flake	1.4	EML
S03/E01	0-10 cm	3143-114(a)	Percussion Flake fragment	1.6	EML
S03/E02	0-10 cm	3143-118	Rose Spring/Guntheroid PP	1.9	EML

TABLE 2: Obsidian Hydration and Sourcing Results.

The obsidian hydration data yielded a late date that places the occupation of the site in the Late Archaic to Terminal Prehistoric period (see Appendix 1). Of the 16 specimens submitted for hydration, two were from surface contexts, 13 were from the 0-10 cm surface scrape and screen, and one was from below the 10 cm level from a test unit. Table 2 below illustrates the proveniences of the specimens, the hydration readings, and the geochemical sources as identified through X-Ray Fluorescence.

The 13 hydration readings from the East Medicine Lake specimens yield an average hydration reading of about 1.823 microns. Using the proposed hydration rate formula from the PGT/PG&E and Tuscarora pipeline projects for the Grasshopper Flat/East Medicine Lake obsidian (see Mikkelsen and Bryson 1997) this yields an average date of about 720 years ago, or circa 1280 AD. This is somewhat earlier than expected, but still within the Late Period.

```
N   5 |
u   4 |
m   3 |
b   2 |                         x s b  x x     x
e   1 |_______________________ x x x x  x x  x c x x ____________
r     0 1 2 3 4 5 6 7 8 9 1 1 2 3 4 5 6 7 8 9 2 1 2 3 4 5 6 7 8 9 3 1
                                  Microns
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x = East Medicine Lake   b = Buck Mountain   c = Cougar Butte   s = Spodue Mountain

FIGURE 15: Obsidian Hydration Plot.

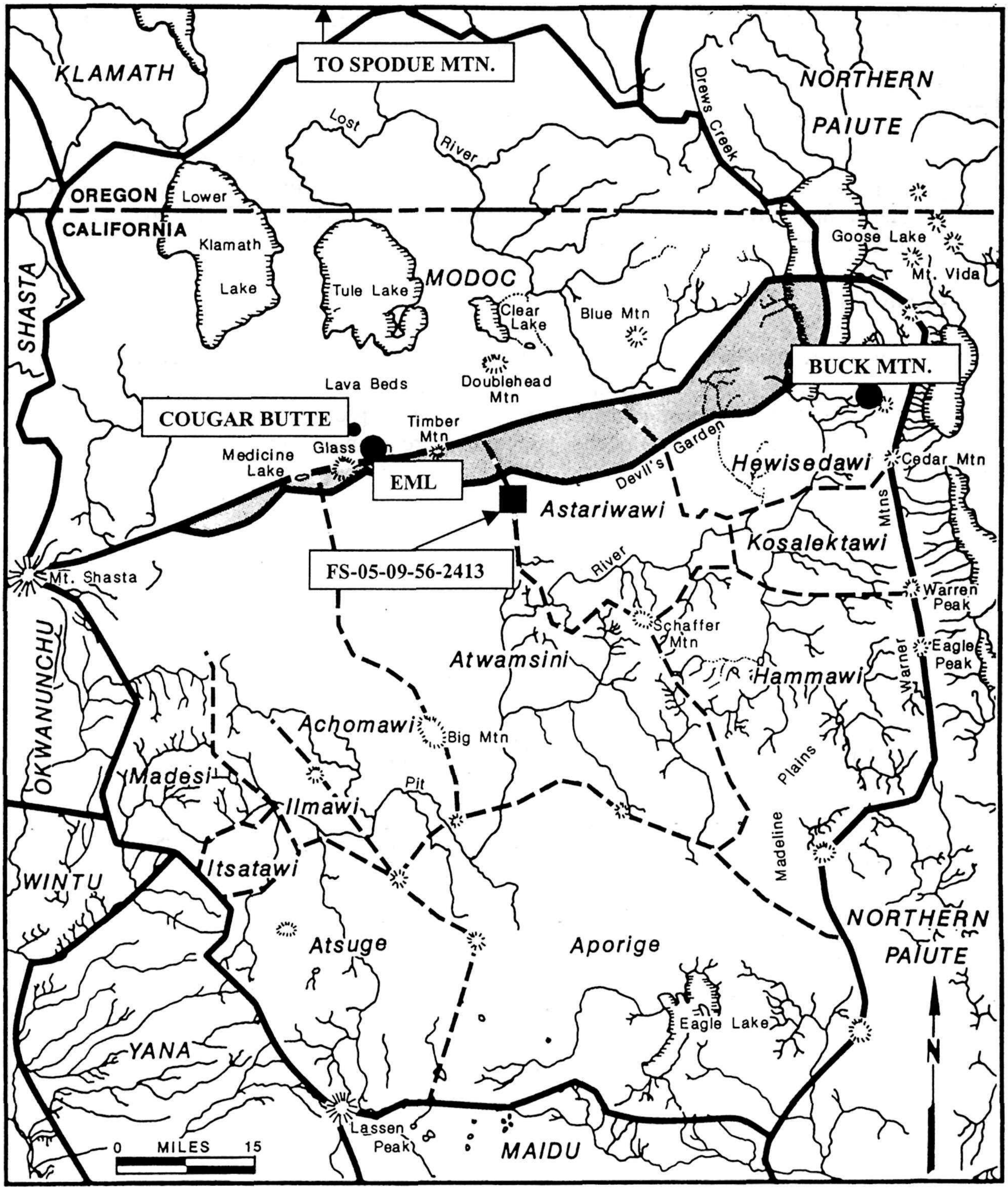

FIGURE 16: Location of Obsidian Sources.

However, the hydration readings measuring from 2.1 to 2.4 microns may possibly be the result of exposure to heat during wildfire. As Skinner et al. (1997) have noted, between 200•C and 300•C obsidian hydration rinds tend to expand before becoming diffuse and unrecognizable. If this has occurred here, a more accurate hydration mean can be obtained by eliminating these readings. The result is an average hydration reading for East Medicine Lake of about 1.622 microns, yielding an average date of about 640 years ago, or circa 1360 AD. This is much closer to the expected date, however, it is likely that the real date lies somewhere between 1280 and 1360 AD.

Blood Residue Analysis

The blood residue analyses on two projectile points and a small biface consisted of testing the items against the antisera for 1) human, 2) bear, 3) deer, 4) bovine, 5) Mountain. sheep, 6) rabbit, and 7) chicken. The results, however, were negative for any reaction to the antisera tested. See Appendix 2 for the detailed lab report.

Faunal Remains

Faunal remains were recovered from most of the units. Figure 12 shows the distribution of 116 bone fragments (non-human), which were nearly all burned or charred. Heating, most likely human-caused, as opposed to a result of the recent wildfire or past wildfires, is probably the reason for the bones being preserved in these forest soils. Two of the specimens were animal teeth, which may or may not have been subjected to burning.

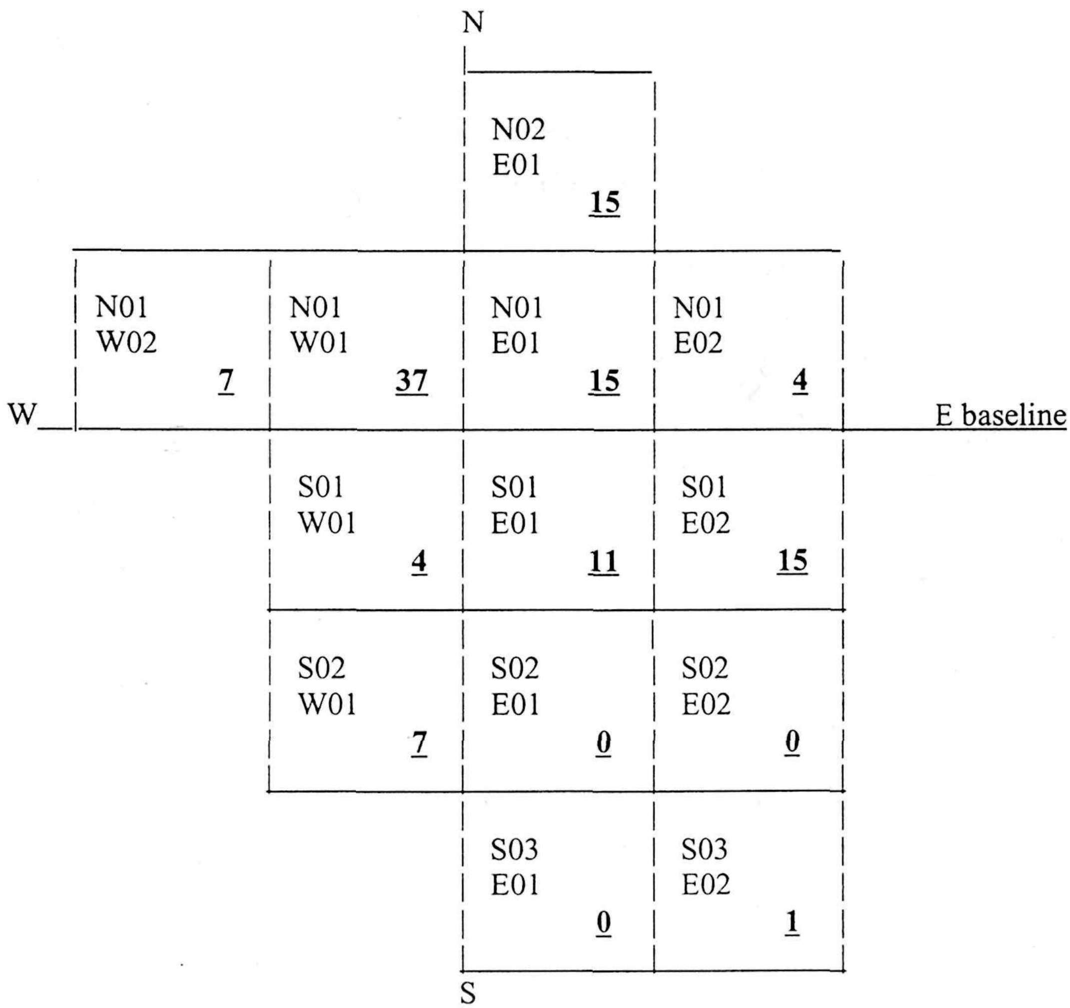

FIGURE 17: Distribution of Faunal Remains/Bone (N = 116).

The faunal remains were examined by Russell Bevill (see Appendix 3), of Dames & Moore, using the comparative collection housed at the Zooarchaeology Lab, Department of Anthropology, California State University, Chico. During shipment, a few of very dry fragments of bone splintered, resulting in a total of 125 bone fragments at the time of examination. Of the 125 bone fragments collected, 66 specimens, or roughly 53%, were too fragmentary to assign a class level. Fifty-two fragments, or nearly 42% of the sample, were classifiable as medium-to-large size mammal bones, including two partial ribs, one skull fragment, two long bone fragments, and two teeth. One tooth root (FSMA 09-3143-06b) is of a size similar to Artiodactyl and other large mammal teeth; however, it could not be identified to species since its crown has been removed by grinding and polish, evidence of a gritty diet. The other tooth (FSMA 09-3143-07b) is identified as a Mule deer (*Odocoileus hemionus*) mandibular incisor. A second mule deer bone (FSMA 09-3143-06a) was identified as a partial left astragalus bone from the rear leg or hindquarter of a deer. Five other bone fragments could be classified as small-to-medium mammal. One of these most likely belonged to a small rodent.

The vast majority of the bone is highly fragmented and was burned and calcined, interpreted as indication that the bone was the result of food remains discarded in a fire after consumption.

INTERPRETATION OF THE DATA

What does the data collected from this site tell us? First, we can address the following areas: a) the nature of the archaeological values in this sparse lithic scatter, b) adequacy of our traditional testing method, and c) NRHP eligibility determination for FS-05-09-56-2413 (CA-Mod-3745).

In order to discuss archaeological values, we will look at the general research questions. This site has two, and possibly three, types of archaeological data that may be used to deal with CHRONOLOGY. The six diagnostic projectile points (Figure 8), first of all tell us that this is a Late Archaic period site, dating between 1800 and 600 B.P. (years before present), or possibly a Terminal Prehistoric site, dating post-600 B.P. Second, the obsidian hydration readings clustering around 1.823 microns for the East Medicine Lake (EML) obsidian, may refine that date to circa 720 B.P. based upon the suggested hydration rate (Mikkelsen and Bryson 1997) for EML obsidian. Since charred faunal (bone) remains were recovered, they may be used for radiocarbon dating, thus offering a possible third method of placing this site in chronological perspective.

The questions dealing with SITE FUNCTION may also be addressed with data from this site. The presence of the hunting-related toolkit (i.e., projectile points, bifaces, utilized/edge-damaged flakes) and tool repair/manufacture (discarded points, broken bifaces, debitage) strongly suggests that this site was a very short-term, possibly overnight, camp for a small party of hunters. The charred faunal remains show that a portion of their prey was butchered, cooked, and consumed on-site. The limited archaeological remains seem to identify this as a task-specific site, rather than as a more generalized temporary camp. A temporary camp would probably contain a more diverse array of tools, including groundstone tools indicative of plant food processing (and probably the presence of women and children, as well).

The short duration of occupation/use of this site adds to its value for addressing LITHIC TECHNOLOGY questions. First, the lithic debitage appears to be the product of one flintknapping episode, by one or a few knappers, uncontaminated with either earlier or later chipping debris. Chartkoff (1995) notes "(i)n some cases, it could be possible to isolate flakes generated by single episodes of flaking, so that the toolmaking task could be reconstructed with a clarity not possible in more complex sites...Lithic scatters may be places where the archaeology of such individual actions can be reconstructed." As indicated by the two soft-hammer percussion flakes that can be refit, one next to the other, this site appears to be such an opportunity. The obsidian sourcing information shows a prehistoric preference for EML obsidian as a toolstone source. The two bipolar core remnants also illustrate that use of locally available obsidian nodules for expedient needs also took place. These last two points address the procurement of lithic raw materials.

The locational and temporal data contained in this site may address SETTLEMENT PATTERNS for this particular time period, and data from this class of site will shed light on questions dealing with changes of land use and settlement patterns through time.

Faunal remains and the blood residue data address SUBSISTENCE PATTERNS. Through the data contained in this class of site, identification of subsistence patterns may be possible for particular time periods, as well as illustrating any changes in those patterns through time.

The two theses by van de Hoek (1990) and Luhnow (1998) have shown the ability to use local archaeological data (e.g., Blue Mountain obsidian) to reconstruct ethnic territory boundaries. Based on the data from those two works, it is very unlikely that this site was created by members of the Kokiwas band of the Modoc, as indicated by the lack of Blue Mountain obsidian. Given the geographic location and existing ethnographic information, it is far more likely that the archaeological deposit at FS-05-09-56-2413 (CA-Mod-3745) was generated by members of either the Atwamsini (Big Valley) or Astariwawi (Warm Springs Valley) bands of the Pit River Tribe. Thus, data contained within this class of site may be useful in identifying ethnographic territories and boundaries, and as older sites of this type are studied it may be possible to identify and reconstruct changes in ethnic boundaries through time on the Devil's Garden. Both obsidian source and projectile point style data, as contained in this class of site, may be useful in addressing questions dealing with POPULATION MOVEMENT through time.

NATIONAL REGISTER OF HISTORIC PLACES ELIGIBILITY

This research indicates that FS-05-09-56-2413 (CA-Mod-3745) is eligible for nomination to the National Register of Historic Places based on criteria D. It "has yielded or is likely to yield information important in prehistory or history." The presence of relevant data to address each of six general research areas: CHRONOLOGY, SITE FUNCTION, LITHIC TECHNOLOGY, SETTLEMENT PATTERNS, SUBSISTENCE PATTERNS, and POPULATION MOVEMENT, illustrates the archaeological values present within this one site.

CONCLUSIONS

Now that we have presented and reviewed "the rest of the story", we have quite a more complex picture of FS-05-09-56-2413 (CA-Mod-3745). True, the site is still a task specific location with what may be construed as a limited set of data, but we must look at the associative value of that data. This site is a relatively pristine time capsule. The limited data are not contaminated with either earlier or later cultural deposits.

The site is a complete analytical unit in the sense of Mikkelsen and Bryson (1997) and represents a specific point in time. It is not a Late Archaic or Terminal Prehistoric occupational analytical unit with considerable mixing of artifactual constituents over time, masking exactly what artifacts were truly in use at the same time. Instead the picture is clear here at FS-05-09-56-2413 (CA-Mod-3745). All of the artifacts at this site were likely in use at the same time by the same small group of people. This is a sparse lithic scatter version of Pompeii! It is a site frozen in time. If one of the goals in anthropological archaeology is to identify past human behavior, then I propose that this type of site, albeit of a limited set of data, is exactly the type of site best suited to the task. It can reveal the activities of a small group of people at a particular point in time. By investigating additional sites of this nature in a similar fashion, it may be possible to identify patterns of human behavior exhibited at this type of site for the Terminal Prehistoric, the Late Archaic, the Middle-Late Archaic, the Middle Archaic, and the Early Archaic, and to determine if changes through time are evident. If such changes are apparent, then we may be able to postulate reasons for those changes and prepare a research design to test those hypotheses.

In a recent article Chartkoff (1995) noted:

> Among other things, the lithic scatter is an extremely common site type, possibly the most abundant type in California. It therefore represents a significant portion of the prehistoric archaeological record and needs to be taken into account for a full understanding of past cultural patterns. In addition, lithic scatters, by their very simplicity, provide unique representations of certain types of past behavior, particularly (but not only) lithic reduction, with fewer obscuring variables than in more complex sites. Some kinds of regional behavior patterns, such as raw material exchange, may be studied especially economically through lithic scatter analysis. For these and other reasons, then, the lithic scatter is a type of site whose significance deserves greater attention.

By examining this type of site in known ethnographic tribal territories it may be possible to identify and compare Pit River, Modoc, and Northern Paiute patterns. By using a direct historical approach, examining recent sites and then going back through progressively older sites, we can begin to address changes in populations and technology through time. The current study area purposefully includes both Pit River and Modoc ethnographic territory for a preliminary assessment of these directions for research. Recent studies by van de Hoek (1990) and Luhnow (1998) have shown the possibility of using a specific obsidian source (Blue Mountain) to identify tribal/band territories in the Devil's Garden area.

The current sample of one site is not adequate to realistically evaluate this class of site. That evaluation will await the collection of additional data from nine more sites as proposed for this research project.

What may be said, albeit with only one site excavated, is that our traditional methods of assessing the significance for small sparse lithic scatters should most likely be called into question. One of our excavators put it quite simply – "open a bigger window and you get a bigger picture." Perhaps our traditional 1x1's are just too small of a window for small, shallow sites with apparently limited sets of data?

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Appendix 1:

Obsidian Sourcing and Hydration Analysis
for
Site FS-05-09-56-2413, Modoc National Forest,
Modoc County, California

Northwest Research Obsidian Studies Laboratory

Craig Skinner at the Northwest Research Obsidian Studies Laboratory conducted obsidian sourcing and hydration. The obsidian sourcing equipment includes a Spectrace 5000 energy dispersive X-ray fluorescence (EDXRF) spectrometer containing a Si(Li) detector with a resolution of 155 eV FHWM for 5.9 keV X-rays (at 1000 counts per second) in an area 30 mm2. Signals from the spectrometer are amplified and filtered by a time variant pulse processor and sent to a 100 MHZ Wilkinson type analog-to-digital converter. The X-ray tube employed is a Bremsstrahlung type, with a rhodium target, and 5 mil Be window. The tube is driven by a 50 kV 1 mA high voltage power supply, providing a voltage range of 4 to 50 kV. Samples were analyzed for Zinc, Lead, Rubidium, Strontium, Yttrium, Zirconium, Niobium, Titanium, Manganese, Barium, and Iron (Skinner 2000).

Obsidian hydration is performed by making two parallel cuts into the edge of the artifact using a lapidary saw equipped with 4-inch diameter diamond-impregnated .004" thick blades. These cuts produce a cross-section of the artifact approximately one millimeter thick which is removed from the artifact and mounted on a petrographic microscope slide with Lakeside thermoplastic cement. The mounted specimen slide is ground in a slurry of 600 grade optical-quality corundum abrasive on a plate glass lap. This initial grinding of the specimen reduces its thickness by approximately one half and removes any nicks from the edge of the specimen produced during cutting. The specimen is then inverted and ground to a final thickness of 30-50 microns, removing nicks from the other side of the specimen. The result is a thin cross-section of the surfaces of the artifact (Skinner 2000).

The prepared slide is measured using an Olympus BHT petrographic microscope fitted with a filar screw micrometer eyepiece. A Panasonic color CCTV camera is mounted on the filar eyepiece and the image is directed to a Panasonic color video monitor. The filar eyepiece is used to measure the thickness of the hydration band projected onto the high resolution monitor. The specimen is first scanned under crossed polarizers and a first-order red (gypsum) plate in order to identify the birefringent hydration layer; the hydration layer is scanned under a magnification of 500X, 750X, or 1250X. The magnification is generally selected with regard to the opacity of the obsidian and the width of the hydration layer. When a clearly defined hydration layer is identified, the section is centered in the field of view to minimize parallax effects. Four rim measurements are typically recorded for each artifact or examined surface. Narrow rinds (under approximately two microns) are usually examined under a higher magnification. Hydration rinds smaller than one micron often cannot be resolved by optical microscopy (Skinner 2000).

Sixteen obsidian artifacts were submitted for obsidian sourcing and hydration. Thirteen of the sixteen (81.25%) samples were of East Medicine Lake (EML) obsidian, with one sample each from Buck Mountain, Spodue Mountain, and Cougar Butte. The Buck Mountain and Spodue Mountain samples were projectile points, while the Cougar Butte sample was debitage. Two of the East Medicine Lake samples were projectile points (15.4%), one was a biface, and one was a utilized flake. The remainder of East Medicine Lake samples were debitage.

It must be noted that the samples analyzed are not a random sample of the lithic material found during this project. Instead they represent a judgemental sample, and should not be considered a statistically accurate representation of the population of obsidian material from this site.

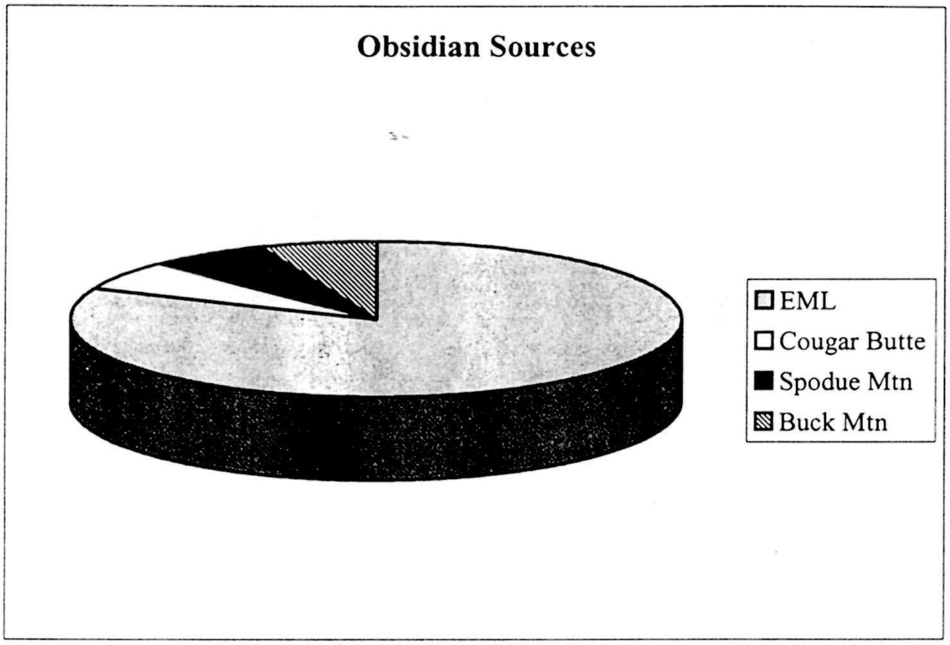

Figure 1: Obsidian sources determined by X-Ray Fluorescence

Obsidian hydration readings yielded an average measurement of 1.823 microns, placing the date for the site at about 1280 AD. However, as indicated earlier, the hydration readings from 2.1 to 2.4 microns may possibly be the result of exposure to heat during wildfire. As Skinner et al. (1997) noted, at temperatures between 200•C and 300•C obsidian hydration rinds tend to expand before becoming diffuse and unrecognizable. If these outlying hydration measurements are eliminated, the mean reading drops to 1.622 microns, yielding an average date of about 640 years ago, or circa 1360 AD. As is visible in the graph below, the hydration readings cluster into several peaks, perhaps indicating that some of the artifacts were subject to heating, while others were buried at the time of the fire and escaped heat damage to the hydration rind.

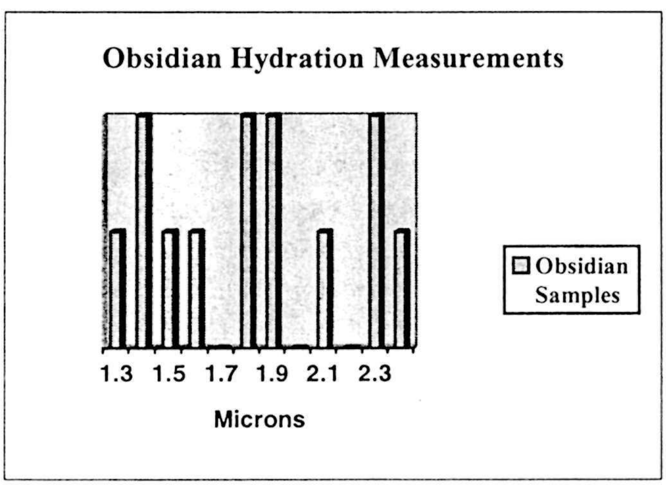

Figure 2: Obsidian hydration measurements for East Medicine Lake obsidian.

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Site FS-05-09-56-2413, Modoc County, California

Site	Specimen No.	Catalog No.		Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe2O3^T$	Fe:Mn	Fe:Ti	Artifact Source
				Trace Element Concentrations											Ratios		
FS-05-09-56-2413	1	09-3143-01		30	13	125	72	19	110	14	450	258	NM	0.43	20.1	34.4	Buck Mountain
			±	10	5	4	7	3	7	2	95	47	NM	0.11			
FS-05-09-56-2413	2	09-3143-02		40	27	151	80	25	210	12	1148	201	NM	1.06	60.6	30.7	East Medicine Lake
			±	9	3	4	7	3	7	2	96	47	NM	0.11			
FS-05-09-56-2413	3	09-3143-18		43	26	154	79	32	213	12	1368	241	NM	1.36	60.8	32.5	East Medicine Lake
			±	7	3	3	7	3	7	2	97	47	NM	0.11			
FS-05-09-56-2413	4	09-3143-43(a)		76	41	175	7	67	165	20	237	303	NM	0.99	34.5	130.7	Cougar Butte
			±	7	3	3	7	3	7	2	95	47	NM	0.11			
FS-05-09-56-2413	5	09-3143-93(a)		36	25	148	81	26	207	12	1186	240	NM	1.35	60.5	37.0	East Medicine Lake
			±	7	3	3	7	3	7	2	97	47	NM	0.11			
FS-05-09-56-2413	6	09-3143-93(b)		34	28	162	81	28	213	6	1336	257	NM	1.42	58.7	34.6	East Medicine Lake
			±	7	2	3	7	3	7	2	97	47	NM	0.11			
FS-05-09-56-2413	7	09-3143-77		34	22	149	82	28	214	12	1312	263	NM	1.50	59.9	37.0	East Medicine Lake
			±	7	2	3	7	3	7	2	97	47	NM	0.11			
FS-05-09-56-2413	8	09-3143-83		41	21	113	49	25	125	18	723	479	NM	0.65	14.1	31.1	Spodue Mountain
			±	7	3	3	7	3	7	2	96	47	NM	0.11			
FS-05-09-56-2413	9	09-3143-87		27	32	160	82	30	222	8	1263	233	NM	1.29	60.1	33.3	East Medicine Lake
			±	7	3	3	7	3	7	2	97	47	NM	0.11			
FS-05-09-56-2413	10	09-3143-118		29	23	149	81	27	210	10	947	216	NM	0.99	52.1	34.8	East Medicine Lake
			±	7	3	3	7	3	7	2	96	47	NM	0.11			
FS-05-09-56-2413	11	09-3143-43(b)		33	32	162	82	30	216	12	1323	256	NM	1.38	57.1	33.9	East Medicine Lake
			±	7	2	3	7	3	7	2	97	47	NM	0.11			
FS-05-09-56-2413	12	09-3143-43(c)		30	27	146	76	30	203	13	1380	272	NM	1.46	56.2	34.4	East Medicine Lake
			±	7	2	3	7	3	7	1	97	47	NM	0.11			
FS-05-09-56-2413	13	09-3143-93(c)		26	28	149	81	30	212	10	1201	224	NM	1.29	63.3	35.0	East Medicine Lake
			±	7	2	3	7	3	7	2	97	47	NM	0.11			
FS-05-09-56-2413	14	09-3143-93(d)		15	23	144	76	29	200	10	1193	246	NM	1.33	58.3	36.4	East Medicine Lake
			±	8	2	3	7	3	7	2	97	47	NM	0.11			
FS-05-09-56-2413	15	09-3143-93(e)		23	31	157	82	30	215	8	1240	241	NM	1.29	57.8	34.0	East Medicine Lake
			±	7	2	3	7	3	7	2	97	47	NM	0.11			
FS-05-09-56-2413	16	09-3143-114(a)		40	27	151	78	29	209	8	1471	272	NM	1.56	59.9	34.4	East Medicine Lake
			±	7	3	3	7	3	7	2	97	47	NM	0.11			

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Site FS-05-09-56-2413, Modoc County, California

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe2O3^T$	Fe:Mn	Fe:Ti	Artifact Source
NA	RGM-1	RGM-1	37	23	146	103	25	216	10	1473	270	NM	1.73	66.6	37.8	RGM-1 Reference Standard
		±	7	2	3	7	3	7	1	97	47	NM	0.11			

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Site FS-05-09-56-2413, Modoc County, California

Site	Specimen No.	Catalog No.	Unit	Depth (cm)	Artifact Type[A]	Artifact Source	Hydration Rims Rim 1	Rim 2	Comments[B]
FS-05-09-56-2413	1	09-3143-01	--	Surface	PPT	Buck Mountain	1.6 ± 0.1	NM ± NM	--
FS-05-09-56-2413	2	09-3143-02	--	Surface	PPT	East Medicine Lake	2.3 ± 0.1	NM ± NM	--
FS-05-09-56-2413	3	09-3143-18	N01/W01	0-10	BIF	East Medicine Lake	2.1 ± 0.1	NM ± NM	--
FS-05-09-56-2413	4	09-3143-43(a)	N01/E01	0-10	DEB	Cougar Butte	2.2 ± 0.1	NM ± NM	--
FS-05-09-56-2413	5	09-3143-93(a)	S01/E01	0-10	DEB	East Medicine Lake	1.5 ± 0.1	NM ± NM	DFV
FS-05-09-56-2413	6	09-3143-93(b)	S01/E01	0-10	DEB	East Medicine Lake	1.4 ± 0.0	NM ± NM	--
FS-05-09-56-2413	7	09-3143-77	S02/W01	10-20	DEB	East Medicine Lake	1.4 ± 0.1	NM ± NM	--
FS-05-09-56-2413	8	09-3143-83	S01/E01	0-10	PPT	Spodue Mountain	1.5 ± 0.1	NM ± NM	--
FS-05-09-56-2413	9	09-3143-87	S01/E01	0-10	UTF	East Medicine Lake	2.3 ± 0.1	NM ± NM	--
FS-05-09-56-2413	10	09-3143-118	S03/E02	0-10	PPT	East Medicine Lake	1.9 ± 0.1	NM ± NM	--
FS-05-09-56-2413	11	09-3143-43(b)	N01/E01	0-10	DEB	East Medicine Lake	1.8 ± 0.1	NM ± NM	DFV
FS-05-09-56-2413	12	09-3143-43(c)	N01/E01	0-10	DEB	East Medicine Lake	1.3 ± 0.1	NM ± NM	--
FS-05-09-56-2413	13	09-3143-93(c)	S01/E01	0-10	DEB	East Medicine Lake	2.4 ± 0.1	NM ± NM	--
FS-05-09-56-2413	14	09-3143-93(d)	S01/E01	0-10	DEB	East Medicine Lake	1.8 ± 0.1	NM ± NM	--
FS-05-09-56-2413	15	09-3143-93(e)	S01/E01	0-10	DEB	East Medicine Lake	1.9 ± 0.1	NM ± NM	DFV
FS-05-09-56-2413	16	09-3143-114(a)	S03/E01	0-10	DEB	East Medicine Lake	1.6 ± 0.1	NM ± NM	--

[A] BIF = Biface; DEB= Debitage; PPT = Projectile Point; UTF = Utilized Flake
[B] See text for explanation of comment abbreviations
NA = Not Available; NM = Not Measured; * = Small sample

Abbreviations and Definitions Used in the Comments Column

A, B, C - 1st, 2nd, and 3rd cuts, respectively.
All hydration rim measurements are recorded in microns.

BEV - (Beveled). Artifact morphology or cut configuration resulted in a beveled thin section edge.

BRE - (BREak). The thin section cut was made across a broken edge of the artifact. Resulting hydration measurements may reveal when the artifact was broken, relative to its time of manufacture.

DES - (DEStroyed). The artifact or flake was destroyed in the process of thin section preparation. This sometimes occurs during the preparation of extremely small items, such as pressure flakes.

DFV - (Diffusion Front Vague). The diffusion front, or the visual boundary between hydrated and unhydrated portions of the specimen, are poorly defined. This can result in less precise measurements than can be obtained from sharply demarcated diffusion fronts. The technician must often estimate the hydration boundary because a vague diffusion front often appears as a relatively thick, dark line or a gradation in color or brightness between hydrated and unhydrated layers.

DIS - (DIScontinuous). A discontinuous or interrupted hydration rind was observed on the thin section.

HV - (Highly Variable). The hydration rind exhibits variable thickness along continuous surfaces. This variability can occur with very well- defined bands as well as those with irregular or vague diffusion fronts.

IRR - (IRRegular). The surfaces of the thin section (the outer surfaces of the artifact) are uneven and measurement is difficult.

1SO - (1 Surface Only). Hydration was observed on only one surface or side of the thin section.

NOT - (NOT obsidian). Petrographic characteristics of the artifact or obsidian specimen indicate that the specimen is not obsidian.

NVH - (No Visible Hydration). No hydration rind was observed on one or more surfaces of the specimen. This does not mean that hydration is absent, only that hydration was not observed. Hydration rinds smaller than one micron often are not birefringent and thus cannot be seen by optical microscopy. "NVH" may be reported for the manufacture surface of a tool while a hydration measurement is reported for another surface, e.g. a remnant ventral flake surface.

OPA - (OPAque). The specimen is too opaque for measurement and cannot be further reduced in thickness.

PAT - (PATinated). This description is usually noted when there is a problem in measuring the thickness of the hydration rind, and refers to the unmagnified surface characteristics of the artifact, possibly indicating the source of the measurement problem. Only extreme patination is normally noted.

REC - (RECut). More than one thin section was prepared from an archaeological specimen. Multiple thin sections are made if preparation quality on the initial specimen is suspect or obviously poor. Additional thin sections may also be prepared if it is perceived that more information concerning an artifact's manufacture or use can be obtained.

UNR - (UNReadable). The optical quality of the hydration rind is so poor that accurate measurement is not possible. Poor thin section preparation is not a cause.

WEA - (WEAthered). The artifact surface appears to be damaged by wind erosion or other mechanical action.

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Appendix 2:

Blood Residue Analysis
for
Site FS-05-09-56-2413, Modoc National Forest,
Modoc County, California

By: John Fagan

Archaeological Investigations Northwest, Inc.

May 17, 2000

ARCHAEOLOGICAL INVESTIGATIONS NORTHWEST, INC.
RESIDUE ANALYSIS LABORATORY
METHODS AND PROCEDURES

Blood protein residue analysis performed at the Archaeological Investigations Northwest, Inc. (AINW) Residue Analysis Laboratory uses the technique of cross-over immunoelectrophoresis (CIEP) to analyze protein residues extracted from the surface of stone artifacts and other objects. This technique has been widely used in forensic laboratories to determine the origin of bloodstains as evidence in criminal investigations, and has fairly recently been adapted for use in archaeology to detect protein residues on stone tools. The CIEP method used by the AINW Residue Analysis Laboratory is based on techniques developed by the Royal Canadian Mounted Police Serology Laboratory in Toronto, Ontario (Culliford 1971; Newman 1990; Williams 1990). The CIEP technique uses the immune (antibody-antigen) reaction, the principle that all animals produce immunoglobulin proteins (antibodies) that recognize and bind with foreign proteins (antigens) as part of the body's defense system. The ability of antibodies to precipitate antigens out of solution is the basis of CIEP analysis (Newman 1990:56). CIEP indicates the presence or absence of a particular antigen, and is not designed as a quantitative test. While other types of immunoassay have been used effectively to analyze blood protein residues under various conditions, the CIEP test is particularly suitable in that it is sensitive (able to detect protein in concentrations of about two parts per million), does not require expensive or bulky equipment, is relatively fast (about 48 hours per test), and can easily and efficiently accommodate multiple samples (Newman 1990:52).

BLOOD PROTEIN RESIDUES

Blood is composed of red and white blood cells and serum, which is composed of about 150 different proteins including albumin, alpha, and beta globulins. Immunoglobulins are large, Y-shaped proteins with antigen binding sites located on the V portion of the Y. There are several immunoglobulin molecules of different weight, size, and function. The most common type (and the most pertinent for CIEP) is immunoglobulin G (IgG). Other less common varieties are immunogobulin A (IgA), immunoglobulin E (IgE), and immunoglobulin M (IgM). Some of these proteins can survive in the environment in a nonfunctional but immunologically identifiable form for long periods of time by forming a "covalently cross-linked proteinaceous mass with a high molecular weight" (Marlar et al. 1995:30). This combination of protein, fatty tissues and soil particles is resistant to microbes and markedly insoluble in water. It seems probable that porosity and surface roughness of the artifact also aids in the preservation of protein residues. Experiments by AINW and others have identified blood residues from mammoth, bison, musk ox, horse, caribou, bear, duck, and trout on Paleoindian artifacts that may be as old as 11,500 years (Forgeng 1998; Loy and Dixon 1998; Williams 1993). Other studies suggest that protein residues can survive in recognizable form for as long as 40,000 years (Prager et al. 1980).

Artifacts can be examined under a binocular microscope (at around 240 x maximum magnification) to identify probable residues, as well as cells, hair and other tissues. Microscopic examination is not always effective as a screening technique as CIEP can still detect otherwise invisible residues. A common medical test for occult blood is sometimes effective when used to screen the extracted residue solution. However, the CEIP technique can detect residues in more dilute concentrations than is possible with the commonly available occult blood test.

THE IMMUNE REACTION

Immunological forensic tests owe their effectiveness to the antigen-antibody reaction, which allows very specific recognition and identification. Essentially, any molecule that can bind to an antibody is an antigen. For archaeological purposes, the antigen is an unknown protein adhering to an artifact after its use. Antigens are foreign proteins that, when introduced into the blood stream of an animal, stimulate the immune system of the animal to produce antibodies (most commonly IgG protein molecules) with specific binding sites that match corresponding sites on the foreign antigen. Polyclonal antibodies, which bind to multiple sites on the antigen and therefore have a high rate of successful matching to unknown proteins, are the most commonly used reactants in CIEP. The meeting of antigen and antibody forms a very strong bond between the two proteins. The visible line formed in a positive CIEP reaction occurs when an antigen with multiple binding sites matches a group of polyclonal antibodies, binds with them, and causes the proteins to precipitate out of solution (Marlar et al. 1995:28).

Antigen-antibody reactions can be highly specific, although proteins from closely related species share enough of the same binding sites on the immunoglobulin molecule to react in similar ways. More distantly related species react less strongly. The purity of the antiserum used in the analysis is thus of primary importance in determining what species of animal is represented. Quantified analyses have been performed using more sophisticated techniques to test the similarity of immune reactions between related animal species, largely to determine relationships between living and extinct species (Lownstein 1980, 1985). These results and CIEP experiments performed by AINW and others indicate that CIEP can generally distinguish between blood proteins at approximately the taxonomic family level.

ANTISERA

The antisera used in AINW's CIEP analysis are obtained from commercial laboratories. A forensic antiserum is made by injecting a host animal, typically a goat or rabbit, with a protein solution obtained from another animal. The immune system of the host animal produces antibodies (mainly IgG) in reaction to the foreign antigen. Blood serum drawn from the host animal is purified and tested to determine the range of reactivity of the antiserum. The purified antiserum is then freeze-dried for storage and shipment. After receipt of a new lot of antiserum, the AINW laboratory routinely tests each antiserum against representative specimens from 32 different animal species.

AINW obtains forensic-grade bear, bovine, cat, chicken, deer, dog, horse, rabbit, and rat antisera from Organon Teknika/Cappel Corporation (OTC). Camel, goat, generic sheep, and trout antisera are manufactured by Sigma Chemical Corporation (SCC). Duck antiserum is obtained from both Nordic Immunological Laboratories (NIL) and Kirkegaard and Perry, Inc. Guinea pig and pigeon antisera are manufactured by NIL. The bear, bovine, cat, deer, dog, horse, pigeon, and rabbit antisera react well within their own taxonomic family (Ursidae, Felidae, Cervidae, Canidae, Equidae, Columbidae, and Leporidae respectively) but do not react with blood proteins from animals from other taxonomic families. Experiments have shown that the deer antiserum reacts well with other cervids such as white-tail deer, mule deer, elk, and moose, but does not react with other artiodactyls such as domestic cows, bison, antelope, goat, or sheep. The OTC chicken antiserum reacts with members of four families of three orders of Superorder Neognathae. These include Phasianidae (pheasants, partridges and quail) and Tetraonidae (grouse) of Order Galliformes, Columbidae (doves and pigeons) of Order Columbiformes and Anatidae (geese, ducks, and swans) of Order Anseriformes. The OTC rat antiserum also reacts broadly at the level of Order Rodentia with many species of rats, mice, and squirrels. NIL guinea pig antiserum also reacts with many rodents including beaver and porcupine. The SCC sheep antiserum reacts with members of Subfamily Ovidae, and less strongly with other bovids, cervids, and antilocaprids. The SCC trout antiserum reacts with members of genus *Oncorhynchus*, including anadromous salmon and steelhead and resident rainbow trout. A chart included with this report shows the species found to interact with each antiserum.

THE AINW RESIDUE ANALYSIS LABORATORY

Ancient protein residues are often difficult to extract from the artifacts that have preserved them. The AINW Residue Analysis Laboratory uses a 5% ammonia solution, which has been used for similar applications in forensic medicine (Dorrill and Whitehead 1979; Kind and Cleevely 1969). Ammonia is generally more effective in lifting old and partially denatured blood proteins than other solvents (Newman 1990). A small amount of the ammonia solution is applied to the artifact in a plastic tray, and the tray and artifact are placed in an ultrasonic bath (Branson 2200) for 30 minutes or longer. The artifact in solution is then placed on a mechanical rotator (Thermolyne Rotomix) for an additional ten minutes. Artifacts that are too large for the ultrasonic extraction, may be placed on the rotator for 30 minutes or longer. Residues from soil samples can also be extracted using variations of these methods. The extraction solution is then drawn off and stored in an airtight microcentrifuge tube. The extracts are refrigerated and the CIEP test is run as soon as possible after extraction. The extracts may be frozen immediately if testing is to be delayed for more than one week.

AINW's CIEP method uses an agarose gel as a substrate. Solutions extracted from artifacts (antigens) are tested against antisera from known animals by exposing both specimens to a weak electric current, which causes the proteins to flow together. An immune reaction forms a precipitate which is visible after the gel is stained. Positive and negative controls are included on each gel. Approximately five microliters of extract are used per test. This frugal use of material is important in archaeological applications, where only a small amount of extract may be available for each artifact or sample.

Electrophoresis is used to drive the antigens and antibodies together. The gel substrates are placed in acrylic electrophoresis tanks filled with barbital buffer solution (SCC), then attached to the regulated H.V. power source. The antibodies move toward the cathode because of the overall negative charge on the molecule, while the antigens move toward the anode. A precipitate is formed where the proteins meet and bond in the area between the wells, visible as a white line or arc (Culliford 1971). The gel is soaked overnight in saline to stabilize the reaction, then dried and stained with a standard protein stain as a permanent record of the CIEP results.

A cross reaction or non-specific reaction sometimes occurs when an antibody recognizes and partially reacts to a generalized or partial shape rather than the specific shape of an antigen molecule. Other proteins in the extract may react strongly with the protein stain. In order to rule out such false positives, the extract is tested against a non-immune serum (NIS). The NIS is a dilute solution of animal serum (usually goat) and the extract should not react with it. If no reaction occurs, then the extract is considered to provide valid results during the CIEP antiserum test. However, if a positive reaction to the NIS occurs, then another test is made to clarify the cross reaction. In this procedure, a 1% solution of a non-ionic detergent (SCC Tween 80) is added to the extract, resulting in a stronger antigen binding by breaking weak, non-specific bonds (Newman 1990). The extract is then retested against the NIS. If this test is negative, then any positive reactions to the antisera may be accepted as true reactions. If the specimen with the Tween added to it still reacts positive to the NIS (it may react positive to one or more antisera), the results must be considered spurious. Experiments at AINW have implicated plant pitch used in hafting prehistoric stone tools as a possible cause of some NIS reactions.

After testing the extracts are refrozen and stored for one year in case additional testing is requested. Positive extracts are kept longer and retested periodically in an ongoing experiment to determine the limits of extract viability.

HINTS FOR ARTIFACT COLLECTION AND TREATMENT FOR RESIDUE ANALYSIS

For optimum results, the following suggestions are provided for archeologists considering submitting artifacts for blood residue analysis (see also Marlar et al. 1995:36)

1. Handle artifacts as little as possible in the field. Avoid contamination by using latex gloves, the tip of a clean trowel, or other careful methods similar to the treatment of radiocarbon samples.
2. Do not brush off, spit clean, or wash the artifact. Since proteins are known to bind to soil particles, loss of adhering dirt may result in loss of blood antigen.
3. Place the artifact in a clean ziplock bag with as little loose dirt as possible.
4. Submit a small amount (about one tablespoon) of soil from the area adjacent to the artifact. As bacteria or animal excreta in the soil may cause false positive reactions, soil controls are useful for cross checking results from artifacts.
5. Positive results have been obtained from projectile points, scrapers, flake tools, debitage, bone, burned bone, fire-cracked rock, cobble tools, ground stone tools, and soil samples from features and general site contexts. Surface artifacts are also good candidates for residue preservation. Obsidian, CCS, and basalt artifacts are equally likely to preserve residues, although some more porous materials may contain more proteins.
6. When selecting the type of antisera for analysis, consider allowing for a broad range of testing supplemented by more specific testing of positive results (for example, testing positives for chicken against duck and pigeon to narrow the results). If an artifact tests negative for all of the selected antisera, it may still contain preserved residues from other species.

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ARCHAEOLOGICAL INVESTIGATIONS NORTHWEST, INC.
RESIDUE ANALYSIS LABORATORY
ANTISERUM CHART

COMPANY	ANTISERUM	HOST	REACTS WITH:
OTC*	BEAR	goat	Family Ursidae: black bear, brown bear, grizzly
	BOVINE	goat	Family Bovidae: domestic cow, bison
	CAT	goat	Family Felidae: cat, mountain lion, lynx, bobcat
	CHICKEN	goat	Order Galliformes, Order Anseriformes, Order Columbiformes
	DEER	goat	Family Cervidae: white-tail and mule deer, elk, moose
	DOG	rabbit	Family Canidae: domestic dog, coyote, wolf
	HORSE	goat	Family Equidae: horse, donkey, mule, extinct equids
	HUMAN	goat	Order Primates: humans, apes, monkeys
	MOUSE	goat	Order Rodentia: mice, rats
	RABBIT	goat	Family Leporidae: rabbit, jackrabbit
	RAT	goat	Order Rodentia: rats, mice, squirrels
	SHEEP	goat	Subfamily Ovidae: domestic sheep, bighorn sheep
NIL*	BOVINE	goat	Family Bovidae: domestic cow, bison
	DUCK	rabbit	Subfamily Anatidae: ducks, mallards, other ducks
	GUINEA PIG	rabbit	Order Rodentia: guinea pig, porcupine, beaver
	PIGEON	rabbit	Order Columbiformes: pigeon, mourning dove
SIGMA*	CAMEL	rabbit	Order Artiodactyla: camelids, bovids, cervids, antelope
	GOAT	rabbit	Bovid Subfamilies Capridae and Ovidae
	SHEEP	rabbit	Order Artiodactyla: ovids, less strongly with other bovids, cervids, antilocaprids
	TROUT	rabbit	Genus Oncorhynchus: salmon, steelhead, rainbow

*Notes: OTC=Organon Teknika/Cappel, NIL=Nordic Immunological Laboratories, Sigma= Sigma Chemical Laboratories

bjmb:anw files/forms/RAL anitserum chart(122799)

ARCHAEOLOGICAL INVESTIGATIONS NORTHWEST, INC.
BLOOD RESIDUE ANALYSIS COMPARATIVE RESULTS

Project No.: 00/617

Modoc National Forest

					TYPE OF ANTI-SERUM						
RAL #	SITE	CATALOG #	MATERIAL	NIS	Bear	Bovine	Chicken	Deer	Human	Rabbit	Mountain Sheep
1	09-3143	3	obsidian	-	-	-	-	-	-	-	-
2	09-3143	4	obsidian	-	-	-	-	-	-	-	-
3	09-3143	5	obsidian	-	-	-	-	-	-	-	-
GEL #1631				1631	1631	1631	1631	1631	1631	1631	1631
REPEAT GEL #1632									1632		

Key: + = Positive; - = Negative

Appendix 3:

Faunal Analysis for Site FS-05-09-56-2413, Modoc National Forest, Modoc County, California

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March 28, 2000

Faunal Remains

Test excavations at site FS-05-09-56-2413 (CA-Mod-3745) yielded a total of 125 faunal remains, most consisting of small, burned or calcined fragments of bone. All bone was collected from the upper 10 cm of the site deposit, with the exception of eight fragments from the 10-20 cm level of Unit N02/E01 (see Table 1). The degree of bone fragmentation and amount of distortion from burning limited attempts to identify the individual bones beyond the level of class. Bone identification was accomplished by using the comparative collection housed at the Zooarchaeology Lab, Department of Anthropology, California State University, Chico.

Of the 125 bone fragments collected, 66 specimens, or roughly 53 percent, are unidentifiable, too small or incomplete to assign to the class level. Fifty-two fragments, accounting for nearly 42 percent of the sample, are classified as medium-to-large size mammal bones, including two partial ribs, one skull fragment, two long bone fragments, and one tooth root. The tooth root, FSMA 09-3142-06(b), is of a size similar to Artiodactyl and other large mammal teeth; however, it could not be identified since the crown has been removed by grinding and polish, evidence of a gritty diet. Another tooth, catalogued as FSMA 09-3143-07(b), is identified as a mule deer (*Odocoileus hemionus*) mandibular incisor. A second mule deer bone was identified within the sample catalogued as FSMA 09-3143-06(a). This burned specimen is identified as a partial left astragalus bone from the rear leg or hindquarter of a deer. Finally, five bone fragments, or roughly four percent, are classified as small-to-medium mammal. Of these, one weathered fragment is of a size comparable to a small rodent.

Overall, the highly fragmented and burned nature of the bone from site FS-05-09-56-2413 suggests that the bone was discarded in fire after consumption. Teeth, particularly dentine, can often withstand burning and weathering, as do dense bones such as the astragalus. Unfortunately, the remaining collection is too fragmented for easy identification. The preponderance of medium-to-large mammal bone fragments likely represents Artiodactyls, as suggested by the identified tooth and astragalus. Recently, Holanda (2000) identified an apparent increase in the exploitation of medium-to-large size mammals relative to small-to-medium size game during the Late Archaic and Terminal Prehistoric periods in the Pit River Uplands, roughly after 1300 years B.P. The predominance of medium-to-large size mammal bone in the current study collection, therefore, is consistent with the trend noted for Late Archaic to Terminal Prehistoric occupations.

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Table 1. Faunal Assemblage for Site FS-05-09-56-2413 (CA-Mod-3745).

Units:	N01/W01 0-10 cm	N01/W02 0-10 cm	N01/E01 0-10 cm	N01/E02 0-10 cm	N02/E01 0-10 cm	N02/E01 10-20 cm	S01/W01 0-10 cm	S01/E01 0-10 cm	S01/E02 0-10 cm	S02/W01 0-10 cm	S03/E02 0-10 cm	TOTAL
Medium/Large Mammals												
Mule Deer	1	1	---	---	---	---	---	---	---	---	---	**2**
Unknown	15	4	4	---	11	6	2	4	3	2	1	**52**
Small/Medium Mammals												
Unknown	1	---	1	1	1	---	---	1	---	---	---	**5**
Indeterminate	21	2	10	3	3	2	2	6	12	5	---	**66**
TOTAL	**38**	**7**	**15**	**4**	**15**	**8**	**4**	**11**	**15**	**7**	**1**	**125**