BEFORE WINTER COMES: ARCHAEOLOGICAL INVESTIGATIONS OF SETTLEMENT AND SUBSISTENCE IN HARNEY VALLEY, HARNEY COUNTY, OREGON

by

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A DISSERTATION

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Many archaeological researchers that have conducted investigations in the Harney Valley of southeastern Oregon use the ethnographic description of the seasonal round of the Harney Valley Paiute reported by Beatrice Blyth Whiting in her 1950 work *Paiute Sorcery* as a framework for discussions of prehistoric human use of the area. Archaeological investigations of seven sites, situated in areas identified as having been utilized by the Harney Valley Paiutes, were conducted to test the relationship between Whiting's ethnographic account and the archaeological record. Data recovery excavations occurred at the Hoyt (35HA2422), Morgan (35HA2423) and Hines (35HA2692) sites near Burns, and test excavations occurred at the Knoll (35HA2530) site in the Silvies Valley, the RJ site (35HA3013) in the Stinkingwater Mountains, and the Broken Arrow (35HA2735) and Laurie's (35HA2734) sites near Malheur Lake.

Studies of the cultural materials recovered during the excavations were undertaken to evaluate the content and complexity of each site. Analyses included typological considerations of the chipped stone tools, ground stone, bone tools, and shell, bone, and stone beads. Radiocarbon dating, obsidian sourcing and hydration, and zooarchaeological and paleobotanical analyses were also conducted when possible. Based on the results of the analyses, the seven sites reported herein were primarily used during the past 2000 years, with periods of less intensive use extending beyond 4000 BP.

The results of the archaeological investigations indicate that there is a strong correlation between the late Holocene prehistoric record and Whiting's ethnographic description. However, the relationship between human use of the centrally-located lakes and wetlands and the neighboring uplands is clearly more complex than the ethnographic record suggests. Patterns of settlement and mobility revealed through the archaeological record indicate that central places, located closer to wetlands and lacustrine settings but within relatively easy reach of the uplands, may have figured more prominently in the behavior of prehistoric populations than the seasonal round as described by Whiting. Future research will benefit from explorations of central place foraging, emphasizing the role of behavioral ecology in the placement of sites and patterns of site use within the Harney Valley and the northern Great Basin at large.

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CHAPTER I
INTRODUCTION

This dissertation is conceived as the beginning of a long term research program in the Harney Basin of east-central Oregon. We know from data already in hand that the area has been occupied since terminal Pleistocene times, but detailed information about its environmental and cultural history is still spotty. We also know a good deal about 19^{th} and 20^{th} Century Northern Paiute peoples' economic and social adaptations to the region from ethnographic work conducted by Whiting (1950) Couture (1978), and others. This local ethnographic information offers an important guide to the study of deeper human time in the region, and the present work focuses on recent archaeological site occupation patterns near Malheur Lake to show how they relate to the historically recent pattern of human land use and mobility. It reports original fieldwork at seven sites, and draws on available information for others in the vicinity. A good correspondence is found between the ethnographic model and the archaeological record of the last 2000 years. An important problem defined for future investigation is that significant, climatically-induced environmental changes about 2000 years ago seem to have had a significant effect on human occupation in the vicinity of Malheur and Harney Lakes, and on the archaeological record of earlier times in the same area. The remainder of this chapter provides essential context for the reporting and analysis that follow, offering needed background on the research objectives, natural environment, and previous investigations in the study area.

Development of the Study Objectives

The Harney Valley is a large, internally draining basin in southeastern Oregon that falls within the confines of the Great Basin of western intermontane North America. The valley has been the subject of numerous archaeological investigations beginning in the 1960s (Atherton 1966) and it was the focus of ethnographic work by Beatrice Blyth Whiting (1950) between 1936 and 1938. Whiting (1950:17-19) collected a brief, but salient description of the lifeways of the

Harney Valley (Burns) Paiute during her fieldwork, as summarized in the following extract, which has been quoted repeatedly:

> In the old days, the entire life of the Paiute was oriented around the quest for food, which was none too plentiful. Around the first of May, when the first green shoots broke through the ground, they left their winter camps and went to those places where they knew the edible roots abounded. Nigger Flat, in the northeast corner of the valley, was the most frequented place and many families camped here while the women dug *epos* (Yapa, Carum oreganum Wats), *hu. ni bui* (Lomatium macrocarpium Cand R), *tsuga* and *sanatsuga* (unidentified). While the women were gathering these roots and and preparing the *tsuga* and some *yapa* for storage, the men visited the Drewsey River to set up and repair their salmon traps so they would be ready for the spring run. When their work was over, the women moved down to the river with their skin sacks full of roots and helped the men dry the salmon which they caught. When the run was over, the group broke up and families wandered off by themselves, hunting deer, sagehens, and other birds and collecting the different seeds and roots as they ripened. The first seed to ripen was the sunflower, *aki* and *kusiaki* (Balsamorhiza hooken Nutt). Later the women went to those places where *atza* (Sisybrium Sophia L.) grew in large quantities. This seed was cached for winter consumption. Most of these early plants grew well in the northern part of the valley.
>
> Around the fifteenth of July, families began to congregate at Cow Creek, about five miles east of Harney. Families from all over the valley and from the Hunibui Eater band to the north came to gather crickets. The women went out early in the morning and caught them, were back by sunrise, and spent the rest of the day roasting, drying, and pounding them and putting them in bags to be cached for the winter.
>
> In the evening, the men and women gathered for gossip and gambling. For the rest of the summer, the families wandered off by themselves again.
>
> July was the month when ground hogs were considered to be the best. Currants and other berries were picked and eaten as they ripened. Fish were caught in the streams. Any game which was encountered was killed and eaten. The families often wandered up towards Seneca and John Day and hunted deer in the timber. In the fall, some of the families went up to Canyon City, the men to hunt elk and the women to pick huckleberries.
>
> Around the first of September the families began to turn south to the vicinity of Malheur Lake and Saddle Butte. Everyone wanted to be on hand when the *wada* (Sueda depress var. erecta Wats) ripened. This was one of the staple seeds and was picked in large quantities for winter consumption. Probably the largest number of people came together at this time and there were many festivities, including circle dances and games of all kinds. Other seeds were gathered at the same time or a little later: *su.nu* – saltbush, *tomomi* (unidentified), *i'ape* (Chenopodium), and *wata* (Chenopodium Album L.). From the lakes many people went to Crow Camp to pick chokecherries, which were

> made into cakes and and sun dried for winter. At this time there were also communal antelope and rabbit drives.
>
> By the first of November the families started to collect their cached foods and to move into their winter camps. Sites were selected which had a spring or some other source of water, a good supply of wood, and where it was known that there was not likely to be a heavy snowfall. Most of the camps were at the foot of hills or in protected regions near the lakes. Here tule mat houses were set up. (During the summer sagebrush enclosures were the only types of structures used.)

The passage is useful for archaeological purposes because it provides an account of seasonal subsistence activities, the locations where such activities occurred, and the food items that were sought. In the context of another project, I had begun working on the analysis and reporting of three sites (the Hoyt, Morgan, and Hines sites) located along the northern edge of the Harney Valley, and Whiting's description seemed to be a suitable starting point for further consideration of past subsistence and settlement patterns in the Harney Valley, working from the "known to the unknown" in a sense, to determine if the behaviors noted during historic times might illuminate information gleaned from the archaeological record. Since most of the radiocarbon dates so far obtained from Harney Valley sites fall within the last 2000 years, including those from the Hoyt, Morgan, and Hines sites, it seemed possible that some degree of continuity might be established between the ethnographic record and the late Holocene archaeological record. A straightforward means of determining this would be to conduct archaeological investigations at locations described in Whiting's account.

Between 1995 and 1997, the University of Oregon Museum of Natural and Cultural History completed excavations at the above three sites near Burns, Oregon, which are included as a part of this dissertation. The three projects were carried out as data recovery in advance of highway projects, and all were financed by the Oregon Department of Transportation. The Hoyt and Morgan sites are located on the northern edge of Harney Valley approximately 0.7 km apart, and the Hines site is 10 km to the west between Burns and Hines. Laboratory analysis revealed considerable variation at the three sites and they are certainly interesting of their own accord, but they could not be placed directly into the pattern of use that Whiting described in terms of their geographic locations. I felt that a dissertation project could be developed which would incorporate sites from Whiting's ethnographically documented locations, in association with the Hoyt, Morgan, and Hines sites, to establish a more coherent context for the Harney Valley at large. Possible research sites could include winter villages, as well as camps utilized for collecting upland roots, riverside and lakeside fishing, cricket collecting, hunting (groundhogs, large game, and rabbit drives), chokecherry and berry picking, and harvesting of wetland resources.

I began discussing the possibilities with Scott Thomas of the Burns District Bureau of Land Management, and four sites from areas discussed by Whiting were selected for work as part of the University of Oregon Archaeological Field School during the 2000, 2001, and 2002 field seasons. The Knoll site, located in the Silvies Valley north of Burns, was selected both because of its location along a known travel route between the Harney Valley and deer and elk hunting grounds near John Day, and as a location where huckleberries and currants were picked at various times. The RJ site is located in the root grounds of the Stinkingwater Mountains. Both Broken Arrow and Laurie's sites are located adjacent to Malheur Lake, where a variety of ethnographically recorded activities could have taken place. The addition of the four sites allowed me to report on a total of seven archaeological sites in this study of prehistoric settlement and subsistence patterns in the Harney Valley drainage system.

Analyses conducted in association with the excavations included radiocarbon dating, typological analysis of projectile points, obsidian sourcing and hydration, paleobotanical and faunal analysis, and mass analysis of lithic debitage. Descriptions of artifacts recovered from the excavations are also included, as are soil descriptions. What resulted was an evaluation of seven sites primarily utilized from 650 BP to 2000 BP, calculated in radiocarbon years. The sites were used for a variety of purposes, as was made evident through differences in the material remains at each site. Several of the sites, including the Hoyt, Broken Arrow, and Laurie's sites, are believed to have served as "central places" from which logistical forays were mounted to obtain plant resources, tool stone, and large and small game. The other four sites, including the RJ, Knoll, Morgan, and Hines sites, all appear to have been more task-specific in nature; the kinds of places that would have been visited during outings from the base camps, or central places mentioned above. None of the sites studied here are believed to have served as winter camps, due of their lack of complex stratigraphy, storage features, and burials, but sites of this character come into the discussion of previous research in the Harney Valley.

Although this study would focus on establishing a material record for sites in ethnographically known use areas, as described above, climatic and cultural changes that occurred in the late Holocene had also to be considered. Wigand's (1987) work at Diamond

Pond, southeast of Malheur Lake, indicates that climatic fluctuations, including at least two significant droughts, occurred during the last 2000 years. The arrival of bow and arrow technology took place within the last 2000 years as well, and the Numic expansion, extensive movements within the Great Basin by people speaking Paiute, Shoshoni, and related languages, probably occurred during the last 1000 years (Aikens 1994; Bettinger and Baumhoff 1982; Lamb 1958). Changes in the patterns of use at each site might include less evidence of human occupation during droughts, a transition from atlatl darts to arrow points when the bow and arrow arrived, and the appearance of sites containing Desert Side-notched points as a part of the material record of the Numic expansion.

What might have happened around 2000 BP to cause a dramatic increase in radiocarbon dated sites after that time? The Harney Valley has been used at least since Clovis times (Thomas and O'Grady 2006), and the presence of all recognized Great Basin projectile point styles indicates that the valley was probably utilized continuously thereafter, though at times there may have been periods of reduced use due to long term drought episodes (Fagan 1973). There have also been times of population increase such as during the Neopluvial period of greater effective moisture from 5000 BP to 3000 BP, and possibly after 2000 BP, by which time Jenkins (1994) believes increasing populations and more circumscribed territories were responsible for intensified use of upland roots in the highlands surrounding Fort Rock. The arrival of bow and arrow technology may have opened new areas to exploitation through hunting, leading to a broader dispersal of sites across the landscape. It may also be true that much of the archaeological record prior to 2000 BP was "erased" through the dynamics of lake expansion and contraction due to fluctuating water levels. The era of greater effective moisture that led to the Neopluvial period between 5000 and 3000 BP, which created conditions favorable to plant and animal populations and, by extension, human populations, might also have destroyed or obscured earlier archaeological sites in the central Harney Valley basin. Although I have seen intriguing evidence of some very old sites at elevated margins along the shore of Malheur Lake, many of the sites that were once situated at lower elevations adjacent to the lakeshore may now be re-deposited in the form of extensive lag deposits on relict shorelines.

Obsidian sourcing information had already revealed some intriguing relationships within the Harney Valley and with points beyond. Jenkins and Connolly (1990:112) first reported on the relationship between the resource area of the Harney Valley Paiutes and sources of obsidian recovered from the Indian Grade Spring site on the Stinkingwater Mountains, noting that sources used were comparable to those of the Burns Paiute foraging area. O'Grady (1999) noted that obsidian sources for projectile points recovered from upland villages at the Silver Lake/Summer Lake divide further west and south included high quantities of material from the western edge of Harney Valley, but virtually none from the central or eastern portion of the same valley. Relationships of the western Harney Valley people seemed to be more evident with the Fort Rock, Warner Valley, and Lake Abert areas than with the inhabitants of nearby Malheur and Harney lakes, despite high frequencies of local obsidian found in both areas. Lyons et al. (2001:286) suggest that a limited obsidian resource area was operational at Lost Dune, south of Malheur Lake, between about 2000 BP and 500 BP, identifying an area they refer to as the Western Malheur/Catlow area of resource procurement. They noted that people near the lake gained access to more distant sources less often than central ones, and interpreted the correlation as indicating that "people using a particular low-lying wetland community foraged only so far as the surrounding upland areas having the resources they needed (2001:286-287)."

Clearly, there is much to consider in terms of climatic and cultural transitions over time, but the chronological focus for this project is the last 2000 years of Harney Valley prehistory. The present work is the starting point of a much more extensive project that will seek to establish an archaeological context for the entire Holocene, but for now, we begin at the end of prehistory.

Land, Resources, Ethnography, and Archaeology

In the next portion of this introductory chapter I present an overview of the natural resources that would have been available to the human inhabitants of Harney Valley, and in the concluding portion I review the main outlines of the regional culture history. It is clear that throughout human history, a variety of floral and faunal resources could have been obtained at different times of the year, and reconnaissance and strategic planning would have been necessary to insure that the most was made of each procurement opportunity. Seasonal availability and travel time would have been influential factors in the choices made about residential and logistical mobility patterns.

Geology, Land Forms, and Water

The Harney Valley lies within eastern Oregon's High Lava Plains, which extend from the Deschutes River Valley to the eastern edge of the Harney Valley (Baldwin 1981:131). The High Lava Plains are comprised of a series of both old and relatively new volcanic deposits, including basalt flows and cinder cones, along with vegetation that is uniquely characteristic of the xeric environment. To the north is the Blue Mountains physiographic province, a rugged region blanketed with forests and well watered. The Owyhee Uplands east of the divide created by the Stinkingwater Mountains. The Malheur River and the Owyhee River flow northeast through the Owyhee Uplands to meet the Snake River, which eventually enters the Columbia. To the south of Harney Basin is the Basin and Range physiographic province; a series of upthrust fault blocks that extend eastward from the Cascades to the Owyhee Uplands. These four physiographic provinces, closely juxtaposed, have provided a broad range of plant and animal resources for the indigenous peoples of the region.

In broadest context, the Harney Valley consists of two kinds of terrain; an alluvial lowland and a surrounding volcanic upland (McDowell 1992:13). The uplands have a base of Late Miocene ash flow tuffs that are approximately 12 million years old, and contain some sedimentary rocks, along with andesite, basalt, pumice, and rhyodacite. Capping this base are Pliocene basalts (5-2 million years old) and related sedimentary rocks, including tuffaceous sandstone, siltstone, and conglomerate rock of both fluvial and lacustrine origin (Greene, et al. 1972). The valley floor consists of Quaternary alluvium deposited over the past 2 million years, which forms two primary lobes surrounding Harney Lake and Malheur Lake (McDowell 1992:13).

The geology of the Harney Basin has been dominated by deposition from volcanic flows or by volcanically derived sedimentary rock for more than 16 million years (McDowell 1992). The oldest known volcanic deposits in the Harney Valley are outcrops of silicic material that were the result of both intrusive and extrusive volcanic activity during the Oligocene and Early Miocene, more than 16 million years ago. A series of basalt flows flooded the existing landscape between 16 and 11 million years ago (Middle Miocene). The Harney Valley basalt flows occurred at about the same time that the better known Columbia River basalt flows were emerging to the north. While the Harney basalts were generally thin, accumulations as deep as 2000 feet have been noted. Approximately half of the eastern portion of Harney Valley is composed of these basalts. Between 12 million and 2 million years ago during the Late Miocene and Pliocene eras, extrusive silicic materials found their way to the surface through vents in and around the valley, forming both domes and flows. Burns Butte is one example of this extrusive activity, which provided a valuable source of obsidian for the local inhabitants. During the Late Miocene, from 10 to 6 million years ago, a series of explosive volcanic eruptions deposited mantles of ash-flow tuffs across broad areas of the basin (McDowell 1992). Three major flows occurred during this time, erupting from calderas within Harney Valley and burying portions of the basin with 30 to 60 meters of ash-flow tuffs per episode. The calderas that were formed during the eruptions may have played an important part in developing the present shape of the Harney and Malheur lake basins.

Volcanic and sedimentary activity that took place in the Pliocene (from 5 to 2 million years ago) resulted in a geologic sequence that is up to 150 meters thick in some places. Lava cones, shield volcanoes, and cinder cones were the principal products of volcanism during this time, and the presence of subaqueous tuff cones indicates the existence of at least one large lake. This was also a time of sedimentary in-filling, with deposits up to 60 meters thick in some areas, possibly deeper in parts of the basin that are yet to be explored.

The early Pleistocene (2 million years ago) was a time of deep erosional episodes that appear to have been associated with exterior drainage of the basin. A drainage point between the Harney basin and the headwaters of the Malheur River (Malheur Gap) has opened and closed periodically as a result of movement along a nearby fault line, and erosion caused on occasion by overflow from Pleistocene Malheur Lake. The drainage gap is currently closed and Harney Valley is filling with fluvial, lacustrine, and some eolian deposits, especially around the Harney Lake and Malheur Lake basins (Figure 1.1). Pleistocene basalt flows are responsible for the current blockage of Malheur Gap, and basalts and andesitic cinder cones have formed south of Malheur Lake. The most recent volcanism in Harney Valley occurred at Diamond Craters between approximately 15,000 and 1,000 years ago. The Diamond Crater events spanned at least several thousand years, consisting of basaltic flows and explosions of tephra.

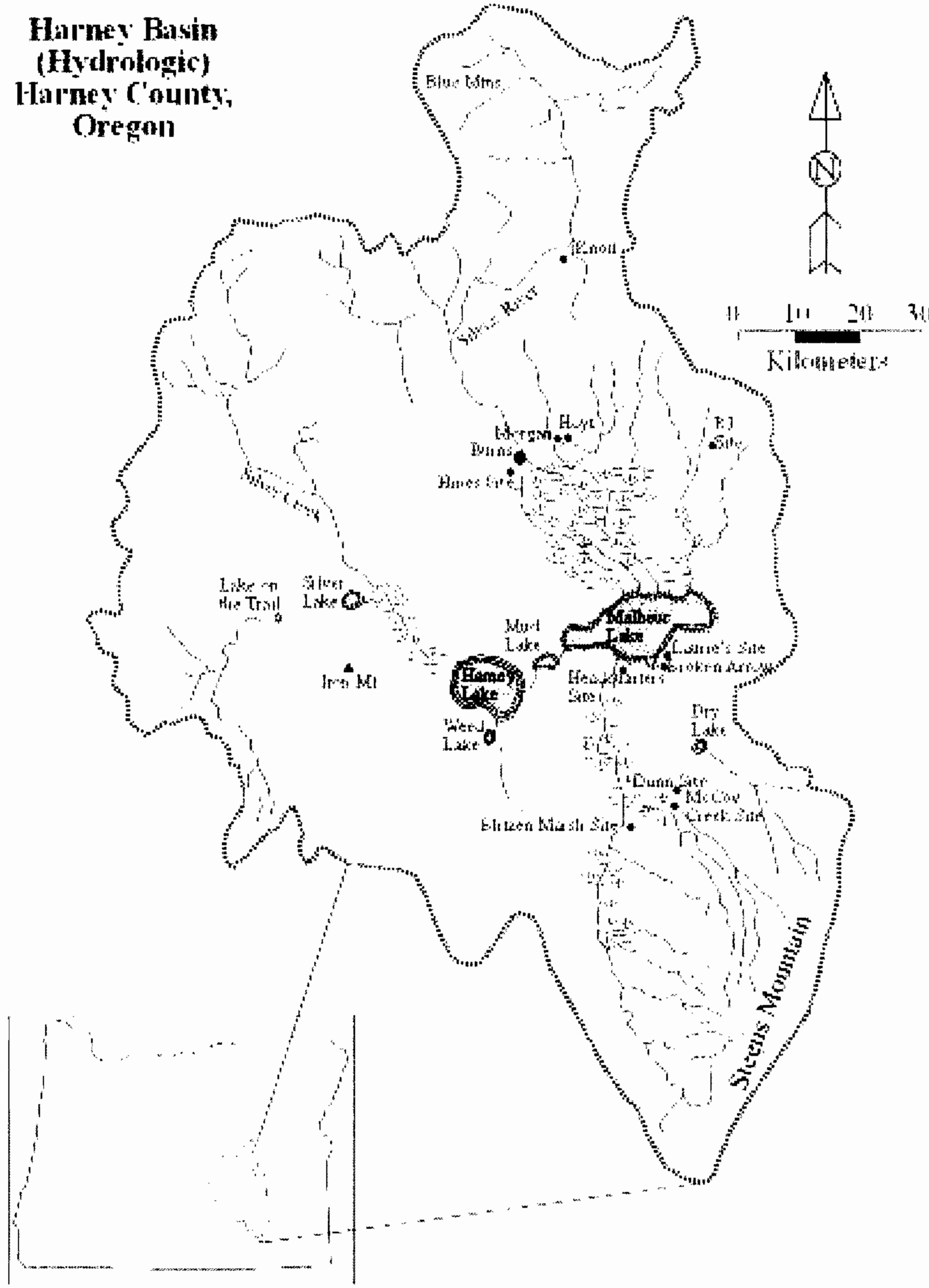

Figure 1.1. Hydrologic map of the Harney Basin, showing the locations of the sites reported in this study (after Oetting, 1999).

Geologic faulting has altered the landscape in significant ways. McDowell (1992:17) states that "Virtually all of the relief and geomorphic features of the present landscape were created by faulting and erosion since the eruption of Miocene basalts." Mid-Miocene basalt flows in particular show the dramatic effects of block faulting in association with the Brothers fault zone, which crosses both Harney and Malheur lake basins, extends at least as far north as Bend, Oregon, and may even cross the Cascades to join the Clackamas River-Portland Hills fault near Portland, Oregon (Baldwin 1981:131). The Brothers fault zone includes a number of north trending faults south of Harney Lake that have continued to be active into the Holocene.

McDowell (1992:18) notes that a structural downwarping towards the center of Harney Valley seems to be suggested by the tilt of Tertiary rocks in the northern uplands. She also notes that the limited amount of faulting observed around the margins of the Harney and Malheur alluvial basins may possibly be due to the formation of calderas during the eruption of ash-flow tuffs in the late Miocene (McDowell 1992:18). Faulting is responsible for the creation of the Basin and Range physiographic province to the south and west of Harney Basin. Steens Mountain is a fault block formation that provides a substantial water drainage into the southern end of Harney Valley.

High precipitation between 1981 and 1984 greatly increased the amount of water entering the Harney Valley, leading to flooding at an historically unparallelled level. Malheur, Mud, and Harney lakes fused into a single body of water approximately 33 miles in length by 12 miles in width, more than doubling the normal surface area (Oetting 1990a). Oetting noted that the combined shorelines of the pre-flood lakes were about 106 miles long, of which two-thirds were within Malheur National Wildlife Refuge boundaries. At the peak water level, the shoreline was 170 miles long, the water was eight feet deeper than pre-flood levels, and only 25% of the shoreline remained within the Refuge. Flooding periodically flushes mineral salts from Malheur Lake and maintains a water chemistry suitable for the maintenance of high populations of aquatic plants and invertebrates (Duebbert 1969). These, in turn, attract numerous species of water and shore birds in large numbers.

Indicating the volatility of this lacustrine environment, Duebbert (1969) reports that Malheur Lake dried completely in 1934, and Bailey (1936) reported that the skeletal remains of numerous bison were collected from the dry lake bed during that period. With consideration of long term wetland stability, periodic drying of the marshes may be vital to "...maintain a proper balance between oxygen and other elements in the soil so essential to the growth of marsh plants and animals (Weller and Spatcher 1965 in Duebbert 1969)". In terms of human behavior, the growth or subsidence of the lake level surely must have affected prehistoric population levels, settlement patterns, and resource availability over extensive portions of the basin.

Economic and Industrial Plants

The project area is situated in the shrub-steppe region; an area that encompasses the majority of southeastern Oregon and includes portions of the High Lava Plains, Owyhee Upland, and Basin and Range physiographic provinces. The vegetation is dominated by sagebrush *(Artemisia),* which occurs as four principal species, each of which occupies a particular habitat (Franklin and Dyrness 1988). Big sagebrush *(Artemisia tridentata),* which prefers relatively deep soils, is the primary species found at the archaeological sites and through much of the Harney Valley. The other species include *Artemisia arbuscula*, which inhabits shallower, rocky soils; *A. rigida*, found on very shallow lithosols common to the uplands; and *A. cana*, which inhabits moister locations such as seasonally ponded valley floors (Franklin and Dyrness 1988). These *Artemisia* species are part of broader plant communities which share similar moisture, mineral, and elevation requirements. Because of the variation in topography and soil quality (often over relatively short distances), plant communities can be quite mixed and would have provided a variety of subsistence opportunities for indigenous peoples.

Other plants common to the shrub-steppe zone include greasewood (*Sarcobatus vermiculatis*), green (*Chrysothamnus viscidiflorus*) and gray rabbitbrush (*Chrysothamnus nauseosus*), and bitterbrush (*Purshia tridentata*) Grasses include giant wild rye (*Elymus cinereus*), Idaho fescue (*Festuca idahoensis*), Thurber needlegrass (*Stipa thurberiana*), Sandbergs Bluegrass (*Poa sandbergii*) and bluebunch wheatgrass (*Agropyron spicatum*). A belt of western juniper (*Juniperus occidentalis*) surrounds the upper limits of the big sagebrush zone, and mountain mahogany (*Cercocarpus ledifolius*) is generally found in the upper elevations of the juniper belt (Ferguson and Ferguson 1978). Camas (*Camassia quamash*), biscuit-root (*Lomatium sp.*), and wild buckwheat (*Eriogonum sp.*) are also common in the uplands, and provided an important food source early in the spring. Couture (1978: 29) reports that the Northern Paiute collected a total of 18 plant species at the Pine Creek camp during that season.

The wetlands support a wide variety of plant life. Willow (*Salix sp.*), and black cottonwood (*Populus trichocarpa*) are relatively common along the rivers and streams in the area. Cattail (*Typha latifolia*), hardstem bulrush (*Scirpus acutus*), sedge (*Carex sp.*), Baltic rush (*Juncus balticus)*, and burreed (*Sparaganium eurycarpum*) are the dominant emergent varieties of the marshlands. Hardstem bulrush occupies the deepest portion of the emergent zone, with burreed, cattail, and Baltic rush found in shallow water. The separation of these vegetation zones increases the value of the marshland as a waterfowl habitat (Duebbert 1969). Small pondweed *(Potamogeton pusillus*) and sago (*Potamogeton pectinatus*) are common open water plant species, and water milfoil (*Miriophyllum exalbescens*) is the most abundant submergent. Sago is the most valuable waterfowl food plant in the marshes, and Duebbert (1969:13) notes that the use of the lake by migratory birds directly depends on its availability. Moist soil plants include alkalai ryegrass (*Elymus triticoides*), meadow barley (*Hordeum brachyantherum*), spike rush (*Eleocharis palustris),* water plantain *(Alisma plantagoaquatica*), broadleaved arrowhead (*Sagittaria latifolia*), hoary nettle (*Urtica holosericea*), and flixweed *(Descurainia sophia*). The lakeshore margin where seasonally receding waters left mudflats was a home for chenopods (*Atriplex sp., Chenopodium sp., Suaeda sp.*) including seepweed, or wada (*Sueda depressa*), for which the Harney Basin Paiute bands were named the *Wadatika*, or "wada eaters" (Blyth 1938; Duebbert 1969).

Fowler (1986) documents Native use of 346 food plants in the Great Basin. Of these, 83 were attributed to either the Nevada Northern Paiute or Northern Paiute in general, and 50 were attributed specifically to the Oregon Northern Paiute. Fowler (1986) does not consider her list to be complete, nor does it take into account the wide variety of plant species that were used for clothing, basketry, and the construction of dwellings. Couture (1978) describes 47 "useful" plants that are still collected by the Burns Paiutes for food, medicine, basketry, and for use as tools (e.g. digging sticks).

Mammals

The environmental setting of the Harney Valley provided a variety of habitats for a diverse assortment of mammals, birds, and fish. More than 85 species of mammals, 290 species of birds, and 41 species of fish are known to inhabit the Northern Great Basin (Ferguson and

Ferguson 1978). Some species inhabit the region year round, while many others, particularly birds, are seasonal visitors. In addition, some species have limited ranges constrained by water, vegetation, or elevational requirements, while others roam freely across the landscape. High biological productivity at Malheur Lake led to the establishment of the Malheur National Wildlife Refuge in 1908, and, even today, the basin teems with wildlife particularly during the spring and fall.

The largest animals currently found in the Harney Basin are Artiodactyls, such as mule deer (*Odicoileus hemionus*), white-tailed deer (*Odicoileus virginianus leucurus*) and pronghorn antelope (*Antilocapra americana*). Rocky Mountain elk (*Cervus canadensis)* were once common throughout the Blue Mountain physiographic province, and elk antlers have been collected along the Silvies River (Bailey 1936:78). Bailey (1936:57) reports that bison (*Bison bison*) were once abundant in southeastern Oregon, northeastern California, and northern Nevada. Peter Skene Ogden recorded the presence of bison remains at Harney Lake in 1826 (Eliot 1910:207), and bison bones have been collected from dried lake beds and cave floors throughout southeastern Oregon. Recent work by Stutte (2004) to clarify bison geographic and temporal distributions indicated that *Bison bison* were present east of the Cascades between 800 BP and 170 BP. Once plentiful, mountain sheep (*Ovis canadensis*) fell victim to diseases imported to the region with domestic sheep species. Mountain sheep have been reintroduced to the area from distant populations.

Wolves (*Canis lycaon*) were once common in eastern Oregon, found in association with bison throughout their former range. By 1931, wolves had been hunted to extinction across the state (Bailey 1936:272-275), although Ferguson and Ferguson (1978:47) report that a gray wolf was killed in nearby Malheur County in 1974. More recently, a gray wolf that crossed the Snake River in February, 1999, was captured near the headwaters of the John Day River and returned to Idaho. Other members of the *Canidae* family present in the region include the red fox (*Vulpes vulpes*), the kit fox (*Vulpes velox*) and the ubiquitous coyote (*Canis latrans*).

The skeletal remains of grizzly bears (*Ursus mirus*) have been collected along the Silvies River and at Malheur Lake. Yakima Jim, a Paiute chief interviewed by William Schnabel in 1916 commented that long ago there were so many bears on Steens Mountain that Indians never went there alone, but always in groups of two or more. Grizzlies were largely eradicated at an early date by settlers and ranchers in the area (Bailey 1936:330), but the last known grizzly in Oregon was killed in 1931.

The family Felidae is represented by bobcats (*Lynx rufus*), lynx (*Lynx lynx*) and mountain lions (*Felis concolor*). Lynx are extremely rare in the region today, inhabiting forested areas on the northern edge of the basin (Ferguson and Ferguson 1978).

Ten species of mustelids are found in the Harney Valley. Martens (*Martes americanus*) and fishers (*Martes pennanti*) are found in forested areas near deserts, but weasels (*Mustela sp.*), skunks (*Spilogale putorius, Mephitis mephitis*), minks (*Lutreola lutreola*), and badgers (*Taxidea taxus*) are common. River otters (*Lutra canadensis*) are now extinct in the basin, and wolverines (*Gulo luscus)* were thought to be until an individual was recorded on Steens Mountain in 1975 (Ferguson and Ferguson 1978:49).

Numerous small mammal species were economically important to the native populations in the area. Leporids, including blacktailed jackrabbits (*Lepus californicus*), mountain cottontails (*Sylvilagus nuttalli*), and pygmy cottontails (*Sylvilagus idahoensis*) were vital as a source of food and material for fur robes. Woodrats (*Neotoma sp.*), chipmunks (*Eutamias sp.*), ground squirrels (*Citellus sp.*), yellow-bellied marmots (*Marmota flaviventris*), voles (*Microtus sp.*), gophers (*Thomomys sp.*), and mice and rats (Family *Cricetidae*) were hunted or trapped whenever possible. Muskrats (*Ondatra zibethica*) were an important faunal resource at some archaeological sites around Malheur Lake, comprising over 45% of the total mammalian faunal assemblage (Aikens and Greenspan 1986; Botkin and Carambelas 1992; Elston et al. 1993). Duebbert (1969:19) reported that muskrat populations can exceed 50,000 during good years. Beavers (*Castor canadensis*), raccoons (*Procyon lotor*), and porcupines (*Erethizon dorsatum*) were taken when available.

All of the species above were hunted when the opportunity presented itself, but Steward (1938:33) commented that in the Great Basin generally, only the bison and the antelope were subjects of "important hunts." Rabbit drives were also conducted, however, with the use of long (150-200 yard) nets to corral the animals. Occasionally, "surrounds" were created with the use of fire (Steward 1938:38-39).

Birds

Approximately 290 species of birds have been recorded in the Northern Great Basin (Ferguson and Ferguson 1978). Some of these species are accidental wanderers blown off course by storms, and others are strays that inhabit areas mainly peripheral to the Great Basin. None the less, Malheur Lake is considered to be among the best waterfowl producing habitats in North America (Duebbert 1969:14), particularly for shallow water (or surface feeding) species. Up to 22 species of ducks , three species of geese, and two species of swans (all *Anatidae*) occur at the lake during peak migration periods of the spring and fall. Of these, twelve species of ducks, one species of goose, and one species of swan nest at the lake on a regular basis. In areas that contain prime waterfowl habitat, duck production can reach 500 birds per square mile.

Of course, other water birds and shore birds benefit from the fine habitat, including egrets and herons (*Ardeidae*), cranes (*Gruidae*), grebes (*Podicipedidae*), pelicans (*Pelecanidae*), and ibises (*Threskiornithidae*), to name a few. Birds of prey include hawks and eagles (*Accipitridae*), falcons (*Falconidae*), and owls (*Tytonidae* and *Strigidae*), all of which take advantage of the abundant rodent and leporid populations in the area. Several species of blackbirds (*Icteridae*) inhabit the reedy margins surrounding the open water, congregating by the thousands during the breeding season. Sage grouse (*Centrocercus urophasianus*) inhabit the upland regions that surround the marsh.

Fishes

The Northern Great Basin is home to over 40 species of fish, belonging to nine families (Ferguson and Ferguson 1978). Cold, swift upland streams become slower and warmer as they wind across the basin floor and into the marshes, providing a variety of habitats for different species. Temperature, water alkalinity, and evaporation all play a part in the distribution of fish in the Harney Valley.

Archaeological evidence suggests that at least three species of fish were economically important to the indigenous peoples of the area. The remains of tui chub (*Gila bicolor*), suckers (*Catostomus sp.*) and northern pike minnows (previously known as northern squawfish [*Ptychocheilus oregonensis*]) were recovered during archaeological excavations at the Headquarters site (Aikens and Greenspan 1986:42). Large salmon runs (probably *Oncorhynchus tshawytscha;* "chinook") were present in the Malheur River by early summer, and ethnographic accounts describe Northern Paiutes moving across the mountains from the spring root grounds to trap them at various locales (Couture 1978:34). Also, several species of trout (*Oncorhynchus sp.)* were available in the larger streams throughout Harney Valley.

The Ethnohistoric Record

In 1826, Peter Skene Ogden became the first known Euro-American observer to document the lifeways of indigenous people in the Harney Valley. On November 1, 1826, Ogden and a party of Hudson's Bay Company fur trappers entered a "country of rivers and lakes," that they characterized as empty of wildlife, although an abundance of wild fowl was noted, as well as the remains of bison. The cited journal passage seems to be paradoxical, but, as fur trappers, Ogden and his party no doubt had very specific ideas about which wildlife species were important and which were not. Ogden (Eliot 1910:208) made the following entry in his journal on November 3, 1826, while camped near Malheur and Harney Lakes: “It is incredible the number of indians in this quarter. We cannot go 10 yards without finding them. Huts generally of grass of a size to hold 6 or 8 persons. No Indian nation so numerous as these in all North America.” Although Ogden's description of the indigenous population is surely exaggerated, the account does offer insight into the degree of human concentration that occurred at lakeside villages in the Harney Valley.

John Work led another party of Hudson's Bay Company trappers into the Harney Valley during September and October of 1832. Work saw few Indians as his party passed through the area (although he felt his party was constantly being followed), and those he did encounter seemed reluctant to associate with the trappers (Maloney 1945). Perhaps this was a result of violent encounters with other whites following Ogden's more hospitably met forays into the region. Work's own efforts to keep relations with the Native Americans on a friendly basis evaporated after the attempted ambush of one of his trappers was thwarted only by the arrival of reinforcements. This encounter took place near Abert Lake, southwest of Harney Valley. Ogden, Work, and other explorers loosely referred to the Indians over a relatively large region as "Snakes", presumably with reference to the Snake River country northeast of the Harney Valley.

Northern Paiute territorial bands were generally named with regard to a favored resource or a geographic location (many of which were already named for specific resources that were collected there). The culture group that Ogden had encountered during his 1826 explorations are properly known as the *Wada'tika* (wada eaters) band of Northern Paiutes and now commonly referred to as the Harney Valley, or Burns Paiutes. Northern Paiutes belong to the Numic division of the Uto-Aztecan family of languages.

Wada (*Suaeda depressa)*, also known as seepweed, is a marsh-edge perennial from which large quantities of tiny black seeds were harvested in late summer, then stored for use during the winter (Couture 1978:91). Couture (1978) feels that groups named after food resources, such as the *Wada'tika,* did not necessarily derive their names from the most significant resource in their territories, but more from the fact that the resource occurred in the area in which they were associated. On the other hand, Fowler (1982:127), is of the opinion that food names refer to ... *"what the local groups had most to share"* (her emphasis), implying that the resource was plentiful and available for the asking.

Few of the economic pursuits of the Northern Paiutes required the aid of persons outside of the extended family (Whiting 1950:20), but camp groups of three to ten families were known to forage together for much of the year, and, at the very least, winter together at a fixed location within their home territory (Fowler 1982:117). In the Harney Valley, subsistence and settlement patterns would have centered around Harney and Malheur Lakes, with trips into surrounding areas as both plant and animal resources became available at varying times of the year. The territory of the *Wada'tika* extended to Silvies and Drewsey in the north, west to Wagontire, and included Beaty's Butte, Catlow Valley, and Alvord Lake as its southernmost extensions (Blyth 1938:403). The boundaries were not distinct, and people regularly traveled outside of their normal range for a variety of reasons. Populations were quite fluid and families were known to winter with relatives in bands well outside of their common territory.

The Seasonal Round

At the time of historic contact, the *Wada'tika* band of Northern Paiutes were the principal occupants of the Harney Valley, although they regularly came together with other groups both inside and outside of the basin (Couture et al. 1986). Archaeologically, Northern Paiutes have been considered by some to be late arrivals to the Northern Great Basin (Lamb 1958; Madsen et al. 1994). It is speculated that they may have replaced ancestral Klamath populations in some areas (Kelly 1932), or perhaps replaced these populations when either drought or disease encouraged a withdrawal from the area (Aikens and Jenkins 1994b). In any case, Northern Paiute ethnographies provide the best examples of settlement and subsistence patterns in the region, and the following information has been drawn from such sources.

The seasonal round is best picked up in the early spring, when winter stores were depleted and the first shoots, indicating the location of prized roots, began to appear in the uplands. It was common for food supplies to run very low in the late winter, and sometimes a camp group would run completely out of food. In such cases, the starving group would join with another that still had supplies to share, even though they may not have belonged to the same band (Whiting 1950:20). Pine Creek, in the vicinity of Stinkingwater Pass, was a major root collecting location for the *Wada'tika*. Couture (1978:29) notes the collection of 17 plant varieties at this locality, including camas (*Camassia quamash*), biscuit root (*Lomatium sp.*), bitterroot (*Lewisia rediviva*), epos (*Perideridia oregana*), and wild onion (*Allium madidum*), along with other varieties also used as food, or for medicinal purposes.

Another important function of the root camp was to re-establish social ties with other culture groups that traveled to Pine Creek. Among these were Bannocks, Umatillas, Yakimas, Shoshones, and *Gidu'tika* (Groundhog eaters) from Surprise Valley. For approximately six weeks beginning in late April, people met at this location to exchange news, arrange marriages, trade, gamble, and play games (Couture et al. 1986:153).

The spring run of salmon entered the Malheur and Drewsey Rivers around the same time as root gathering began to wane in the uplands. The men left the upland camps to repair and set up their salmon traps while the women finished gathering and preparing roots for storage. After the women finished with this work, they moved down to the rivers and began to help the men process salmon (Whiting 1950:17). The end of the salmon run led to the breakup of the various camp groups. Bands dispersed across the landscape in extended families to hunt, and to collect various roots and seeds as they became available. These included aki (*Wyethia amplexicaulis*), kusiaki (*Balsamorhiza hookeri*), and camas (*Camassia quamash*) (Couture 1978:30, Couture et al. 1986:153-154). Whiting (1950:19) reports that crickets were collected around the middle of July, then roasted, dried and pounded into a protein-rich paste that was cached for winter use. Cricket gathering occurred near Cow Creek, with the Hunibui-Eaters from the north joining the

Wada-Eaters to lay in supplies, socialize, and gamble. After the crickets were harvested, families once again dispersed, hunting game and gathering plant materials at familiar locations. Currants (*Ribes sp.*), hawthorn berries (*Crataegus douglasii*), and rose hips (*Rosa woodsii*), were collected around this time. Groundhogs (Yellow-bellied Marmots) and fish were procured during the summer and deer and elk were hunted when the opportunity arose.

Large numbers of people gathered at Malheur Lake in the late summer, when the *wada* seeds began to ripen. Wada was an important winter resource and large quantities of the seeds were harvested and stored. Indian rice grass (*Oryzopsis hymenoides*), giant wild rye (*Elymus cinereus*), saltbush (*Atriplex sp.*), and chokecherries (*Prunus virginiana*) also matured during this time and were harvested for later use. The *wada* gatherings were a time for festivities as well; games and dancing were an important part of the late summer rendezvous (Whiting 1950:19). Communal rabbit and antelope drives occurred at this time of year, when many hands were available for pushing game toward confining fences or nets.

In the fall, special trips were made to Dixie Butte (near John Day) where men hunted elk while the women collected huckleberries (Couture et al. 1986:154). Other plants collected in the fall included guuha (*Mentezelia laevicaulis*), and tyba (*Pinus ponderosa*) from which pine nuts and cambium bark were harvested.

Sometime around the first of November, the people collected their cached foods and established winter camps near Harney and Malheur Lakes. Winter camps were constructed adjacent to springs or other sources of water, where firewood was plentiful and snow did not accumulate (Whiting 1950:19). Such camps were reported by Blyth (1938:402) at the marshes near Silver Creek, Harney, Diamond, Blitzen, Catlow Valley, and possibly Wild Horse Creek. The winter dwellings were constructed of a willow pole framework, gathered at the top, which was then covered with tule mats. The houses were conical or dome-shaped structures, and it is believed that the dome shaped house was more popular in earlier times (Fowler and Liljeblad 1986:423-424). Food was cached in pits outside of the dwelling, or in bags that were stored inside. Wada, tsuga, yapa, crickets, dried meat, dried fish, and chokecherries were winter staples. The stored provisions were supplemented with fresh meat and fish whenever possible. Rabbits were snared or captured in communal drives even during winter, with 200 to 300 foot long nets stretched across the snow (Whiting 1950:20).

The availability of seasonally collected resources could not be counted on from year to year. A shortage of any resource could mean increased hardship during the already difficult winter months when people were reliant on foods stored from spring and summer collecting. Whiting (1950:20) reported a famine that occurred when Tagu Eaters from Jordan Valley ran out of winter stores, then joined with the Wada Eaters, whose supplies were quickly exhausted. Regarding the Harney Valley Paiutes, Ogden (Eliot 1910:208) comments in his journal entry of November 3, 1826: "Many a day they pass without food and without a murmur." Considering that the entry was made at the beginning of the winter months, the comment suggests that the people may have begun rationing their supplies early, in preparation for the hard times that were ahead. As winter once again gave way to spring, the *Wada'tika* broke camp and converged on the Pine Creek root collecting grounds to begin the annual round anew.

The seasonal round described above has been gleaned from researchers who collected their ethnographic information well after the *Wada'tika* had been in contact with Euro-Americans. The degree to which contact may have altered prehistoric lifeways will never be fully known, but it seems likely that the effect was considerable. A remarkable change in the relations between the Harney Valley Paiutes and Hudson's Bay Company trappers becomes evident through reading the entries of Peter Skene Ogden's November, 1826, journal, and John Work's September, 1832, journal. In the course of less than six years, attitudes toward the trappers had changed from the open and seemingly unconcerned reception that Ogden's party had encountered to the standoffish and occasionally hostile behavior that Work reported. Whatever interactions occurred between Harney Valley Paiutes and Euro-Americans in that short period of time are currently lost to history, but they may have dramatically altered the behavior of the indigenous people. Encroachment by whites, introduced diseases, conflicts with the military, and eventual removal to reservations in the 1870's all surely contributed to the alteration of *Wada'tika* traditional lifeways.

Archaeological Surveys

Archaeological research in the Harney Basin has primarily been limited to surface surveys and occasional subsurface testing, with block excavation at sites either being rare or unreported. The majority of the work has occurred on or adjacent to Malheur National Wildlife Refuge, where there has been financial support for satisfying federally mandated cultural resource management requirements. Survey and testing projects have generally been oriented simply towards determining the presence and significance of archaeological sites on public lands, leaving the addressing of more complex issues about human occupation in the area to later research.

Surveys

Following Cressman's (1937) rock art studies in the early 1930s, the next archaeologicalinvestigation in the basin occurred at the Riley obsidian source, on the northwestern edge of Harney Valley. A surface survey and subsequent analysis of the collected tools was reported by Atherton in 1966. The site appears to have been used primarily as an obsidian quarrying locale. Atherton noted the presence of quarry "blanks" and possible scraping or carving tools. All of the artifacts collected at Riley were percussion flaked; no pressure flaked points were observed and it may be that tools were being roughly shaped at the source, then transported to other localities for use.

In 1970, archaeologists from Portland State University began a three year survey of lands surrounding Harney and Malheur Lakes, and portions of the Blitzen Valley (Newman et al. 1974; O'Brien 2002). The 166 sites that were recorded included open sites, rock art (pictographs and petroglyphs), rock shelters, stone rings, house depressions, and burials. Some excavations were made during the course of the project, but reporting of the results has been limited.

Thomas et al. (1983) reported that a dune site containing pottery had been discovered during a BLM survey near Diamond Craters, south of Malheur Lake. Pottery is rarely found in Northern Great Basin sites. An intensive surface survey at the Lost Dune site (Figure 1.2) produced 189 pottery sherds attributed to the Shoshoni Tradition, along with bison bone. Temporally diagnostic tools included Humboldt Concave Base and Elko Series points from the Middle Holocene, and Desert Side-notched, Cottonwood Triangular, and Rosegate projectile points, indicating late Holocene occupations. Lyons (2001) reported that pottery and sandstone artifacts from the site originated near the Oregon-Idaho border and chert and obsidian tools were from sources near the Oregon-Nevada border.

Toepel and Minor (1983a) conducted a survey following the Eagle's Nest Burn on the west side of Malheur National Wildlife Refuge. Fourteen lithic scatters were recorded, including three which contained groundstone. A second survey was conducted in Diamond Valley (Toepel and Minor 1983b), where six lithic scatters were noted. Four of these sites were returned to later for testing. Two of the sites yielded significant cultural deposits and data recovery was carried

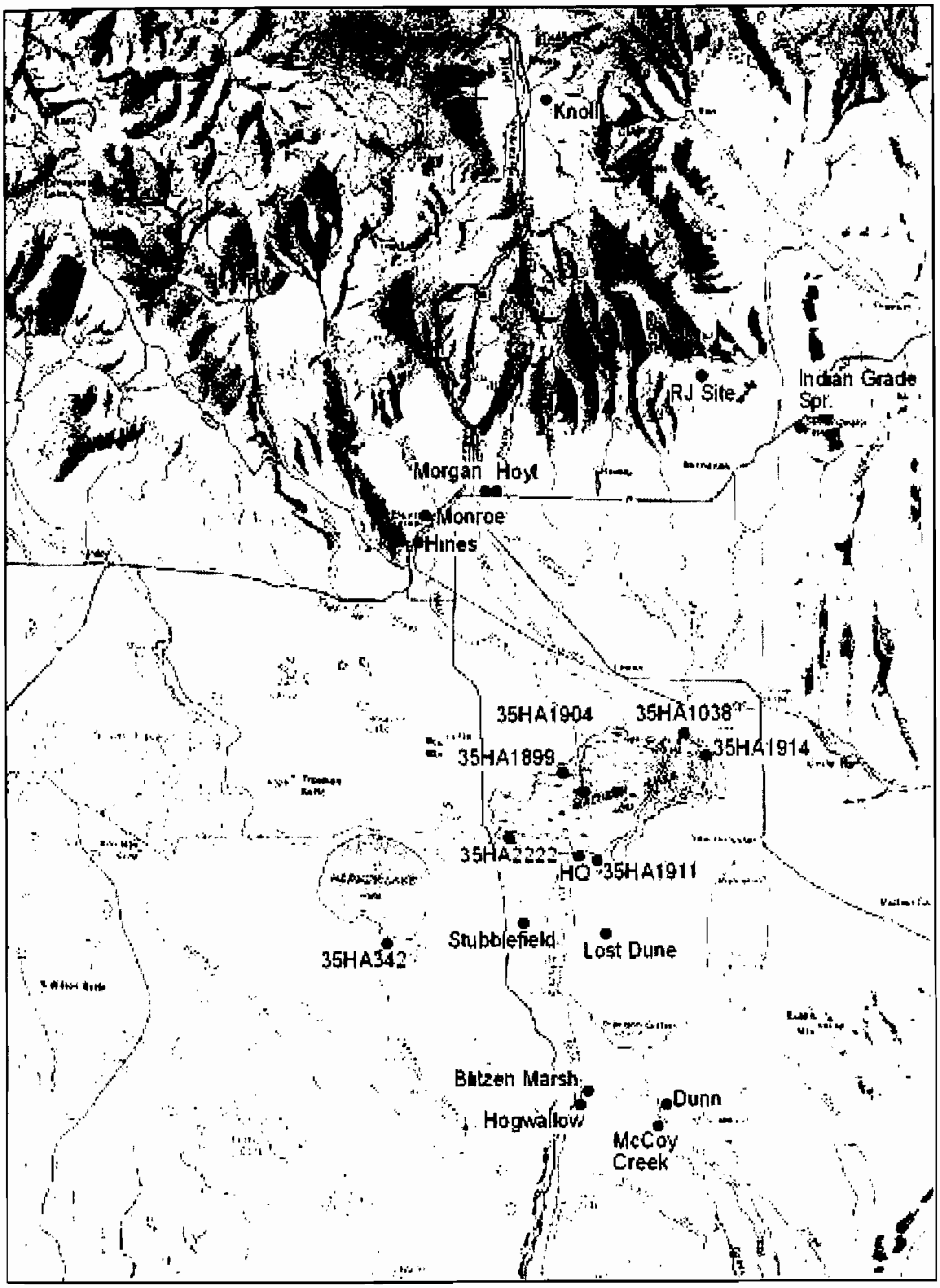

Figure 1.2. Selected Harney Basin archaeological sites described in the text.

out at the Dunn Site (35HA1261), and the McCoy Creek Site (35HA1263) in 1988 (see Musil 1995). Tools recovered during the surveys included Desert Side-notched, Rosegate, and Elko Series projectile points, and occupations are thought to have intensified during the last 4000 years (Toepel and Minor 1983a:28).

Extensive flooding in the Malheur and Harney lake basins occurred in the early 1980's, prompting an investigation into possible flood control mechanisms to avoid future damage to homes and property. The proposal of a drainage canal linking Malheur Lake to the south fork of the Malheur River was taken into consideration, and a 51 mile corridor was archaeologically surveyed from the east edge of Malheur Lake through Voltage Divide, Virginia Valley, and finally to the Malheur River. A total of 130 archaeological sites were recorded, 97 of which were located along the Malheur River and 33 in either the Virginia Valley or Voltage Divide areas (Chatters 1986). The sites included multiple activity sites, lithic scatters, and rock shelters. Relative dates for the diagnostic artifacts collected ranged from the early to late Holocene (approximately 10,000 years). The artifacts included Western Stemmed, Lanceolate, Northern Side-notched, Gatecliff, Elko Series, Rosegate, Cottonwood Triangular, and Desert Side-notched projectile points. Desert Side-notched and Cottonwood Triangular points were found only in the Malheur River sites during the course of this survey.

Erosion caused by the rise and fall of floodwaters at Harney and Malheur Lakes exposed numerous archaeological sites, providing an excellent opportunity for archaeologists to observe and record sites that were previously unknown. Unfortunately, this opportunity did not pass unnoticed by artifact collectors and, because their continued presence on refuge lands became detrimental to nesting shorebirds as well as archaeological sites, Heritage Research Associates was contracted to conduct a survey and collect surface artifacts on behalf of the Malheur National Wildlife Refuge in 1988 and 1989. An additional survey for the State Historic Preservation Office (SHPO) was conducted on adjacent private lands in 1989 (Oetting 1990, 1992).

The initial survey occurred along the southern shore of Malheur Lake, and included 28 islands, all within the refuge boundary. A total of 28 archaeological sites was recorded, and 1940 artifacts were collected. The artifacts included 593 classifiable projectile points, 43 distinctive bifaces, 560 other bifaces, 228 pieces of ground stone, and 132 net weights. Rosegate points made up 50% of the temporally diagnostic artifacts, followed by Elko Series points (20%), with slightly less than 15% of the assemblage composed of Middle and Early Holocene points each (Oetting 1990:18-19). The SHPO surveys covered 26 miles of the 1989 shoreline level on both the north and the south shores of the lake. A total of 45 sites was recorded, three of which were previously known. A total of 191 artifacts was collected from 26 of the sites, of which 102 were projectile points, 38 were formed bifaces, seven were utilized flakes, three were net weights, and 19 were ground stone. Desert Side-notched, Small Side-notched, Cottonwood Triangular, and Rosegate projectile points accounted for 49% of the diagnostic tools collected, Elko Series points represented 28%, and Middle to Late Holocene points made up 15% of the total. The intent of the 1988 and 1989 surveys was to recover artifact classes known to be of interest to collectors, and the quantities of artifacts reported do not reflect the true numbers seen in the field, particularly with regard to utilized flakes, biface fragments, and ground stone. Oetting (1992:125) feels that occupation of the lake and marsh regions intensified after 5000 B.P., based on frequencies of temporally diagnostic artifacts.

Subsurface Testing

Archaeologists from Portland State University carried out limited testing at the Squaw Pit Site (35HA1038), in conjunction with surveys they conducted during the early 1970s. The site consists of a number of circular depressions adjacent to Malheur Slough, which enters Malheur Lake from the north, and may represent a sedentary or semi-sedentary lake-marsh village (Aikens and Greenspan 1988). The depressions are approximately 2-2.5 meters in diameter and 20 cm in depth. Testing exposed three possible living floors, but there was no evidence for structural supports of any kind. Oetting's examination of the cultural materials from the site revealed that 11 of the 13 diagnostic projectile points were narrow-necked, suggesting Late Holocene occupations (Oetting 1989:158).

Portland State University conducted testing at site 35HA974, which was also discovered during the survey period. The site is situated on a rim overlooking Baca Lake, in the Blitzen Valley, and consists of at least seven stone rings up to three courses in height with inside diameters of 2.5-4.0 meters. Although the cultural deposits were very thin, the rings produced 47 projectile points or fragments suggestive of late Middle Holocene to late Holocene occupations, including Elko Series, Rosegate, Desert Side-notched, and Cottonwood Triangular varieties. Other cultural materials included bifaces, utilized flakes, ground stone, debitage, shell, and bone (Newman et al. 1974).

Gehr (1980) studied the geomorphology and archaeology of six sites that were associated with high stand beach terraces on the south shore of Harney Lake. The terraces are the product of erosion and deposition from pluvial lakes that have been radiocarbon dated between 32,000 and 8680 BP. The highest terrace (approximately 4100 meters in elevation) was dated on mollusc shell to 8680±55 BP at Site 35HA342 (The Fenceline Site). A large biface was recovered from within the dated deposit and a blade fragment was found beneath it, but above a lake bottom deposit that had been dated on mollusc shells to 9620±50 BP. The mollusc shell date of 9610 BP is currently the oldest in the Harney Valley associated with an artifact, though it is true that the dated shell fragments were actually collected from below the biface. Of course, diagnostic artifacts that are known to be older have been collected from surface sites. Excavation at 35HA342 failed to produce additional cultural materials. Surface collection at the five other sites in the study produced crescents (at three sites), a Lind Coulee point base, leaf shaped points, and "true" lamellor blades. Ground stone was absent in all of the sites.

Wriston (2003) working on behalf of the University of Nevada, Reno (UNR), and Sundance Archaeological Research Fund (SARF) conducted excavations at 35HA341 near Gehr's Fenceline site during the 2000 – 2002 field seasons. The project was undertaken after a Haskett point was observed in the wall of Weed Lake Ditch during reconnaissance. The Haskett point was found in the ditch cut near Gehr's earlier stemmed point discovery and an examination of the area suggested that there were actually two sites that intersected at Weed Lake Ditch; the multi-component (early to late Holocene) 35HA342, and 35HA341, which is entirely early Holocene. Wriston recommended that the artifacts Gehr recovered from the ditch cut be considered part of 35HA341 based on point typology and stratigraphic position. Excavations at 35HA341 over a three-year period included eight backhoe trenches, eight 1x1 m units, and three auger holes. Wriston's (2003) efforts yielded four Haskett Stemmed points, three untyped stemmed points, a crescent, a bone bead perform, 32 bifaces, eight unifaces, seven utilized flakes, 11 cores, 14,504 bone fragments and 16,242 pieces of debitage. She also collected charcoal samples and gastropod shell. The charcoal was not suitable for radiocarbon dating, but the gastropod shell returned radiocarbon dates of 9860±80 BP, 9540±60 BP, 9820±60 BP, and 9550±60 BP (Cal BP dates range from 11,540 to 10,670). Pedestrian surveys of 400 acres centered on the excavation site resulted in the recovery of 200 hundred tools that included 34 stemmed points, six concave base points, four crescents, and nine others consisting of Elko series, Rosegate, and typologically unidentifiable specimens.

Researchers from UNR/SARF have also conducted excavations at other early Holocene sites in recent years, including the Nials site and the Biting Fly site. The Nials site (35HA2828) is situated on the south shore of Harney Lake approximately 2.5 km from 35HA341. Excavations that occurred from 1997 through 1999 produced evidence of a single component site approximately 8000 years old (Bonstead 2000). A total of 20 1x1 m units, three 1/2 x1 m units and five backhoe trenches resulted in the recovery of five Great Basin Stemmed points, two crescents, a worked bone object, 63 bifaces, over 26,000 pieces of debitage, and 5680 bone fragments that included fish (65%), leporids (21%), and waterfowl (3%). No dateable organic materials were collected, but the cultural stratum is bracketed by aeolian-borne tephra believed to be from the Mazama eruptions (ca. 6900 BP) and gravels deposited during the last high stand of Pluvial Lake Malheur (ca. 9900 BP) below (Bonstead 2000). The Biting Fly site (35HA1260) was first recorded by UNR/SARF researchers in 1997 on the eastern portion of the beach bar that holds 35 HA341. Limited testing occurred at the site in 1997 and 2000, and surface collection took place in 1998, 1999, and 2000. Only one diagnostic artifact (a crescent) was recovered during the excavations and it became apparent that the artifact laden deposit was, at best, shallowly buried (Branigan 2000). Artifacts indicating a time depth from early to late Holocene were noted during surveys of the area, with the majority of the tools consisting of stemmed points and crescents. The statigraphy at Biting Fly appears to be similar to that of the Nials site, suggesting that occupation(s) may have occurred there sometime around 8000 years ago (Wriston 2003).

Intermountain Research investigated the geomorphology and archaeology of two sites on the south shore of Malheur Lake (35HA1028 and 35HA1911) in October of 1991 (Raven and Elston 1992). Seven units were excavated at 35HA1911 and the majority of the cultural materials were recovered in the first 20 cm. Oetting (1990:91-95) reports that 147 artifacts were collected at the site during surveys in 1988 and 1989, including Elko Series, Small Side-notched, Rosegate, and Desert Side-notched projectile points. A total of 51 isolated human bones and three burials were noted, including two that were associated with large ground stone metates and hopper mortars. Chronologically diagnostic artifacts recovered during the excavation included one Great Basin Stemmed point and three Rosegate points (Botkin and Carambelas 1992:75). Rosegate points account for 35 of the 46 diagnostic points collected during both surveys and excavation at the site. In addition, seven bifaces, seven flake tools, and 13 ground stone artifacts were collected.

At 35HA1028, the cultural assemblage was more diverse. Like 35HA1911, projectile points from the latter site indicate the presence of humans throughout the Holocene. Surface reconnaissance along with excavation in eight units produced 24 chronologically diagnostic artifacts, including Great Basin Stemmed, Humboldt, Large Side-notched, Elko, Rosegate, and Desert Side-notched varieties. Also, 27 bifaces, 13 flake tools, two groundstone fragments, an *Olivella* shell bead, one bone tool fragment, and nine historic fragments of glass and crockery were collected (Botkin and Carambelas 1992:103-116).

Intermountain Research conducted surface and subsurface investigations of four sites on dune islands in Malheur Lake during August of 1992 (Elston and Dugas 1993). Trenching and subsequent hand excavations were conducted to examine the archaeological and geomorphological properties at each site. Surface surveys at all of the sites concentrated on artifacts considered to be of interest to artifact collectors, so the amount of ground stone, debitage, cores, and utilized flakes of obsidian and basalt that were actually present at the sites is not reflected in the materials that were reported. Three of the sites (35HA2222, 35HA1899, and 35HA1904) are located on the northwest edge of Malheur Lake, and one site (35HA1914) is located on the eastern side.

Site 35HA1914 consisted of a light scatter of artifacts from which two cores, one piece of ground stone, and a Cottonwood Triangular point were recovered during surface surveys in 1988 and 1989 (Oetting 1990a). A hearth was seen eroding from the surface at that time and charcoal samples were taken, but have not been dated. Two excavation units produced a biface, one flake tool, one core, and two pieces of debitage. All of the cultural material was recovered from above strata dating between 720 and 760 BP (Elston et al. 1993a).

Site 35HA2222 was unknown until 1990, when Malheur National Wildlife Refuge personnel apprehended artifact collectors there (Elston et al. 1993b). A surface survey occurred shortly after that time, but the detailed results of the survey are currently not available. Surface collection over a 5 x 30 meter plot and the excavation of four 1 x 0.5 meter units produced 26 projectile points including Elko Series, Rosegate, and Desert Side-notched types (Elston and Dugas 1993). A total of 17 bifaces, 15 flake tools, 17 pieces of ground stone, four beads (two stone, 1 shell, and 1 bone), a grooved net weight, and three lead shot fragments was collected. The excavation produced one cultural feature; a 1 x 1 meter cluster of artifacts which included a Rosegate projectile point, one biface, three pieces of ground stone, and six pieces of fire-cracked rock.

The Dune Island site (35HA1899) was surveyed in 1988 and1989. Of the 205 projectile points that were collected during the survey of the ca. 38,500 m² site, 100 were Rosegate points, suggesting primarily late Holocene occupations (Elston and Dugas 1993; Oetting 1990). A total of 373 artifacts were surface collected during the surveys. Other diagnostic points from the site included Great Basin Stemmed, Elko, Malheur Stemmed, Cottonwood Triangular, and Desert Side-notched varieties. Excavations at 35HA1899 consisted of trenching, followed by hand excavation of three 1 x 0.5 m units and three 1 x 1 m units. During the surveys, a possible house feature had been noted, but subsequent erosion removed all trace of it. The excavation of Trench A revealed Feature 1, a dish shaped stain 1.80 cm in width that was explored through two units. The feature was not dated, and its function remains unknown. Also recovered in the excavations were nine bifaces, eight flake tools, two Elko and three Rosegate projectile points, a core, three pieces of ground stone, and two beads; one of stone and one of bone. Two of the three burials that were found at 35HA1899 were radiocarbon dated. One burial produced a date of 1730 BP, and the other was dated to 510 BP (Elston et al. 1993c).

At the Dune Island site (35HA1904), 150 artifacts were surface collected in 1988 and 1989 (Oetting 1990). The majority of the projectile points were Rosegate, followed by Elko, Malheur Stemmed, and Desert Side-notched varieties. Excavation consisted of trenching, followed by hand excavation of four 1 x 0.5 m units and one 0.5 x 0.5 m unit. One of the excavation units encountered Feature 1, a hearth that was radiocarbon dated to 950BP (Elston et al. 1993d). A second feature (Feature 2) consisted of a dark stain that was not dated or described in detail. Other artifacts that were recovered during the testing included four bifaces, five flake tools, four projectile points believed to be late Holocene, 30 ground stone tools, a core, and a drilled and polished bone tool believed to have been used on matting. Aside from the poorly represented 35HA1914, the above sites appear to have been most intensively occupied during the late Holocene, and the abundance of ground stone at each site suggests that a great deal of plant processing was occurring during the occupations.

Blitzen Marsh

John Fagan (1973, 1974) conducted test excavations at Hogwallow Spring (35HA8), Blitzen Marsh (35HA9), and 10 sites outside of the Harney Basin during the summer of 1970.

The research was carried out in an effort to test Stephen Bedwell's (1970:217) hypothesis that indigenous people of the Northern Great Basin did not abandon the region during a warm, dry period associated with the Altithermal climatic episode (Antevs 1948). Bedwell believed that settlement patterns shifted to higher elevation spring sites as water sources dried on the valley floors. Fagan was unable to collect radiocarbon dates of a suitable age to test Bedwell's hypothesis, but his work provided important data about upland habitations in the region.

Hogwallow Spring and the Blitzen Marsh site are located on the east edge of Blitzen Marsh, south of Malheur, Mud, and Harney Lakes. The Hogwallow Spring site is adjacent to the perennial spring, and testing revealed the presence of three cultural features at the location. The features included a living floor that was associated with both human and animal bone, an Elko point, and a mano; a concentration of bone tools and debitage; and a separate cluster of partially articulated animal bone associated with a large triangular knife fragment and a bone awl. Projectile points included Rosegate, Elko Series, Northern Side-notched, and Humboldt varieties (Fagan 1973:86-87). Other artifacts included bifaces, drills, groundstone, utilized flakes, scrapers and bone tools; among which were pieces of worked bone and antler, shaped bone tools of unknown usage, awls, and a tubular bone bead. The majority of the faunal remains were of small mammals and birds (46%), followed by fish (35%), large mammal bone (15%), and minute quantities of musselshell, and eggshell (Fagan 1973:88). No radiocarbon dates were reported from the Hogwallow Spring site.

The Blitzen Marsh site is approximately 2.5 kilometers from the Hogwallow Spring site, and appears to have been an area of intense occupation. Fagan (1973:96) suggested that Blitzen Marsh may have been a winter village site (also see Aikens and Greenspan 1988:45), such as was described ethnographically by Whiting (1950). The rich cultural deposits at Blitzen Marsh consisted of four strata, which yielded a varied and abundant assemblage of artifacts. Nine features were reported at the site, including three living floors, two house pits (one of which was lined with a clay floor), a storage pit, a rock oven, a rock cluster that was associated with ground stone and chipped stone tools, and a human burial. Eight radiocarbon dates from the site ranged in age from 150 to 2350 BP (Fagan 1974). Projectile point varieties included Humboldt, Northern Side-notched, Elko Series, Rosegate, Desert Side-notched, and Cottonwood Triangular. A diverse assemblage of other artifacts were recovered, including bifaces, drills, utilized flakes, formed scrapers, ground stone, tobacco pipe fragments, and a *Dentalium* bead. A bone flute, polished bone tubes, tubular beads, and shaped tools of unknown usage comprised the bone tool assemblage. Almost 83% of the faunal remains were small animal bones (including birds), with large mammal bones, fish, eggshell, and mussel shell making up the remainder.

The Stubblefield Lookout Tower site (35HA53) is located on the west side of Blitzen Marsh, and south of Harney, Mud, and Malheur Lakes. Testing occurred at the site in 1994. Intensive surface collection preceded the excavation of two backhoe trenches, thirteen 1 x 1 m units and one 1 x 0.5 m unit (Dugas et al. 1995). Artifact types at the site span the Holocene, but the majority of projectile point types in the assemblage are late Holocene varieties. Chronologically diagnostic points include Great Basin Stemmed, Humboldt, Northern Side-notched, Elko, Gatecliff, Malheur Stemmed, Rosegate, and Desert Side-notched varieties. Other artifacts collected at 35HA53 included 55 bifaces, 27 flake tools, 76 pieces of ground stone and a bone awl. Four features at the site were radiocarbon dated. Feature 1 was a hearth located approximately 30 cm below the surface that dated to 550 BP. Feature 2, another hearth located 15 cm below the surface, was dated to 130 BP. Feature 4, a burial covered by cobbles, was excavated until obvious human bones were revealed (approximately 45 cm below the surface). Charcoal from the uppermost deposits produced a date of 610 BP, and an Elko Eared point was seen in the rock cluster overlying the burial (Dugas et al 1995). Feature 5, a small hearth located 20 cm below the surface, was dated to 650 BP. The site is considered to have initially been a short term hunting camp, but the presence of ground stone and constructed hearths may indicate extended periods of plant processing in the late Holocene.

The Headquarters Site

The Malheur National Wildlife Refuge Headquarters (HQ) Site (35HA403) was originally recorded by Ruth McGilvra in 1973, but the site has been known to U.S. Fish and Wildlife personnel since the 1930s when excavations for the headquarters buildings yielded artifacts and human remains (Aikens and Greenspan 1986). The majority of the site is located on the northeastern slope of a small volcanic cone adjacent to the south edge of Malheur Lake (Dugas and Bullock 1994). The Donner und Blitzen (Blitzen) River enters Malheur Lake nearby, and Sod House Spring is adjacent to the site, providing an excellent source of fresh water. The HQ site has been tested episodically since 1979 in response to a variety of construction projects requiring subsurface excavations. These projects have included the addition of new water systems and septic tanks, the construction of a storage yard, and actual repositioning of the headquarters buildings as a result of flooding in the mid-1980s.

In 1979, 20 auger holes and a 1 x 1 meter test pit were dug along the route of proposed water lines near the observation pond. The test pit was excavated to 175 cm, with cultural materials encountered 20 cm below the surface that continued beyond the level at which the unit was terminated. The overall boundaries of the site were not determined. Recovered artifacts included Rosegate and Elko Series points, ground stone, utilized flakes, and debitage (Thomas 1979).

Charlotte Benson conducted additional testing at the HQ site in 1979, which consisted of nine auger holes and four 1 x 1 meter test pits (Minor and Greenspan 1985). Her work expanded the estimated boundaries of the site from 22 acres to 128 acres, although the study remains unreported and the exact locations of the test pits are unknown. Testing occurred again in 1979 in association with a trench that was excavated for the installation of new water lines. The work consisted of continuously profiling 278 meters of the trench walls, column profiling along 843 additional meters of trench, and limited screening of the backdirt. A variety of artifacts were recovered from rich, deep cultural deposits. Chronologically diagnostic artifacts included Great Basin Stemmed, Humboldt, Northern Side-notched, Elko Series, Rosegate, and Desert Side-notched points. Foliate points were also collected, as were bone tools, fragments of Catlow Twine basketry, knives, awls, drills, and ground stone (Campbell n.d.). Faunal remains included small birds and mammals, fish, and a few large mammal bones.

In 1984, Heritage Research Associates excavated 27 probes and two 1x1 m test pits along the northeastern periphery of the site in an area under consideration for construction of a septic drainfield and a storage yard. Recovered artifacts included two Elko Series points, nine bifaces (including three projectile point tips), scrapers, utilized flakes, ground stone, abraders, and a hammerstone (Minor and Greenspan 1985). Three species of fish were represented in the faunal remains, as were large and small mammals, and birds. Although portions of the test area proved to have high densities of cultural material, a low density location was identified for construction purposes.

In 1985, C. Melvin Aikens monitored the installation of waterlines at the HQ site. Aikens' project consisted of systematic screening of the backhoe backdirt, and profiling the trench walls at 10 meter intervals. The 48 resulting profiles spanned 350 meters of pipeline trenches at depths averaging 50-60 cm (Aikens and Greenspan 1986). A culturally-laden silt layer was encountered from 10 to 30 cm below surface, beneath various layers of fill. A total of 6351 artifacts were collected, of which 172 were formed tools, and 6179 were either unworked flakes or debitage. Chronologically diagnostic tools included three Humboldt Series, two Northern Side-notched, one Elko Series, two Rosegate, and one Desert Side-notched projectile point. A variety of bifaces, unifaces, cores, and ground stone made up the remaining tool types. Fish composed over 40% of the faunal remains at the site, with Tui chub bones representing 70% of that total. Muskrats accounted for 55% of the mammalian remains, and hares (Lepus sp.) 30%. Surprisingly, waterfowl account for less than 2% of the faunal remains at the HQ site. One human burial was encountered, which was covered over in its original position after the trench was redirected.

The flooding that occurred in the mid-1980s exposed cultural deposits to the west of Sod House Springs, prompting an intensive surface survey of a 45,000 square meter area (Minor and Toepel 1988). Surface artifacts were mapped and collected. A total of 1360 lithic artifacts and 230 animal bones were collected during the survey, of which 35 were temporally diagnostic projectile points. These included Northern Side-notched, Elko Series, and Rosegate varieties. Other collected artifacts included bifaces, scrapers, one drill, utilized flakes, debitage, cobble tools, and a variety of groundstone implements, including small palettes and an atlatl weight. Notched net weights were also recovered, the first reported from the Harney Basin.

Some of the most recent work at the Headquarters site was conducted by Intermountain Research in 1993 to assess the affects of a proposed visitor's center. The results were reported by Dugas and Bullock in 1994, and the following information is excerpted from their report. Geomorphic testing was carried out first, consisting of a series of soil cores which included six in the parking lot, eight in the shoreline below the parking lot, six in the lawn, and three in the grove. Two backhoe trenches were excavated, one on the shoreline below Sod House Spring, and one in the visitor's parking lot. Cultural materials were then obtained through the excavation of ten 1x1 meter units. One was excavated in the lawn, one in the grove, four at the backhoe trenches, and three west of the observation pond along the shoreline. Radiocarbon dates included seven charcoal dates ranging from 370±70 to 4760±240 BP, one soil-organics date of 8070±80 BP, and two tephra dates (23,400 BP and ca.120,000 BP). A total of 127 projectile points and preforms was recovered from seven units at the HQ site. Of these, 43 were chronologically diagnostic, including three Desert Series, 15 Rosegate, five Gunther, eight Elko, one Humboldt, one Malheur Stemmed, and ten Northern Side-notched. Dugas and Bullock (1994) observed a pattern of reworking and resharpening of tools and fragments coupled with a lack of cores that was first noted by Aikens and Greenspan (1986), and which may indicate a lack of raw lithic materials at the HQ site. Because the pattern is not consistent with other refuge sites, Dugas and Bullock (1994) believe that HQ occupations may have occurred in the winter, when snowfall masked lithic materials from view. Other artifacts included bifacial tools, flake tools, ground stone, and bone tools of various kinds, including beads, awls, one tube, one matting tool, one antler tool, and one bone harpoon toggle or barb. Faunal materials included approximately 10,000 specimens, of which almost 75% was determined to be fish bone. The faunal material was not identified to taxa, but waterfowl, muskrats, leporids, canids, pronghorn, and mountain sheep remains were noted. Charred botanical remains included species primarily from grassland and marshland settings.

In aggregate, the frequent, but limited test excavations at the Headquarters site have exposed long term and culturally rich occupations, possibly in accordance with Whiting's (1950) description of winter villages. The presence of Great Basin Stemmed projectile points suggests occupational episodes dating to the early Holocene, as the presence of Desert Side-notched points reveals that indigenous peoples were using the site at, or very near, the Euro-American contact period. Unfortunately, some excavation work that occurred at the Headquarters site has been reported inadequately, at best.

Diamond Swamp

In 1983, Heritage Research Associates (HRA) surveyed the area of the proposed Dunn and McCoy Creek land exchanges, properties administered by the Malheur National Wildlife Refuge which were to be exchanged for private holdings near Mud Lake. The surveys identified the Dunn and McCoy Creek sites, among others.

In 1984, test excavations carried out at the Dunn site (35HA1261) were comprised of a series of test probes, three test pits, and two 2 x 10 meter grids for recovering a sample of the surface artifacts. Diagnostic artifacts recovered from the deposits included one Elko Corner-notched point and one Humboldt Concave Base projectile point. In addition, large biface fragments, utilized flakes and scrapers, manos, metates, hammerstones, choppers, cores, debitage, and bone fragments were collected during the test excavations. Analysis of the test excavations suggested that the Dunn site was a two component site that was primarily used for plant processing and as a base for hunting large mammals over a period extending from approximately 7500 to 1000 BP (Musil 1995).

Data recovery excavations began at the Dunn site in 1988 consisted of a three stage process. First, a backhoe trench 47.5 meters in length was excavated across the site just north of the densest cultural deposits, with an additional five meter long trench placed offsite to the south. Second, a series of 15 auger holes were dug across the site at five meter intervals to determine the locations of high concentrations of cultural materials. Finally, 13 unit excavations consisting of five 2 x 2s, five 1 x 2s, two 1 x 1s, and one 1 x 0.5 were placed at select locations within the site grid.

Musil (1995) identified three components at the Dunn site. The earliest was the stemmed point component in which a single stemmed point and 10 pieces of debitage were found. This was followed by a house pit component which returned a radiocarbon date of 3470 BP from a sample derived from the floor fill and an associated storage pit. Features noted in the housepit included a central hearth, a metate *in situ*, postholes, a flake concentration, and the previously mentioned storage pit. Chronologically diagnostic artifacts included eight Elko Series points and one Gatecliff Split-stem. Other tools included bifaces, drills, scrapers, utilized flakes, cores, manos, metates, pestles, bone tools and bone and shell beads. The ground stone tools were not easily transportable, suggesting at least a semi-sedentary occupation of the site. The faunal remains from the housepit reveal the use of both terrestrial and aquatic species, with a higher proportion of large mammals than is usually present at similar occupations in the Harney Valley (Musil 1995). Musil (1995) interprets the house pit as representative of a small village oriented towards the use of a variety of plant and animal resources. The latest component was associated with an ashfall cinder layer overlying the house pit component, which has been attributed to the Diamond Craters eruption (Musil 1995). A variety of diagnostic projectile points were recovered which included two

Humboldt bases, a Northern Side-notched base, an Elko Series point, and three Rosegate points. Their locations in deposits above the house pit suggest continued occupation of the site, though on a reduced level.

The 1984 test excavations at the McCoy site (35HA1263) were similar to those at the Dunn site, consisting of 16 probes, three 1 x 1 meter test units and two 2 x 10 meter surface collection grids. Test excavations resulted in the recovery of 19 diagnostic projectile points, including Rosegate, Elko Series, Northern Side-notched and Humboldt varieties, along with bifaces, scrapers, gravers, utilized flakes, manos, a metate fragment, and a hammer stone. Charcoal associated with the metate fragment and three Rosegate points yielded a radiocarbon date of 1350 BP (Musil 1995).

Data recovery consisted of backhoe trenching, and unit excavations. Seven backhoe trenches were excavated, of which three were offsite, one adjacent to the historic house foundation located on the site deposits, and three situated along the east and west edges of the site deposits. A total of 64 1 x 1 meter excavation units were excavated in six large blocks at the McCoy site. Block A revealed a deep component composed predominantly of chert lithic materials overlying a duripan deposit, which lacked diagnostic artifacts but produced one obsidian and four chert bifaces. A composite charcoal sample taken just above the chert component was radiocarbon dated to 1830 BP. This date is believed to reflect the oldest occupations of the upper deposits. The lower chert component is thought to be much older, possibly early Holocene in age (Musil 1995). Block B consisted of three components and two house features. House Floor #1 contained a rock-lined hearth that was radiocarbon dated to 1220 BP, and the remnants of what may have been a clay-lined house floor. House Floor #2 provided radiocarbon dates from a hearth (930 BP), a lithic feature (1060 BP), and a storage pit (1280 BP). A pit containing a human burial cut through the east edge of House Floor 2. Block C contained no distinct components. Block D was set up directly over a house feature that contained a hearth and portions of a burned superstructure primarily comprised of thin willow poles (Musil 1995). A composite charcoal sample from the house floor yielded a radiocarbon date of 510 BP. Blocks E and F were not productive.

Chronologically diagnostic projectile points recovered during the excavations included Great Basin Stemmed, Humboldt, Northern Side-notched, Gatecliff Series, Elko Series, Rosegate, Small Stemmed, Cottonwood Triangular, and Desert Side-notched varieties. Despite their broad temporal range, the projectile points were recovered exclusively from

Component 2, which yielded C-14 dates only from 1900 to 900 BP. Other tools included bifaces, drills, gravers, scrapers, cores, metates, manos, hopper mortars, grooved abraders, a pestle, and a bowl fragment. In addition, a grooved plummet stone, a stone pipe bowl, and bone tools; including beads, a bone flute, a pendant, and an incised rodent tooth were collected from the deposits. Musil (1995) attributed three basic components to the site as well: an early layer of chert lithic material just above the duripan, a much later second component dated between 1900 and 900 BP, which contained primarily Elko and Rosegate points, and a third component that dated after 900 BP and included Small Stemmed points, the burned wickiup, and generally lighter, more portable artifacts.

Stinkingwater Mountains

Archaeological survey and testing was conducted by the Oregon State Museum of Anthropology (OSMA) at five sites in the Stinkingwater Mountains, initially by David Cole in 1975, followed by Richard Pettigrew in 1984 and 1985 . The purpose of the project was to locate sites which might be affected by highway improvements proposed by the Oregon Department of Transportation. The Stinkingwater Mountains are the eastern divide between the internally draining Harney Basin and the Malheur River drainage, which is a tributary of the Snake River. Ethnographically, the Stinkingwaters were identified as an important upland root collecting area, and people from as far away as the Columbia River to the north and Surprise Valley to the south came to gather roots, trade, and socialize with the Harney Valley Paiutes (Couture 1978:29).

Testing at the Indian Grade Spring site (35HA1421) in 1985 revealed the presence of a significant buried cultural deposit on a slope overlooking Indian Grade Spring (Oetting 1987). The testing consisted of sixteen 5x5 meter surface collection squares, three auger holes, and two 1 x 1 meter test pits. A total of 72 tools were recovered during the testing phase, none of which were temporally diagnostic. These consisted of formed and unformed bifaces, utilized flakes, cores, and a flaked cobble, which were manufactured primarily from basalt or obsidian (Oetting 1987).

Data recovery efforts were conducted at the site in 1987 to sample cultural deposits in the proposed highway construction zone. US Highway 20 bisects the site into a North and

South Locus. Excavations revealed that the strata in the North Locus did not match those of the South Locus, and the North Locus was much less productive in terms of cultural materials. All five features identified at the site (four hearths and a stone-lined roasting pit) were located in the South Locus. A total of six 2x2 meter units were excavated in the North Locus, while seventeen 2x2s, one 1x1, and four 1x2 meter units were excavated in the South Locus.

Jenkins and Connolly (1990) identified three major components in the South Locus at Indian Grade Spring. The first, Component I, represents occupations at the site between 500 and approximately 1100 BP. A single roasting pit feature radiocarbon dated to 540 BP was found in otherwise badly disturbed and stratigraphically mixed deposits. The component contained more basalt cores, but fewer core and flake tools than the earlier components. The debitage is primarily basalt. Use of the site was probably less intensive then during the previous occupations. Diagnostic tools included two Large Side-notched points, one Elko Eared point and a Rose Spring point.

Component II dates from approximately 1100 to 1400 BP, and a single radiocarbon date of 1060 BP was returned on a composite charcoal sample. Component II showed an increase in expedient basalt flake and core tools and a decrease in tools assignable to formal classes. The function of the site is believed to have shifted from an earlier pattern of generalized hunting and gathering during this time. Unfortunately, despite the abundance of fire-cracked rock, no intact features were present in the component. Diagnostic projectile points recovered from Component II included one Side-notched, a Gatecliff Split Stem, two Elko Eared and six Rose Spring points. Component III produced four radiocarbon dates from four hearths. The dates range from 1400 to 2000 BP (Table 3.2), and cultural materials from this component reflect a generalized hunting and gathering lifeway.

The lithic assemblage from Component III appears to be oriented towards the reduction of bifaces. Chronologically diagnostic tools collected from Component III included one Large Side-notched point, one Humboldt Series point, one Gatecliff Split Stem, one Elko Corner-notched, and two Rose Spring points. Finally, a single radiocarbon date of 2940 BP was derived from charcoal at the bottom of the cultural deposits in the Northern Locus, and is believed to mark the earliest occupations at the Indian Grade Spring site (Jenkins and Connolly 1990).

The function of the Indian Grade Spring site seems to have changed over time; from an early pattern of generalized subsistence activities between 2000 to 1400 BP, to what may have been an "...intensified collector subsistence-settlement strategy.", marked by an increase in the production of wooden tools with expedient flake tools (Jenkins and Connolly 1990).

Northwestern Harney Valley

Archaeological Investigations Northwest, Inc. conducted excavations at the West Monroe-Old Camp site in 1996 (Ozbun, Chapman and Fagan 1996). Located on a hill top overlooking the city of Burns, Oregon, the West Monroe site exceeds 30 acres in size and contains a number of spatially discrete activity areas identified as either camping or obsidian quarrying sites. Naturally occurring nodules and pebbles of Burns Butte obsidian were present in the colluvial deposits. A total of 20 50x50 cm probes and 67 1x1 m test pits was excavated at the location. Units seldom exceeded 10 cm in depth due to the shallowness of the cultural deposits. Seven projectile points (including one Rose Spring, three Elko, and two Gatecliff) were recovered from excavations at the site, all of which showed evidence of curation and reuse prior to replacement. No charcoal was available for radiocarbon dating but typological cross-referencing indicates site use may have occurred in the last 5000 years, with the most intensive use of the site between approximately 4000 to 5000 BP. Ozbun, Chapman, and Fagan (1996) were the first researchers in the region to comment on the rapid hydration of Burns Butte obsidian, proposing a tentative calculation of approximately $4\mu m^2/1000$ years. The Old Camp is a historic site partially located within the West Monroe site which originally served as an occupation area for Burns Paiutes returning from internment after the Bannock Uprising of 1878. Occupations continued at Old Camp until the 1930s.

Summary

Harney Valley, with its wide array of physiological and ecological settings, was an attraction for humans throughout the Holocene. The combination of high elevation "big game" country on Steens Mountain to the south and middle elevation mountains and root grounds surrounding well supplied shallow water marshes and lakes provided all of the necessary elements for sustaining human life, and supporting substantial populations operating from semi-sedentary lakeshore villages during times when resources were plentiful. The volcanic highlands, created through flow and faulting of basalts and ashes, probably originated from calderas now mantled under millions of years of erosion and deposition. Hydrologically, the basin was once connected to the Columbia River system through an outlet at Malheur Gap, but now is internally draining. Precipitation that has collected in the highlands as winter snow is released as spring runoff and flows into the central lake basins to collect and foster broad, shallow lakes that teem with wildlife. Almost 300 bird species, more than 85 mammal species and 41 species of fish either inhabit or migrate through the northern Great Basin.

Fowler (1986) identifies 50 food plants utilized by the Oregon Northern Paiutes and Couture (1978) catalogued 47 useful plants that are still gathered by the Burns Paiutes for food, medicine, basketry, and tools. The region is dominated by shrub-steppe that includes sagebrush, rabbitbrush, giant wild rye, and other grasses. A belt of western juniper blankets the upper limits of the steppe. Greasewood concentrates on the alkalai lakeshores surrounding wetlands that contain cattails, bulrush, sedge, and rush among other prominent and economically important marshland species. The uplands are home to camas, biscuitroot, bitterroot, chokecherry, bitter cherry, serviceberry, wild plum and currant. Aspen and mountain mahogany are found at higher elevations.

Fluctuating shorelines might signal periodic hardship for early human populations, tied as they are to drought or flooding. Changes were likely to occur rapidly in the Great Basin and the ebb and flow of climatic cycles is probably best visualized as the jagged sawtoothed pattern portrayed by Mehringer (1986:38 and 49) and Wigand (1987) with abrupt transitions over tens of years rather than the smooth oscillations envisioned by Antevs (1948) as having occurred during the course of millennia. The ways in which such transitions affected human populations is grist for the mill of theoretical reconstruction of past behaviors and has been for a considerable length of time in the Great Basin. In many ways, the theoretical body of material has gained substance and heft. However, it is my feeling that much is yet to be done in terms of identifying how the ecological and physiological settings of prominent drainage basins within the Great Basin and their respective environmental benefits or constraints affected the human populations that operated within them.

Archaeological investigations in the Harney Valley have not been extensive, yet they have revealed a wealth of knowledge about site complexity, ranging from ephemeral lithic scatters to well established pit house villages that reflect episodic occupations throughout the Holocene. The indigenous inhabitants made use of a variety of plant, animal and lithic resources throughout the basin, which (at least in historic times) took them from lakeside resource procurement villages to upland root gathering and processing camps, to scattered basalt, obsidian and CCS quarries, and on to big game hunting and salmon fishing localities well outside of Harney Valley. At times, such travels brought the people to areas where there was an abundance of localized resources, and temporary camps were established to take advantage of them. It is striking that much of what we know about the inhabitants of the Harney Valley from buried contexts is limited to the last 2000 years of occupation, even though diagnostic artifacts span the entire Holocene era. Perhaps the rise and fall of lake levels over the milennia have done much to either mask or obliterate the earlier sites near the lake shores, and archaeologists need to identify and study areas less affected by lacustrine geomorphic activity to come to a better understanding of Middle to Late Holocene archaeological sites in the Harney Valley. As will be discussed further in following sections, this is a very important consideration for future research.

The information presented above provides context in terms of the environmental, ethnographic, and archaeological setting for my research. In Chapter 2, an overview of theoretical issues pertaining to both the northern Great Basin and the Great Basin at large is offered to illuminate both the historic and contemporary realms of archaeological thought about human use of the region. Chapters 3 through 9 are reports of the seven sites excavated for this study, and Chapter 10 summarizes the results of the research.

CHAPTER II

THEORETICAL CONSIDERATIONS: THE ETHNOGRAPHIC MODEL

The enthnographic model that has been provided by Whiting (1950), based on field research and the testimony of Harney Valley Paiute elders, informs our view of historic and protohistoric resource acquisition in the Harney Valley. It is an example that probably holds true well back through time. At this point, however, other views need to be considered, particularly theoretical viewpoints drawn from archaeological research, which allow the consideration of those times that occurred prior to recorded history and informed memory. These periods are best approached through exploration of human behavioral patterns as reflected through variations in the material culture over time, and in the placement of particular kinds of sites on the landscape.

A number of researchers, operating in and outside of the Great Basin setting, have approached sedentism, mobility, resource acquisition, and the effects of climate change on human behavior with great vigor and remarkable insight. In pursuing this research, it is recognized that the degree to which mobility and sedentism played a part in the lives of the early human inhabitants was influenced not only by cultural values, but also by climate and the effect that variables such as temperature, precipitation, and landforms had on the distribution of plant and animal resources. Anthropological studies in the Great Basin began early to focus on factors of social group composition, mobility, and cultural ecology, due to the opportunity the setting provides for studying elemental human societies that retained a surprising level of stability over the course of the Holocene and exhibited clear relationships between culture and environment (Aikens 1978). Early Great Basin researchers contemplated the role of mobility in considerable detail, developing theoretical frameworks that attempted to set humans, landforms, climate, and available resources in coherent relationships. Sedentism was viewed to some degree as a behavior that became necessary in the winter months when resources were scarce and reliance on stored resources took precedent. It was only later that sedentism became a central topic of Great Basin archaeology, following the discovery of sites with evidence of substantial dwellings and storage features that indicated human adaptations to the environment exceeded the tenets of simple collecting and foraging rounds.

Theoretical approaches to these topics are examined here to provide context for the seven sites explored in this volume and their relationship to each other and the general setting of the Harney Valley. The work of early Great Basin research pioneers will first be considered, followed by the efforts of researchers who focused their attention more specifically in the Fort Rock Basin, the Harney Basin, and the Carson Desert; the latter is a comparator region of particular usefulness to the present study. The emphasis in this review will primarily be on the late Holocene, because human activity at the sites reported herein is limited to this period. It is also important to remember that my emphasis, as I discuss resource availability in the northern Great Basin, is weighted towards floral resources. While the importance of both large and small game of all kinds in the aboriginal human diet is unquestionable, I feel that the structurally most important focus of resource acquisition involved roots, fruits, berries and seeds. These were subsistence items that offered a lower caloric return rate and greater processing costs than game animals, but were more readily scheduled from a logistical standpoint, were storable, and which offered a greater level of consistency in preparations for the winter lean season.

Research Beginnings

The earliest anthropological forays into the Great Basin began in the 1870s, seeking to amass collections of artifacts for the Smithsonian and Peabody museums. These were artifact procurement expeditions as much as they were scientific endeavors, but much emphasis was given to developing a culture history for the region. Loud's excavations at Lovelock Cave, Nevada, where artifacts were being scattered and destroyed by guano miners in 1912-1913, and Judd's surveys and excavations along Utah's Wasatch front in 1915 are notable early 20th Century archaeological projects in the Great Basin. M.R. Harrington carried out excavations at various locations in the 1920s and 30s, including Gypsum Cave, Borax Lake, and Little Lake (reported in 1933, 1948, and 1957, respectively). Interest in the region was building, but the theoretical underpinnings for archaeological and ethnographic explorations of the Great Basin were yet to be developed.

In the 1930s and 40s, archaeological programs were being developed at a number of academic institutions in the western United States. Cressman began his work at the University of Oregon in 1932, and Steward at the University of Utah in 1930. Jennings joined the University of Utah in 1948, the same year that Heizer started the California Archaeological Survey at

Berkeley. These four researchers in particular developed hypotheses that would be central to the direction of current archaeological theory in the Great Basin region.

Julian Steward began conducting archaeological research at cave sites in the Great Salt Lake region after being hired on at the University of Utah in 1930. He stayed for only a brief period before moving on to the University of California at Berkeley, then to the Bureau of American Ethnology in Washington D.C. in 1935. In 1938, he published *Basin-Plateau Aboriginal Sociopolitical Groups,* which documented ethnographic work conducted during his employment at the latter two institutions. Steward noted the relationship between human inhabitants of the Great Basin and the availability of floral and faunal resources; a kind of "Cultural Ecology" based on the need to procure certain types of resources during periods of availability, with contingency plans for times when shortages might occur. Shortages might be countered by caching of supplies or by withdrawal to locations where kinship ties would assure some measure of assistance in times of hardship.

Steward felt that Basin populations were constrained by the availability of resources at any given time, and that, for most of the year, the sustainable unit of economic activity was the nuclear family. Small, highly mobile family groups would be less likely to deplete resources in a given area and have the flexibility to move quickly as other resources became available. Families might converge during certain times of the year for jackrabbit and antelope drives in the fall and winter, at pinyon camps in the winter, and occasionally for festivals or ceremonies of various kinds. Sedentism was practiced in the winter months when resources were difficult to obtain and activities were focused around winter villages strategically located near stored resources with access to water and firewood. Steward identified a generalized pattern of behavior in the Great Basin, while at the same time recognizing that exceptions existed in the form of more organized tribal governance, some degree of land ownership (particularly in relation to pinyon pine groves), and substantial villages that did not reflect a pattern of continuous mobility.

At the time that Steward was crafting his assessment of Great Basin lifeways, issues relating to sedentism and mobility were not bolstered by an understanding of the sophistication in house construction and storage technology that that would be revealed in later archaeological research throughout the area. It was clear to Steward that, although culture was not wholly determined by the environment, it was deeply affected by the options that were available in the sense that greater environmental severity meant fewer adaptational alternatives. People needed to move across broad expanses in pursuit of limited resources that kept populations at a minimum and limited choices regarding settlement patterns and social development.

Jesse Jennings developed the view that human behavior in arid regions of the intermountain west could be typified as a "Desert Culture" (Jennings and Norbeck 1955). Jennings was struck by the remarkably consistent nature of artifact assemblages spanning almost 7,000 years of cultural history in Danger Cave (Jennings 1957). He posited that activities relating to the procurement of resources and patterns of settlement must have remained fairly consistent over time, with minor adjustments for changing climatic patterns and availability of some kinds of resources. Life during those times was nomadic, with people moving about the countryside in pursuit of various resources, without specialization and without establishing sedentary villages or substantial structures.

The Desert Culture hypothesis was in many ways the archaeological expression of Steward's (1938) ethnographic descriptions of Shoshonean lifeways. Cultural stability was a hallmark of Jennings' hypothesis, and, though he identified exceptions to his concept (particularly with regard to the Owens Valley Paiutes) he felt that Great Basin cultures largely fit into the Desert Culture framework. As is true for most pioneering treatises the early works of both Steward and Jennings have had their share of supporters and detractors over the years, but it is now completely clear the patterns of behavior they described are broadly reflective of the nature of human occupations in the Great Basin. Both felt that sedentism was an issue of limited utility in understanding the lifeways of the region; thus they would have benefited greatly from the knowledge of settlement patterns that has been developed by researchers over the years. Jennings (1973) acknowledged that the usefulness of the Desert Culture as a theoretical model was waning by the early 1970s when evidence for lacustrine-based cultures appeared to be on the rise.

In the northern Great Basin, Luther Cressman began his pioneering archaeological research in 1932 upon arrival at the University of Oregon. Beginning with a survey of rock art east of the Cascades, he went on to conduct archaeological research in the Klamath Basin, Catlow Valley, Summer Lake Basin, Fort Rock Basin, and Guano Valley, among other locations. Cressman initially sought to test whether the cultures of the northern Great Basin preceded the Southwestern Basketmaker culture, and his work at Catlow, Paisley Five-mile Point, and Fort Rock caves seemed to indicate occupations of considerable antiquity, especially at Paisley and

Fort Rock, where artifacts were found buried under volcanic ash from the eruptions that created Crater Lake. Radiocarbon dating methods were still unknown at the time of the discoveries and many of his chronological assertions were called into question. The advent of such dating techniques confirmed, however, that human occupations in the Great Basin clearly preceded the Basketmaker period in the southwest and, more importantly, spanned the Holocene epoch. Cressman brought a pioneering emphasis on interdisciplinary scholarship to his work in the northern Great Basin, involving researchers such as the geologists Ernst Antevs and Howel Williams, and the palynologist Henry P. Hansen to contextualize archaeological sites in broad environmental terms. Interdisciplinary studies became the norm, following examples like his.

Robert Heizer founded the California Archaeological Survey at the University of California, Berkeley, in 1948. This followed a period beginning in the mid 1930s during which he conducted archaeological work at various sites around western Nevada's Humboldt Sink. Heizer took issue with Jennings' Desert Culture concept, believing instead that early human populations were focused on a "limnosedentary" pattern of subsistence (Heizer 1967). The limnosedentary specialization was one in which subsistence pursuits would be focused on wetland and lacustrine resources, which Heizer felt to be generally abundant and reliable. He argued that such resources may have allowed a greater degree of sedentism than would be possible through the nomadic pursuit of plant and animal resources as suggested by Jennings. Heizer pointed to the significant archaeological evidence for lacustrine adaptations at Lovelock and Humboldt caves (Loud and Harrington 1929, Heizer and Napton 1969) that included duck decoys, nets, and fish hooks. Evidence for a marshland subsistence regime was apparent in human coprolites also obtained at Lovelock Cave (Cowan 1967, Heizer and Napton 1969) in which tui chub bones, bulrush seeds, and cattail seeds and pollen were encapsulated. Heizer believed the Northern Paiutes who occupied the Humboldt Sink later in time were culturally tied to the inhabitants of Lovelock Cave, but that connection has not been generally agreed upon. Heizer also criticized the Desert Culture concept for minimizing the significance of local cultural and environmental variations in archaeological patterning, but it was his early emphasis on wetland adaptations that stood out in contrast to common perceptions of the time.

Mobility and Settlement

A shift in focus from individual sites to settlement-subsistence systems occurred around the beginning of the 1970s (Fowler and Jennings 1982) and it was also during this time that the first early archaeological evidence of substantial house structures became apparent in Surprise Valley (O'Connell 1975). Researchers began to grapple with new concepts of sedentism, mobility, and population growth within the context of basin or valley-wide systems, recognizing that such systems were subject to modification over the course of time and climatic change.

Binford (1980) described two strategies of hunter-gatherer mobility. *Residential* moves were made by an entire group, including men, women, and children. *Logistical* moves are those made by task groups which depart from the residential base for specific purposes such as hunting, collecting roots, or exploring nearby territory, then return back to the residential base. Binford (1980) felt that the economy and mobility of hunter-gatherer cultures around the world could be categorized as variations along a continuum, with foraging at one end and collecting at the other. Foragers, who have high residential mobility and low logistical mobility, are best suited to regions where resources are consistently distributed across the landscape and movement *en masse* occurs after resources are exhausted in an area. Collectors, who have low residential mobility, will transport resources collected in the field back to the residential base through a series of logistical forays. Binford noted that the collector strategy is more important in regions of low annual temperature, as resources may be less frequent, more seasonal, and scattered across greater distances. Storage technologies may reinforce collector behavior by necessitating reduced residential mobility while at the same time increasing the need for more logistical mobility to enhance stores over time. Binford (1980) was careful to stress that logistical and residential mobility may be used in various mixes as organizational alternatives, but are not part of a mobility continuum in the same way that foraging and collecting behavior may be.

Insights regarding the issues of mobility and the role of wetlands in the northernmost portion of the Great Basin, particularly the Fort Rock Basin, have benefited considerably in recent years from the researches of Helzer (2001), Jenkins (1994), Oetting (1989), and Wingard (2001).

Helzer (2001) analyzed the paleobotanical remains from the Bergen site. Helzer's analysis included two multiple component house floors, each four meters in diameter, situated on a lunette dune in the Fort Rock Valley. Evidence from test probing indicated that other such houses were present in the area, and cultural materials associated with the the site extend for almost two kilometers along the lunette. Earliest occupations of the houses date to ca. 5200 BP and later use occurred between 4000 and 3500 BP.

Occupations at the Bergen site began during a time of increased effective moisture throughout the northern Great Basin. Paleo Lake Beasley is located west of the lunette, the terminus of an extensive overflow system of channels, ponds, and sloughs that began at Silver Lake to the south. The presence of bulrush seeds and willow in the house floor deposits indicate the lakeshore setting. The diversity of plant remains found within the houses is striking. Fuel wood utilized at the site include sagebrush, saltbush, rabbitbrush, bitterbrush, mountain mahogany, willow, greasewood, and juniper. Edible plant species include Cheno-ams, wada, sedge, saltbush, and bulrush. Bulrush was also an important material for house construction and for interior matting. Evidence of discernable activity areas within the structures is also present. High densities of bulrush seeds and plant fragments, and freshwater snail shells (fastened to the plant stalks) in the northern interior of the house may suggest the presence of sleeping mats (Helzer 2001:175). The highest concentrations of edible seeds were found in the area of the central hearth, declining dramatically at the edge of the house floor except on the east side probably in association with the entrance. Other discernable areas included the pathway from the entrance, and eating, food preparation and tool manufacturing loci.

Plant and animal remains recovered from the excavations provide compelling evidence that the houses were occupied in the winter. The presence of goosefoot and sedge seeds which are harvested from late summer to winter, and the absence of spring roots and summer-ripening grasses is telling, as is the high frequency of faunal remains from large game animals that are absent from the area in the summer months. The spatial patterning apparent from Helzer's study will guide sampling for other studies of this type, and the need for high resolution sampling at even the richest sites has become apparent. Most important to this discussion, however, her study indicated that lowland and wetland resources were significant components of the middle Holocene diet, and that such resources were being consumed in substantial houses occupied during the winter months.

Turning to another large Fort Rock Basin village, Wingard (2001) recently explored the possibility that Carlon Village, situated on a peninsula at the south end of Silver Lake, was a regional center poised between Penutian and Uto-Aztekan spheres of influence that exhibited evidence of social stratification through the scale and technique of house construction. Carlon Village consists of eight large house rings (between 4.6 to 7.0 meters in diameter) whose foundations are shaped from boulders weighing between 200 to 5,500 kilograms (Wingard 2001:93). The large house rings are the most prominent habitation features at Carlon Village, but there are others of lesser bearing that were revealed through the process of test excavations across the breadth of the peninsula. These smaller habitations may have belonged to people of lower economic stature. Occupations occurred from 2300 to 230 BP at Carlon Village, but a bimodal distribution of dates is evident, primarily clustered between 2350-1500 BP, and 700-500 BP (Wingard 2001:141).

Evidence of plant and animal use at Carlon Village is weighted heavily toward wetland and lowland resources, but lomatium and onion collected from the nearby upland root grounds near Boulder Village, and pine, which also comes from upland forests a minimum of 2.5 kilometers from Carlon Village, are also present. Wingard (2001:142) believes the pine to be associated with structural elements of the large houses, probably roof beams.

Wingard (2001:143) envisions Carlon Village as a defensive and ceremonial center for the surrounding region because of its prominence both from a physiographic and economic standpoint. As he puts it: "It could have drawn on local occupants of Paulina Marsh and other dune and wetland localities to the north as well as including some to the south at Ana River and Summer Lake Marsh during times of celebration, ceremony, strife, or economic stress (2001:143)."

In support of his viewpoint regarding the economic importance of the site, Wingard observes that some of the shell beads found at the site are either rare or unknown elsewhere in the Great Basin (2001:142) and are suggestive of high status occupations. Also, the number of bone beads is three times the total for all other Fort Rock Basin sites combined, and the specimens are similar in type to those found in Klamath country, as are other finely wrought bone tools and decorative items (2001:142). Then, of course, there are the massive house structures. Wingard (2001:142) notes the high quality of wood, twine and basketry artifacts recovered from the site by collectors that included Catlow Twining, known to have been utilized by Penutian speakers. He sees these as: "strong indications that Penutian Klamath-Modoc influences at Carlon Village were operant over the past 2,500 years. Since no known contemporary settlements in the Fort Rock Basin have similar economic advantages to those that Carlon Village residents held prehistorically, they may have been at the top of the social echelon in the area (2001:143)."

As for what processes drew inhabitants to the site, the geographic position of the site; at the edge of a substantial marsh but adjacent to uplands that are separated by rapid elevation changes and multiple compacted ecozones provided a broad economic base that would have allowed easy acquisition of a variety of resources for subsistence, and for trade with neighbors to the north and south (Wingard 2001:143). According to Wingard (2001:148-149), it is not particularly vital to elaborate whether the attraction was based on the "push" to settle near wetland resources because of a lack of sufficient terrestrial resources, or the "pull" of the rich wetland resources themselves. He feels that there were probably numerous reasons why people settled at Carlon Village based in part on cultural preference and economic necessity, among other things. In any case, Wingard believes that Carlon Village operated as a highly successful regional center during much of the last 2500 years as well as one of the best examples of a sedentism in the Great Basin.

Jenkins (1994 a and b, 2000, 2004; also Jenkins, Aikens, and Cannon 1999; Jenkins, Connolly, and Aikens 2004) has considered northern Great Basin subsistence and settlement patterns from the vantage point of over 15 years of research in all settings within the Fort Rock Basin. In his 1994 proposed model which elaborates on patterns of human activity over the last 5000 years (1994a:599-618), Jenkins points out significant clustering of radiocarbon dates that has occurred during that time, suggesting that human populations were more concentrated at some times than others, that populations in neighboring physiographic regions may have ebbed and flowed in relationship to population shifts occurring in the northern Great Basin, and that cultural boundaries were permeable in response to changing environmental conditions (1994a:610). He views large scale population and settlement changes in the Fort Rock Basin during the middle to late Holocene as being fueled by wetland instability, increasing populations, and the need to utilize the region's upland and lowland resources more intensively as a result.

Three premises are considered to hold true during this time: first, that human populations continued to increase over the last 5000 years, though climatic variation caused rapid fluctuations of the population at times; second, that some population increases were the result of people moving into the Fort Rock Basin from elsewhere, including the Klamaths and other Penutian speakers; and, finally, that shifts in settlement patterns were responses to environmental and cultural changes that occurred both within and outside of the Fort Rock Basin (Jenkins 1994a:612).

Between 5000 and 3500 BP, a lowland subsistence focus occurred that was oriented towards concentrated wetland resources. Jenkins (1994a:614) sees the time between 3500 and 3000 BP as relatively moist, but with less climatic stability, perhaps experiencing broadly fluctuating temperature and moisture levels. There may have been a dispersal of the Fort Rock Basin population to other areas, with a greater emphasis placed on the use of upland roots. As lowland resources became less reliable between 3000 and 2000 BP, Jenkins (1994a) hypothesizes that a shift from lowland to upland resources began to occur, but that populations in general remained relatively low. In the time between 2000 BP and the contact period, Jenkins (1994a:615) believes that there was an in-filling of populations in the surrounding basins, prompting those in the Fort Rock Basin to intensify their use of upland root crops to a greater degree than they had previously. After the spring and early summer root harvest, people returned to the lowlands for grass seed harvesting, the acquisition of wetland resources, small game, and fishing. The winter months were spent in the lowlands, with a return to the uplands in the early spring to be on hand as the first roots of the season became available. This pattern was well established by 1500 BP and Jenkins sees a major increase in populations between 1500 and 1000 BP, probably as a result of precipitation changes favoring seed and fish production (1994a:616). After 1000 BP, conditions were not as favorable, with drought conditions probably occurring around 900 BP and between 500 to 300 BP. Jenkins (1994a:616) notes clustered radiocarbon dates in the uplands between 600 to 500 BP indicating favorable conditions were once again in place at least in the Boulder Village area. General reductions in human populations after 400 BP may be attributable to worsening environmental conditions or possibly the onset of European borne diseases that are known to have decimated Native American populations throughout the Americas.

Jenkins (1994a:616), like Wingard (2001), sees indications of a Klamath or Modoc presence in the Fort Rock Basin through settlement patterns, subsistence practices, and technologies, and the suggestion is made that the period of Penutian occupation may have spanned from 4000 BP to the Historic period in the region (Jenkins, Aikens, and Cannon 1999:69). No matter who occupied the Fort Rock Basin, Jenkins has recognized a middle Holocene wetland/grassland orientation that progressed over time to include a greater emphasis on upland resources as increasing populations necessitated intensified use of all available subsistence items. Populations were highly mobile and Jenkins stresses the rapid intra-regional movement of people in response to short term climatic fluctuations throughout his proposed model. When possible, the occupants of the Fort Rock Basin located their villages near the edges of lakes and marshes presumably during the winter months as well as at other times. Jenkins' (1994a) model implies that people were "pushed" into intensified use of all available resources by the constraints imposed from burgeoning populations throughout the northern Great Basin. In times of climatic stress, populations were also pushed into neighboring areas, dependent to some degree on social, cultural, and family ties for support when subsistence systems in their preferred home territory collapsed.

How similar or different are human lifeways in a place like Harney Valley, where water is consistently available, as are resources associated with its stream courses, lakes shores, and marshes? How did people pattern their movements to take advantage of root grounds, camas meadows, upland fruit and berry groves,wetlands, and the movements of game herds? South of the Fort Rock Basin, two other examples are important to the line of thought I wish to develop before proceeding with the Harney Valley comparison: Oetting's work at Lake Abert – Chewaucan Marsh (1989) and Malheur Lake (1999), and models developed by Zeanah (2004) and Kelly (1985, 2001) for the Carson Desert of western Nevada.

Oetting's (1989,1994) research at Lake Abert and Chewaucan Marsh southwest of Harney Valley, focused on the multi-causal development of large scale wetlands adaptations, giving consideration to the roles of stress-based or choice-based transitions to reliance on wetland resources. Oetting's Middle Archaic and Late Archaic cultural periods span the last 5000 years of occupation in the area and both are divided into two phases. Middle Archaic I extends from about 5,000 to 3,500 BP, and the projectile point assemblage is dominated by Elko Series points, with Gatecliff specimens making up a significant, but lesser portion. Middle Archaic II, from roughly 3,500 to 2,000 BP, contains largely Elko Series, a small proportion of Gatecliff points, and a few Rosegate specimens (1994:56-57). This temporal division of the Middle Archaic cultural sequence is modified from Oetiing's original (1989) which had Middle Archaic I between 5000 and 4000 BP. Oetting (1994:56) suggests that the transition may even occur closer to 3,000 BP than 3,500 BP, and that further refinement of the sequence will be necessary.

The Late Archaic, which occurs between 2,000 BP and the historic period, is broken into Late Archaic I, between 2,000 to 1,000 BP, and Late Archaic II, from 1000 BP to historic contact. Late Archaic I has similar proportions of Elko Series and Rosegate points, and Late Archaic II primarily consists of Rosegate points with infrequent Desert Side-notched and Cottonwood Triangular specimens (Oetting 1994:57). Oetting (1994:57-58; 1989:226) notes only a small increase in site frequency during the Late Archaic, but housepit villages increase substantially and are generally located near wetlands. Also, Oetting observed a trend toward more houses per village and an increase in house size during the Late Archaic Period. According to Oetting (1989:226): "The population of the last1,000 or 2,000 years was more sedentary than at any time in the past. Currently there are no data that conclusively demonstrate full sedentism (year round occupation of the site), but the substantial nature of the cultural features, the density of tools and debitage, and comparisons with ethnographic Klamath suggest these villages were semi-sedentary ..."

The Klamath connection is not left trailing. Oetting (1989:232-234) considers the inhabitants of the Lake Abert – Chewaucan Marsh region over the last 4,000 years to be representative of a single cultural tradition, "the direct predecessors of ethnographically known Penutian-speaking people.," and those of the Late Archaic II Phase were prehistoric Klamath, culturally affiliated with the Klamath people of the Klamath Lake and Marsh region. To support this contention, Oetting (1989:232-236) highlights the wetland-based economy of the Klamath; patterning of annual movements; timing of the development of large pithouse villages between 1,700 and 1,250 BP in accordance with Cressman's work at Klamath sites; the resemblance of Lake Abert house pits to Klamath houses; the presence of handled manos, well formed mortars, and Catlow Twined basketry (from Chewaucan Cave); and oral traditions handed down by Northern Paiutes.

Oetting (1989:273-274) sees the development of pithouse villages in the Lake Abert – Chewaucan Marsh region as a response to the opportunities offered by wetland resources, not a stress-related "push" to use low quality subsistence items. He does not see evidence that large scale environmental stress forced the abandonment of the basin at any time during the last 4,000 years, nor that it had other archaeologically discernable affects on patterns of habitation. Had occupations been stress-induced, they would have also been "transitory with changes in the local site patterns occurring when the operating stress was removed (Oetting 1989:273)" In essence, wetland resources were both diverse and reliable and the ethnographic pattern was already in place for utilizing settlement and subsistence systems in that way. If Oetting's hypothesis is correct, then a difference is clearly apparent between the archaeological pattern of human activity seen by Jenkins in the Fort Rock Basin, and that identified by Oetting in the Lake Abert – Chewaucan Marsh area. The important difference is water, which was available even in drought years at springs located on the west side of the lake, and it may be the case that human populations ebbed and flowed as increased effective moisture enhanced landscapes where resources were otherwise limited, but remained stable and semi-sedentary in locations where water was readily available.

Oetting (1989:273) felt that "Rather than applying a reductionist optimal foraging model of strict resource use and sequent use of ranked plants and animals, one must consider resources as they occur on the landscape." Wetlands may not have the highest ranking resources, but they are "abundant, concentrated, diverse, and reliable (1989:273)". He argued that such resources in a limited area, in association with processing, storage and a reduced need for transportation, could foster a reduction in residential mobility and lead to a settlement pattern that he termed "semi-sedentary." Writing with reference to the Chewaucan Marsh and Abert Lake setting,

Oetting noted that people could continue to apply collector-like strategies *and* return to the same winter villages every year; and do so not because they were forced into the wetland circumstance by stress, but because of the opportunities that existed in such locations. Wetlands would have become *more* attractive at times of climate stress, because resource diversity there would have been greater than in surrounding basins and uplands, but they would have *always* been attractive regardless of regional stress levels, for the resources they contained. The same would be true if populations were on the rise – a broader array of resources would have been available for intensive processing in the wetlands than in any other environmental setting during times of demographic stress. Oetting felt that, given time and increasing dependence on nearby wetland resources, a shift to a fully sedentary lifestyle was not out of the question although he does not appear to believe that it was ever fully realized in the Chewaucan Marsh/Lake Abert setting.

Oetting (1990 a and b,1999) also offers a perspective on cultural dynamics in the Harney Basin, in reporting the results of surveys at Malheur Lake following the extensive flooding in the mid 1980s. He noted that at least several of the sites observed held "...spectacular arrays of hundreds to thousands of tools from a wide range of artifact classes. (1999:206)." Almost 100 sites were recorded that included many projectile points, large bifaces, well made ground stone tools, net weights, ornaments, and, in some cases, burials. House floors were observed eroding out of cutbanks. Utilizing the flood survey data along with other sources, Oetting notes an intensification in use of Harney Valley beginning around 5,000 years ago that may be tied to greater effective moisture and redevelopment of wetland systems that began at the onset of the Medithermal (1999:208). Oetting feels that human use of the valley increased significantly around 2,000 BP, a trend marked by the dominance of Rosegate points in sites as well as by numerous radiocarbon ages.

As was the case in the Lake Abert – Chewaucan Marsh region, Oetting (1999:213) finds the Klamath-Modoc ethnographic model to be the most appropriate for human activity in the Harney Valley between 5,000 to 1,000 or 500 BP, based on the examples provided by the Dunn, McCoy Creek, Blitzen Marsh, and Headquarters sites. After 500 BP, he considers the *Wada'tika* model to be a better fit. As is my belief, he is of the opinion that several large sites recorded on the Malheur Lake shoreline during the post-flood surveys are also villages, and that wetland resources were key to Harney Valley subsistence practices. The presence of housepit villages and dense concentrations of artifacts at lakeside settings are unlikely attributes of highly mobile populations, as Oetting points out (1999:214), nor are they hallmarks of locations where wetland resources are being utilized as secondary or fallback food sources. However, wetland resource utilization would require that village populations engage in some labor-intensive plant processing or procurement activities (fishing), periodic transportation of resources to the village, the establishment of storage facilities and the presence of equipment needed to process the resources for consumption, such as grinding stones. The presence of features and artifacts related to these activities should be visible in the archaeological record. Artifacts such as net weights, ground stone, and other task specific tools, bone tools, decorative items, house floor remains and storage pits have all been recorded in Harney Valley archaeological sites.

Archaeologically, Oetting (1999:216) finds Harney Valley associations with Columbia River Plateau people and possibly the Klamath-Modoc, through the surviving remnants of material culture that include large bifaces, decorated ground stone, decorated bone tools and "head scratchers or sweat scrapers," and pit houses. He does not consider pre 500 BP ancestral populations to be specifically from the Klamath-Modoc area, but finds their lifeway to be the best analog for archaeological manifestations in Harney Valley. Oetting is careful to keep to a broader association that includes both Klamath and Columbia River groups (or Plateau at times) when he discusses the Harney Valley, and points out that while the artifacts are suggestive of those cultures, they are by no means conclusive evidence, nor are wetland oriented subsistence practices exclusive to plateau groups. It is unclear whether he is backing away from his earlier stance that ancestral Klamath populations were the probable occupants in the lake basins of southeastern Oregon (specifically Lake Abert), or if he is simply uncomfortable in extending the possible scope of Klamath cultural influence as far to the east as Harney Valley without consideration that other Plateau groups may have held influence there. He certainly sees the transition from Penutian influence to Uto-Aztecan with the advent of Desert Side-notched and Cottonwood Triangular points after 1,000 BP.

David Zeanah's 2004 exploration of the role that sexual division of labor plays in the placement of hunter-gatherer base camps brings a behavioral ecology perspective to this discussion. Utilizing data from the Carson Desert in western Nevada, Zeanah (2004:2-4) points out that subsistence roles for men and women were not necessarily as cooperative as was once believed and that men and women may have foraged to achieve different goals, with women gathering resources to feed children and men hunting because the sharing of meat led to more opportunities for mating.

Zeanah (2004:6-7) uses a model that combines 41 soil based habitat maps designed to identify pre -1850 vegetation patterns with data indicating the carrying capacity for 14 varieties of game, generated from modern wildlife management inventories. Reasonable estimations of return rates for various floral and faunal resources were derived from the two sources, then divided into men's and women's prey sets. Men focused on resources with the highest return rates (large game), but with greater search costs. Women's (plant) resources are easier to find, but caloric return rates can be considerably lower for the effort involved in both gathering and processing. Calculated on an annual basis, however, it is apparent that women had higher foraging returns at all times of the year except late summer when cattail pollen is out of season in the marshes. For men to show an equivalent rate of return from hunting strategies, herds would have to attain population levels that would be in excess of the carrying capacity of the region by a substantial margin (2004:24). Despite the efficient returns that may have come from concentrating on wetland resources, it seems clear that, whenever possible, men focused their efforts on hunting and women gathered plants.

The questions from Zeanah's behavioral ecology perspective are: where did the prehistoric inhabitants of the Carson Desert position their base camps, and what concessions would have to be made for men and women to operate effectively within their preferred catchment areas? As Zeanah (2004:21) puts it: " if male and female foragers in a camp pursue different sets of prey to achieve different objectives, whose individual interests are served by positioning camps to minimize travel and transport costs?" He feels that hunter-gatherers who establish camps in areas where combined return rates are high benefit from a selective advantage over those who position their camps in favor of either men's or women's preferred resources, thus camp placement would be where the intake of food into camp would offer the highest return rates after transport. Based on the generally smaller return rates for hunters versus wetland gatherers, and the fact that meat can be dried to reduce transport weight, the band or family unit would be better served by positioning camps closer to the women's best foraging habitat near the wetlands. Hunting success would have to be high, and game populations much greater than modeling based on the late Holocene climate would suggest, for central place foraging camps to have shifted from the lowlands to better hunting territories in the uplands.

According to Zeanah (2004:21) even during the Neoglacial, when conditions would have improved in favor of large game populations, wetland resources would still be accessible in many of the same places and game herds would have been available in a wider variety of ecozones, offering greater availability with less travel investment and search time. As a result, the most effective residential bases over time and through periods of climatic variability would have been those positioned near the wetlands of the Carson Desert.

Kelly (1985:2001) reported on changes in mobility strategies over the last 5000 years in the Carson Desert and Stillwater Marsh. In his analysis, a mobility strategy describes the ways in which resources were obtained by group movement, whereas a seasonal round is characterized by the resources and locations utilized by a particular band. Kelly, incorporating mobility models from Binford's (1980) work, attempted to identify tool sets and archaeological features that might be associated with residential or logistical behaviors. He noted that human use of the Carson Desert shifted over time, but sedentism did not appear to be a sustained activity either in the desert or at Stillwater Marsh. Caching and storage, which is more common in the archaeological record after 1500 BP, was interpreted as a stress-based response to increased winter severity. Kelly reasoned that as winter severity increased, die-offs of large mammals became more common, and forced hunter-gatherer groups to become less mobile, concentrate on processing and storing lower-ranked resources near wetland settings, and send small parties from residential bases to pursue big game. The implication he drew was that big game would always be the first choice in resource selection and marshland resources were less important because they required too much investment of energy for their caloric yield. Kelly subsequently revised his viewpoint on hunter-gatherer sedentism, mobility, and resource selection after the exposure of substantial pithouse villages at Stillwater Marsh by extensive flooding in the 1980s.

As Kelly noted in 1985, the seasonal round provides information about places and resources that come into play as populations move around a given basin or valley, but such descriptions are usually not mindful of the patterns of fusion and fission that occurred at residential base camps, what personnel were included in logistical outings, or what significance sedentism played in the overall scheme of resource acquisition and management. Was sedentism an aspect of human behavior simply because the concentrations of varied resources in wetland settings, and their increased processing and storage needs made residential mobility less attractive? Was residential mobility actually more attractive than sedentism, which became a necessary alternative only in times of climatic stress? Was sedentism utilized only in the winter months because it reduced energy expenditures during periods of limited resource availability, or was it a favored pattern of behavior during other times of the year too because it allowed high yield resource acquisition in the manner described by Zeanah (2004) for "central places?" Were patterns of human behavior relatively stable over many thousands of years? The answers to some of these questions are approachable through in-depth examinations of the seven Harney Valley archaeological sites here reported, and these analyses will also suggest future research directions for the years to come.

The pioneering work of the above researchers provides a theoretical context for the evaluation of the seven Harney Basin sites that is to follow. In the Fort Rock Basin, Helzer (2001) provided insights regarding human occupations in the Fort Rock Basin at the intra-site level. Wingard (2001) has taken us a step further into investigations of Carlon Village and its place in a regional context, and Jenkins (1994) provides a broad-scale evaluation of overall settlement and subsistence systems that extend beyond the Fort Rock Basin, into other basins and physiographic provinces. The work that has been carried out in the Fort Rock Basin is recent, intensive, insightful and important for considering the roles that physiographic settings, and population movements may have played in the lives of the human inhabitants of the northern Great Basin. One key element that may differentiate the lifeways of the Fort Rock inhabitants from those in other nearby drainage basins is its comparative paucity of water, except during climatic periods where greater effective moisture was available. Oetting (1989, 1999) has documented human use patterns in both the Lake Abert – Chewaucan Marsh and Harney Valley settings, supplying broad-scale perspectives for the two well watered regions, while Zeanah (2004) and Kelly (1985) have done the same for the Carson Desert region. Their insights are important to consider in relation to the seven sites that are being reported here. Two large scale studies carried out earlier in the Harney Valley and adjacent areas deserve mention as well. They are described below, along with a brief discussion of important resources that may have affected decisions regarding settlement and subsistence strategies in the area.

Considering the circumstances in the northern Great Basin, human behavioral patterns in the Harney Valley may have been similar to those of Lake Abert from the standpoint that perennial water sources of high quality were available and populations may have practiced semi-sedentary modes of residence and resource procurement. Some semi-sedentary village locations may have moved with the fluctuating shorelines of Malheur and Harney lakes, while others like the Headquarters site were situated in elevated places where repeated occupations could have occurred, building a substantial archaeological record over time. The shallow nature of the centrally located lakes supports a lush growth of wetland plant species, emergent shorelines offer the preferred habitat for *wada* production, and fish, waterfowl, and muskrats would have been available on a regular basis. One of the earliest large scale research projects in Harney Valley addressed the possibility that human populations abandoned broad areas during the Altithermal Period around 7,000 BP (Antevs 1948).

Fagan (1974) looked at the possibility of Altithermal abandonment of the Harney Valley through the examination of 11 spring sites and one lake shore site that are located in the Harney Valley or its neighboring drainages to the east. The sites were typically situated at high elevations (above 1525 meters [5000 ft]) and exhibited evidence of repeated occupations ranging from early to late Holocene. Fagan found that the spring sites were occupied during all cultural periods and ten of twelve were used during the Altithermal, indicating that full abandonment of southeastern Oregon did not occur even during the driest times. Although full abandonment seems to be an unlikely option except in the most dire of circumstances, Fagan's effort was hindered by the fact that radiocarbon dates from the excavations were scarce and never exceeded 3000 years in age, so that dating of the Altithermal component had to be based on the recovery of Large Side-notched and Elko Series points (among other, non-diagnostic implements). These types are known today to cover a time depth between 7000 to 1000 BP, a considerably longer period than was realized at the time of Fagan's study.

The Steens Mountain Prehistory Project (Aikens, Grayson, and Mehringer 1982) was a large scale project designed to test the hypothesis that human occupation patterns in the area encompassing the Alvord Desert, Steens Mountain, and the Catlow Valley changed over time. Utilizing extensive surveys, pollen coring, and large-scale collection procedures to explore possible changes, they discovered that all artifact types diagnostic of the past 10,000 years of human use were regularly found in the study area. They also determined that there was no simple correlation between the size of an archaeological site and its possible use at any given time in its history. Simply put, a wider variety of artifacts are found in larger accumulations and small sites had less diverse assemblages simply because they were not as well situated and were therefore used less.

Although the study area was continuously used by aboriginal peoples over time, population increases were apparent at certain times. Aikens (1993:69) reported that site frequencies showed a bimodal distribution over time: low from 10,000 to 6000 BP and higher thereafter, peaking between 4000 to 3000 BP, declining between 3000 and 2500 BP, then increasing again after that time. Site area does not correlate well with intensive periods of occupation. Sites dated between 10,000 to 6000 BP and 4000 to 2500 BP, tended to cover large areas, and sites dated between 6000 and 4000 BP and after 2500 BP were smaller in size. The Steens Project research revealed that there was little use of the uplands from 10,000 to 6000 BP, a greater variety of localities were used from 6000 to 3000 BP, fewer, but larger sites were used from 3000 to 2500 BP, and site numbers increased but sites were smaller after 2500 BP. Associations can be made between these trends and the climatic record, with drier conditions occurring from 10,000 to 7500 BP, greater effective moisture after 5000 BP, and fluctuating conditions after 2500 BP. Fewer sites may have been used more regularly during drier conditions, becoming larger in size as a result of repeated use. Moist climate conditions, leading to higher production of floral and faunal resources, were associated with a greater dispersal of smaller sites as more resource patches became available. A higher degree of sedentism may have also resulted from improved moisture conditions. The period from 3000 to 2500 BP, when sites are found to be larger, may be the outcome of people staying in one place for longer periods of time.

Finally, where does the Harney Valley fit in terms of all the issues outlined above? What kinds of mobility options were in use in the Harney Valley, and can the archaeological record provide insights about such behavior? To begin with, the basin has several kinds of resources which would have been important factors in the placement of sites and the movements of people during the last 4000 years. First, Malheur, Mud and Harney lakes lie near the center of the valley in relatively level terrain. Fluctuations in the water levels from year to year would have enhanced productivity for some resources such as *wada* and other species that benefit from an emergent shoreline. Today, when water levels at The Narrows between Malheur and Harney Lake draw down, a rich black fringe of *wada* covers the area between the old and new shorelines. The lake basins are not deep, and considerable rise and considerable lateral movement of the shorelines can occur with the only result being the expansion or contraction of wetland plant communities like the wada. Drowning of emergent cattails, bulrush, and other species would require flooding on a massive scale. Minor flooding would cause the shoreline to broaden and marshland plant communities would occupy the newly acquired wetland in short order. Drying would reduce resource availability to some degree, but plants such as wada would still exist near the water's edge, and Malheur Lake is such a large body of water that conditions would have to change markedly to cause habitat loss on a scale that would be detrimental to sustaining human populations. Of course, that has happened over the millennia, but the important point is that water would have been available in the region with enough regularity to allow patterned settlement and subsistence activities to occur over prolonged periods, which should be visible in the archaeological record.

The second important resource zone that was available to human populations were the root grounds on the north and east edges of the Harney Valley, particularly in the Crow Camp Hills, Stinkingwater Mountains, and Pine Creek Divide. The quality and quantity of the roots available there attracted people from throughout the northern Great Basin and Plateau, and spring and early summer gathering at these camps were important times for re-establishing social ties with distant neighbors and relatives, arranging marriages, and participating in contests, games, and gambling. Again, roots were resources that, like the water, offered some degree of reliability for the inhabitants of the valley.

The third resource that deserves consideration is camas, which even today grows in startling abundance on the northern edge of the valley floor. Although camas is a resource that has not been well documented from archaeological sites in the region, it was (and is) a known dietary staple for many aboriginal people and was surely important to the people of Harney Valley in the past. Finally, numerous varieties of wildlife are found in a variety of ecozones in Harney Valley. Large game herds inhabited the mountains and foothills of the region, tremendous flights of waterfowl take advantage of the lakes during migratory stopovers, and thousands of muskrat lodges can be found in the northeast quadrant of Malheur Lake during the winter. The grasslands and sagebrush steppe support high numbers of rabbits and hares, upland fowl, and rodents, and provide an important source of grain for winter use. Other resources were also available, but the key point is that at least several important resources were available in large quantities and at different times of the year. From our distant viewpoint, it is easy to discount the amount of labor that was involved in gathering, processing, and storing enough different kinds of resources to last a winter, and do it consistently from year to year. Undoubtedly, winters in which everything went just right and families had "enough" were few, and treasured memories. The fact remains that Harney Valley had a number of resources that could have been used in winter provisioning, they were available on a scale that would have buffered the failure of some or all of one kind of resource, and they would have been consistent producers which human inhabitants could factor into logistical planning and residential mobility decisions. The archaeological record should reflect the use of these items.

The following seven chapters report a series of sites, all of which are situated in the Harney Valley drainage system, that are germane to the issues which have been brought up in the preceding chapters. The organization and treatment of the data in the site chapters has been guided by the issues raised above.

CHAPTER III
MORGAN SITE (35HA2423)

Data recovery excavations at the Morgan site were carried out in August of 1995. The site is located on Sand Hill, approximately 10 km (6 miles) from the community of Burns, Oregon. The excavations were guided by a data recovery plan developed after testing at the site occurred in March of that same year (Jenkins and Connolly 1995). In the data recovery plan, it was recommended that up to 60 square meters of the deposits at the site be excavated at two locations on the north side of the highway; the West and East Loci, as they will be referred to in the following report. The two loci were established where peaks in the quantities and varieties of cultural materials occurred during the testing phase. The total area excavated was 58 square meters, resulting in the removal of 31.68 cubic meters of fill. Connolly (1994) originally recorded the site as John Logan Lane 2 (JLL-2), consisting of a sparse scatter of obsidian flakes and one utilized flake exposed by the recent installation of a fiber-optic telephone cable.

Excavation Strategies

Test excavations at the site occurred from February 28 to March 7, 1995, and included two 1 x 1 meter test pits and thirty-seven 50 x 50 cm test probes averaging 50 cm in depth (Figure 3.1). Recovered artifacts included a projectile point fragment, two biface fragments and five groundstone fragments, along with charcoal, 559 pieces of debitage, and 90 bone fragments (Tasa 1995). No temporally diagnostic artifacts were recovered during the testing phase. It was determined that significant cultural deposits were in the path of proposed highway safety improvements, which would involve widening both sides of the highway. Tasa (1995) called for

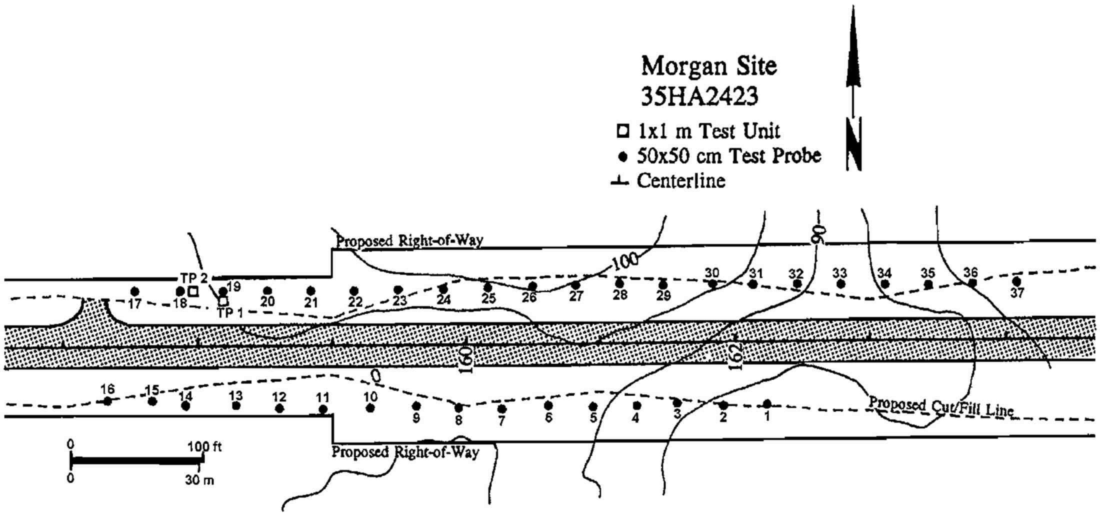

Figure 3.1. Plan view of the Morgan Site (35HA2423) indicating the locations of 50x50 cm probes and 1x1 m test pits (from Tasa 1995).

either avoidance or mitigation of site disturbance at the Morgan site locality, and the decision was made in favor of mitigation.

Archaeological testing in Probes 17-37 had confirmed that significant cultural deposits were located in the West and East Loci (Tasa 1995). Debitage counts ranged from 0-17 flakes per 10 cm level in the 50 x 50 cm probes (up to 680 flakes per cubic meter). Test Pit One yielded a maximum of 19 flakes in the second level (10 cm levels; 190 flakes/m^3) and the highest debitage count at Test Pit Two was 24 flakes for the third level (240 flakes/m^3). Probes 1-16 were excavated on the south side of the highway, where excavation did not occur beyond the testing phase. The probes produced an average of four flakes per 10 cm level at this location, with a maximum of 13 flakes recovered from Probe 1, Level 3.

The upper levels of the site in which cultural materials are found consist of a light gray-brown silty sand, primarily of eolian origin, ranging from 45 cm to over one meter in depth. Underlying this silty deposit is a thin layer of weathered bedrock cobbles encrusted with calcium carbonate, followed by solid bedrock. This was true at both the East and West Loci. Data recovery excavations at the Morgan site were confined to a narrow strip of land along a 90 meter corridor within the enlarged right-of-way established for improvements to U.S. Highway 20. Excavations were established in a linear pattern along the north side of the highway. Pasture lands belonging to the Morgan Ranch are located to the north of the right-of-way. The south side was bordered by a drainage ditch and the highway. The original site was estimated to have been approximately 1.5 acres in size, but previous highway construction destroyed approximately 40% of the site and the excavation of two trenches for fiber-optic telephone cable damaged an additional portion of the site. It was expected that the next round of safety improvements to the highway would cause the destruction of an additional 20% of the site.

Excavation Units

Prior to excavation, an arbitrary datum was established on a nearby high point from which a grid system could be created for the entire site. Using a Topcon GTS-203 total station, coordinates for the datum were set at 100 N/0 E, with an elevation established for the site (recorded in meters) based on actual elevations from nearby bench marks. The individual excavation units were then tied into the grid system. Unit coordinates have been replaced by letter designations for this report. Individual elevation datums were shot in for the excavation units and vertical control was maintained by the use of level lines attached to the datum stakes.

The basic unit of excavation was a 2 x 2 meter square, divided into 1 x 1 meter quadrants oriented towards magnetic north. Each quadrant was excavated in order beginning with Quad A in the northwest and continuing on to Quad B in the northeast, Quad C in the southwest, then Quad D in the southeast. Paperwork was maintained for each level which included drawings, artifact counts, the locations of *in situ* artifacts and various physical features, and written descriptions of soil types observed in the unit. Chronologically diagnostic artfacts and other formed tools, features, utilized flakes, and noteworthy bone fragments were recorded *in situ* when possible. Drawings were made of selected stratigraphic profiles and photographs were taken of representative walls in some excavation units. *In situ* artifacts and potential features were also photographed. Fill was removed in five centimeter contour intervals. All of the fill was passed through 1/8 inch mesh hardware cloth and cultural materials were sorted from the remaining portion. Debitage, bone, and other overlooked artifacts were retrieved during the screening process, counted, and added to the level record.

Analytical Components

The Morgan site was divided into a West Locus (Figure 3.2) and an East Locus based on two concentrations of cultural materials occurring approximately 165 meters apart. Additionally, the East Locus has an earlier and later cultural component. The two components were tentatively

Figure 3.2. The Morgan site West Locus, facing west.

identified in the field based on the presence of Side-notched and Elko points deeper in the deposits and Rose Spring points higher in the deposits, but the soil stratigraphy did not show clear depositional differences. The differences became more evident through the analysis of obsidian hydration bands on tools and debitage recovered from the site (Connolly, see Appendix). The late component was identified primarily in Units U-AA at the East Locus. The late component occurred at a depth of 5-30 cm below the surface on the west end. Deflation of the deposits four meters to the east (Unit Y) reduced late component materials to a 5-10 cm layer exposed on the surface. The early component was first encountered between 35-40 cm below the surface to the west, and 10-15 cm below the surface on the east end of the excavation block. All artifacts in this report have been separated into West and East Loci, and early and late components when pertinent.

A total of 27 units was excavated at the Morgan site. Of these, 35 square meters were excavated in the West Locus and 23 square meters in the East Locus. Excavation loci were expanded or terminated depending on the quantities of cultural materials that were collected during the data recovery process. The results of the data recovery efforts at each locus are discussed below.

The West Locus

The West Locus of the Morgan site is located approximately 165-190 meters west of the East Locus, and is about 3.5 meters higher in elevation (Figure 3.3). The excavation units occupy portions of an area that is three meters wide from north to south, and 26 meters in length from west to east, rising slightly to the east. The excavated area was confined between the highway and the fence line of the Morgan property. The West Locus included Units A through P, located in the area between Probes 17-21 and Test Pits 1-2 from the testing phase (Jenkins and Connolly 1995). The surface cover includes Great Basin wild rye, Indian rice grass, forbs, and sagebrush. Road gravels, red cinder, and historic artifacts were common through the first 40-50 cm of deposits, due in part to the disturbance caused by the installation of two narrow fiber-optic trenches running parallel across the northern portion of the right-of-way. The red cinder was probably used to "sand" the highway during icy winter conditions. The southernmost fiber-optic cable was inactive,

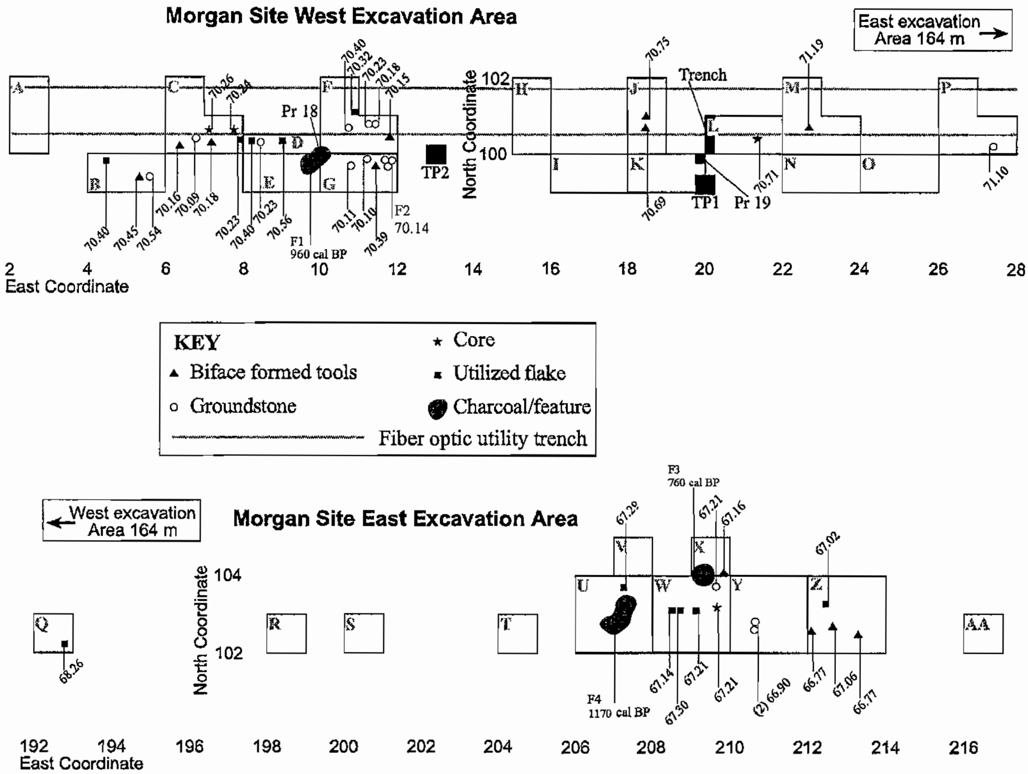

Figure 3.3. Plan view of the Morgan site excavation area, indicating the location of excavation units and various features.

the northernmost was "live". Units were opened and closed based on their integrity and productivity in terms of what information they could provide about the archaeological and geomorphic characteristics of the site. Because of the destruction caused by the fiber-optic trenches and the limited confines of the project area, complete 2x2 m units were not opened. hearth (Feature 1) and a ground stone cluster (Feature 2).

The West Locus produced 108 tools, 1548 pieces of burned and unburned animal bone, and 6014 pieces of debitage. Two features were identified at the West Locus; a hearth (Feature 1) and a ground stone cluster (Feature 2). The site deposits consisted of light gray-brown silty sands that graded to a darker gray with increased depth. The depth of the deposits was quite variable at this locus. The percentage of sand in the fill increased as the excavations approached bedrock and the color of the fill became light gray to tan nearer the bedrock. Units were excavated to 80 cm on the average, with a range between 50-105 cm. Either bedrock or cobbles that had weathered from the upper surface of the bedrock began to appear between 35-75 cm below the surface (Figure 3.4). The West Locus deposits became more laden with calcium carbonates as The majority of excavations neared the bedrock. The deposits also contained small numbers of well rounded obsidian pebbles, and tabular pieces of chert with rounded edges, in a variety of sizes. The cultural materials was recovered from Units B through G, in the western portion of the West Locus between 15-65 cm below the surface. The artifacts were clustered around Feature 1, a hearth radiocarbon dated to 950 BP (calibrated radiocarbon years are used in this report unless otherwise specified; conventional radiocarbon dates are provided in Table 3.1) , and included an abundance of ground stone along with cores, hammerstones, utilized flakes, and bifaces. The highest quantities of both debitage and bone at the West Locus occurred in a small area that included Quad D of Unit F, and all of Unit G. Projectile points in Units B-G. included

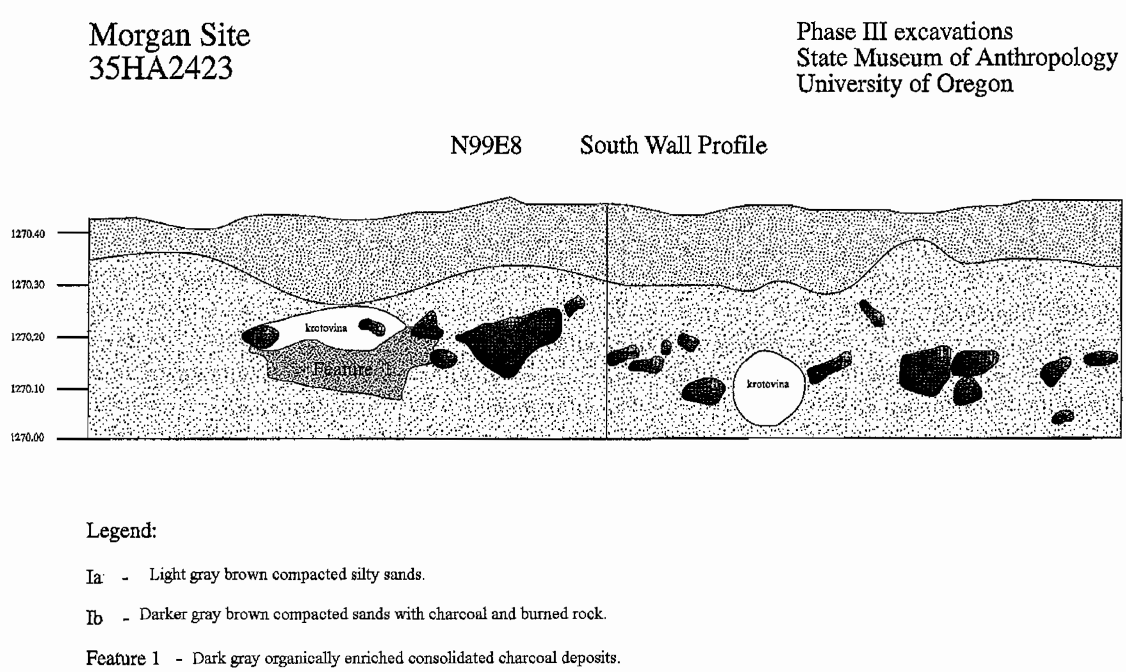

Figure 3.4. Profile of Unit N99, E8 (West Excavation Block). Note Feature 1.

Side-notched (1), Elko Corner-notched (1), Elko Eared (1), and Eastgate (1) varieties. Units H through P produced smaller quantities of cultural materials, generally between 30-65 cm below the surface, including one Eastgate and two Elko Corner-notched points, bifaces, cores, and ground stone. The two Eastgate points recovered at the West Locus were found in association with Elko Corner-notched points. Debitage counts at the West Locus did not exceed 100 flakes per square meter, and bone did not accumulate beyond 50 pieces per square meter. Evidence supplied through obsidian hydration readings from the artifacts indicates that the locus has a single component. This topic will be further addressed in a later chapter.

The East Locus

The East Locus is east and downslope from the West Locus and somewhat sheltered by the slope of Sand Hill (Figure 3.5). Data recovery at this locus consisted of a linear series of excavations in an area that was three meters wide from north to south by 25 meters long from east to west. The excavations included Units Q through AA (with paired letters after Z). The highway is built on fill above and to the south of this locus, and the right-of-way extends beyond the fence and onto the Morgan Ranch pasture lands, where the excavation took place. The ground cover included sagebrush, rabbit brush, Indian rice grass, mustards, and other small grasses and forbs. Road gravels were not as prevalent in the deposits in comparison to the West Locus, and historic artifacts were limited to the first 20 cm of deposits. This area was unaffected by the cable trenches.

A total of 53 tools, 3361 pieces of lithic debitage, and 1447 pieces of burned and unburned animal bone was recovered from the East Locus. The most concentrated area of cultural activity was located in Units T through Z, between 5-45 cm in depth. The four 2x2s and seven 1x1s that were excavated at the location produced primarily utilized flakes and bifaces, with lesser numbers of cores, hammerstones, and ground stone. Chronologically diagnostic projectile points included two Side-notched, one Elko Corner-notched, three Rose Spring, one Eastgate, and one Cottonwood Triangular. Only one of the eight projectile points recovered from the East Locus was found *in situ*, but it is apparent from the excavation notes that arrow points were recovered from higher in the deposits than the larger dart points. The Rose Spring and Cottonwood Triangular points were found in levels 1-4, while the Elko and Northern Side-notched varieties came from levels 5-8. As was true at the West Locus, the single Eastgate point found at the East Locus was associated with an Elko Corner-notched point, in Level 9 of Unit U.

The fill generally consisted of light grayish-brown silty sands to an average depth of 35-45 cms, followed by a layer of calcium carbonate-encrusted cobbles weathering free of the bedrock beneath. A statistical analysis of hydration rinds on various obsidian artifact types from the Morgan site revealed that there are two possible components at the East Locus, which fits well with the typological evidence. The upper component is situated at approximately 0-50 cm in depth, and appears to angle downslope to the east. The component is believed to be comparable in age to the single component of the West Locus. Feature 3, a 760 BP hearth, is associated with this stratigraphic layer as is Feature 4, the hearth dated to 1170 BP. The lower component is not clearly defined due to some mixing of late projectile points and the possible intrusion of shallow hearths into the earlier deposits. The early component appears to be situated approximately

Figure 3.5. The Morgan Site, East Locus, facing northwest.

25-50 cm below the surface in deposits that also trend downslope to the east. The relative uniformity of the components (with arrow points generally overlying dart points) seems to suggest that this portion of the site was only moderately disturbed, perhaps due to rodent activity. The presence of Side-notched points may indicate that either earlier occupations occurred at the site, or artifacts from an earlier time were curated by the later occupants. Based on the obsidian hydration of numerous artifacts from the site, the former possibility is most likely. The obsidian hydration evidence supporting this contention is explored by Connolly later in this volume (see Appendix).

Radiocarbon Dates

A total of three radiocarbon dates was assayed on materials collected from the Morgan site. The dated materials were selected from the three hearths identified at the site; Features 1, 3, and 4. Feature 1 was located in the West Locus, and Features 3 and 4 were identified in the East Locus (Table 3.1). The latest date from the site was 760 BP returned on Feature 3, a small hearth located in Units W and X of the East Locus. The dated material was a composite charcoal sample, collected from the lowest hearth deposits between 50-60 cm below the surface. The date may be representative of occupations containing Rose Spring points at the East Locus, but is probably too early to be associated with occupations yielding Cottonwood Triangular points. The base of the hearth is at the same elevation as the maximum depth of the lower component, indicating that the feature was excavated into the older deposits.

Table 3.1. Radiocarbon dates for the Morgan Site.

Feature	Component	Sample No.	C-14 date	Calibrated BP*	Material
1	West	Beta-88079	1060±70	1055 (950) 924	composite charcoal
3	East Upper	Beta-88081	870±60	898 (760) 702	composite charcoal
4	East Upper	Beta-88080	1260±60	1270 (1170) 1077	composite charcoal

* Probable intercept in parentheses, bracketed by one-sigma error range.
Calibration from Stuiver and Reimer 1993.

The earliest date from the Morgan site was 1170 BP from Feature 4, a hearth which may be associated with the late component at the East Locus. Located in Quads C and D of Unit U, the dated material consisted of a composite charcoal sample collected approximately 10 cm from the bottom of the hearth, between 50-60 cm below the surface. This date is in keeping with the hydration rate proposed in Chapter 7 which places the latest occupations at the site in the last 1300 years.

A third radiocarbon date from the site was derived from Feature 1, the hearth located in the West Locus considered to be associated with a late component at the site. A composite charcoal sample collected near the bottom of the hearth (50-60 cm below the surface) produced a date of 950 BP.

All of the radiocarbon dates are derived from hearths which reached a maximum depth of 50-60 cm below the surface. Based on obsidian hydration studies, the West Locus is considered to have a single late component and the East Locus appears to have a later and an earlier occupational period. The radiocarbon dates from the West and East Loci are not compatible with the presence of Side-notched points and are late for the inclusion of Elko Series points as well. On the opposite end of the timeline, the presence of a single Cottonwood Triangular point may indicate that the site was also occupied after 700 BP, the time when these points first appear in Monitor Valley (Thomas 1981), even though the radiocarbon dates at the Morgan site are too early for even the earliest appearances of Cottonwood Series artifacts. The dates do go well with the use of Rose Spring and Eastgate points, however. The dated hearths may reflect a particular period of occupation which, for unknown reasons, has a better state of preservation than earlier and later occupations. It may also be possible that activity at the site intensified during the Rose Spring and Eastgate period, leaving a greater number of cultural traces behind.

Features

Four cultural features were identified at the Morgan Site. Of these, three were hearths and one was a ground stone cluster located in an intensely occupied portion of the site.

Feature 1 consisted of a rock-ringed hearth that was identified in Quad D of Unit D, Quad B of Unit E, and Quad A of Unit G at the West Locus (Figure 3.6). The feature was radiocarbon dated

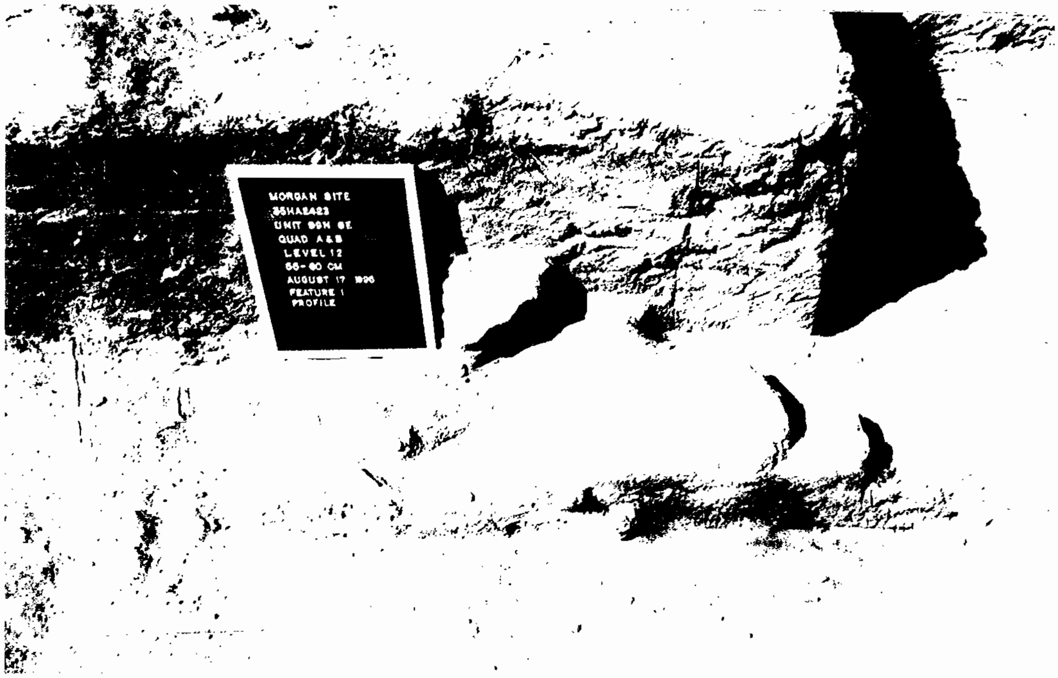

Figure 3.6. Feature 1, Unit D, Level 12, facing north.

to 950 BP. Feature 1 was located near the most intensely occupied portion of the Morgan site, in an area where artifact concentrations and variability were highest. The debitage count was also higher here than at any other portion of the Morgan site, and faunal analysis revealed the widest variety of species for the site as well as the highest quantities of bone. Charcoal staining associated with the feature first became noticeable at a depth of approximately 45 cm below the surface, and continuing to a depth of 65 cm. The hearth reached a maximum width of 75 cm (east to west), and a length of 1.0 meter (north to south). A number of rodent burrows had infiltrated the feature, but dark, organically enriched, consolidated charcoal deposits were still evident at the time of excavation. One utilized flake was found in the hearth deposits, and many tools were found nearby, including an Eastgate point. The paleoethnobotanical remains included sagebrush charcoal and what may be a fragment of a charred camas bulb (Prouty 1995).

Feature 2 consisted of a cluster of milling stones that were exposed in Quad B of Unit G at the West Locus, roughly 1.5 meters from Feature 1 (Figure 3.7). The cluster included three small

Figure 3.7. Feature 2, a milling stone cluster 45-50 cm below the surface in Unit G.

manos, of which one has a single grinding surface, one has two grinding surfaces, and one has three grinding surfaces. The artifacts were found in the ninth level of excavation at a depth of 45-50 cm below the surface. The cluster occurred in the portion of the site where artifact, debitage, and animal bone counts were the highest. Unit G bone counts exceeded 150 pieces per level, and debitage counts were above 250 flakes per level. Other artifacts in the vicinity included bifaces, hammerstones, utilized flakes, and cores. An Elko Corner-notched point was recovered adjacent to the feature, but higher in the deposits, at a depth of 30 cm.

Feature 3 is a hearth located in Quad B of Unit W, and Quad D of Unit X in the East Locus (Figure 3.8). The feature was radiocarbon dated to 760 BP, and is considered to be associated with the upper component of the East Locus. The feature was encountered at a depth of 25 cm, continuing to a depth of 55 cm below the surface. Four mano fragments were collected near the southeast edge of the hearth. Three of the fragments were refitted to form a unifacial mano fragment, and the other fragment was from an unrelated tool. None of the artifacts appeared to be

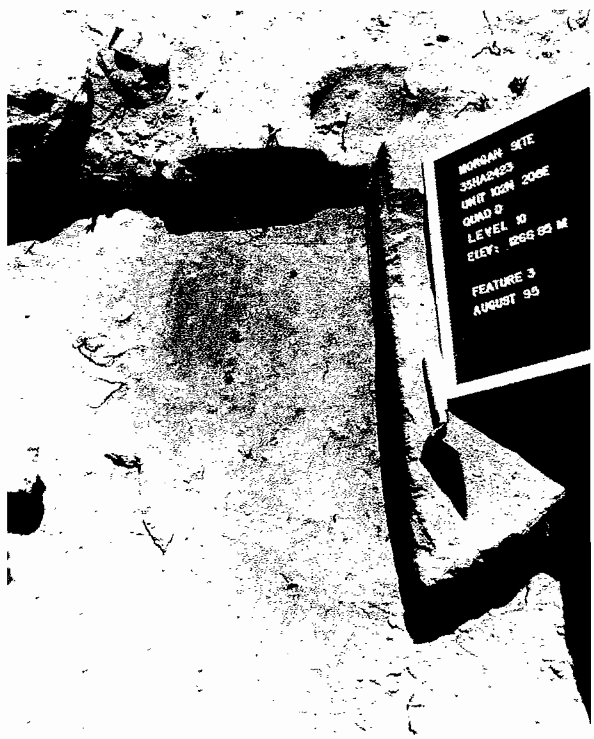

Figure 3.8. Feature 3, a hearth, 25-55 cm deep in Unit W

fire-cracked. The hearth was revealed to be a shallow basin 90 cm in length (north to south) by 65 cm (east to west) dug well into the deposits of the lower component at the site. The feature did not have a stone ring surrounding it, and only one piece of fire cracked rock was noted. Chronologically diagnostic projectile points recovered from the upper component deposits near Feature 3 included one Rose Spring and one Cottonwood Triangular point. Other artifacts included utilized flakes, bifaces, a core, and a hammerstone.

Feature 4 is the oldest dated feature at the Morgan site, a hearth radiocarbon dated to 1170 BP (Figure 3.9). First noted at a depth of 35 cm below the surface in Unit U of the East Locus, the hearth continued to a depth of 55 cm. The maximum length was 1.05 meters (east to west) and

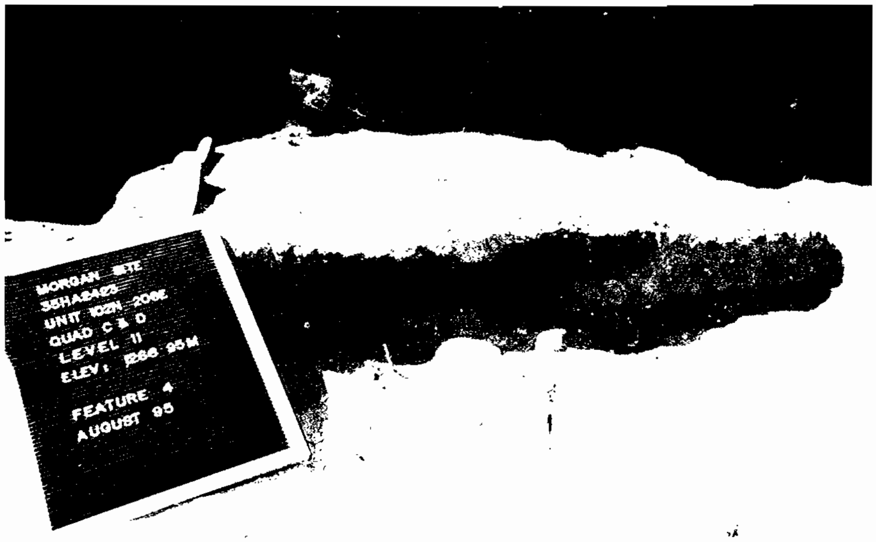

Figure 3.9. Feature 4, a hearth 35-55 cm deep in Unit U.

the width was 90 cm (north to south). The perimeter of the hearth was oval in shape, with light traces of charcoal present. Charcoal staining intensified with depth as the feature became smaller and clearly more basin-shaped. The hearth appeared to have been scooped out of surface deposits and was not surrounded by a stone ring. Diagnostic projectile points found near the feature included a large Elko Corner-notched point manufactured from CCS, and an obsidian Eastgate point. Utilized flakes were the only other tools directly associated with the hearth. Rodent damage was minimal in Feature 4. Only three pieces of fire-cracked rock were observed within the feature.

Artifact Assemblage

This section treats all of the flaked stone tools recovered during the excavations, including bifacial and unifacial tools. Bifacial tools have been subdivided into two categories; shaped and unshaped bifaces. Shaped specimens show evidence of having been reduced through percussion and pressure flaking to a distinct form, such as an oval or leaf-shaped preform (among others), or further into typologically defined tools such as projectile points. The shaped bifacial tools have been classified according to a system based on five stages of manufacture that was employed by Jenkins and Connolly (1990). Their system will be outlined in greater detail below. Unshaped bifaces have bifacial modification of at least one edge of a flake, but have not been further worked into a more defined shape.

Unifacial tools are those which exhibit intentional edge modification to a single side of the flake, and generally show a clear pattern of wear from extensive use. Scrapers and notched spokeshaves fall into this category, reflecting use at an angle transverse to the material being processed (Jenkins and Connolly 1990).

Edge-modified flakes are those which have been applied to expedient cutting and scraping tasks. They exhibit wear patterns reflective of systematic use, but have not been purposefully shaped or modified for use other than by the activity to which they were applied. Research has shown that trampling of lithic materials can produce patterns of flaking similar to what has been seen on utilized flakes (McBrearty et al. 1998), so only those flakes with uniform patterns of flake removal along the edges have been considered for this analysis.

Projectile Points

A total of 16 diagnostic projectile points was recovered from the Morgan site; of which 15 were manufactured from obsidian and one from CCS (Table 3.2, Figure 3.10). The projectile points have been classified according to the system established by Thomas (1981) for the Monitor Valley region of central Nevada, with consideration also given to Columbia Plateau typological sequences proposed by Dumond and Minor (1983). Researchers have suggested possible cultural associations between the Northern Great Basin region and Columbia Plateau populations based on the lengthy archaeological record of occupations in the basin and a possible late arrival of Numic speakers into the area (Aikens 1985; Aikens and Witherspoon 1986). The Klamath and Modoc tribes are both linguistically and culturally tied to the Columbia Plateau and currently occupy areas adjacent to the Northern Great Basin. Because of this, and the fact that artifacts are regularly seen in the Northern Great Basin that suggest connections to Plateau cultures, Plateau typologies need to be considered when Harney Basin projectile points are being analyzed.

Obsidian was the principal material used at the Morgan site. Only one diagnostic point was made of CCS and none of the points were made from basalt. The projectile points include one Cottonwood Triangular (6.3%), three Eastgate (19%), three Rose Spring (19%), one Elko Eared (6.3%), four Elko Corner-notched (25%), and three side-notched (19%). Temporal associations between these artifact types and radiocarbon dated features across Northern Great Basin archaeological sites suggest that the Morgan site may have been occupied over the past four thousand years, several millenia longer than is suggested by the radiocarbon dates. Elko and Northern Side-notched points were designed for use with the atlatl, or throwing stick, and Rosegate and Cottonwood Series points were manufactured for use with the bow and arrow, which probably did not arrive in the region until sometime after 1900 BP (Wegener 1998:17) The presence of Northern Side-notched and Elko points stratigraphically separated from Rose Spring, Eastgate, and Cottonwood Triangular arrow points in portions of the Morgan assemblage probably indicates that the site was occupied both before and after the arrival of bow and arrow technology though the earlier occupation has not been dated.

Cottonwood Series. Cottonwood Series projectiles consist of small unnotched points that occur after 700 BP. There are two varieties; Cottonwood Triangular, which are small triangular points that have either a flat or slightly concave base, and Cottonwood Leaf-shaped, which have a rounded base. Both varieties weigh < 1.5 grams, are not longer than 30 mm, and no thicker than 4.0 mm (Thomas 1981:16). The Cottonwood Series points are not comparable to any of the Columbia Plateau artifacts classified by Dumond and Minor (1983). The single obsidian Cottonwood Triangular point (Specimen 977-23-Y-C-2-1) recovered at the Morgan site has a flat base with a base width of 12.2 mm, and a thickness of 2.1 mm. The point was broken just above

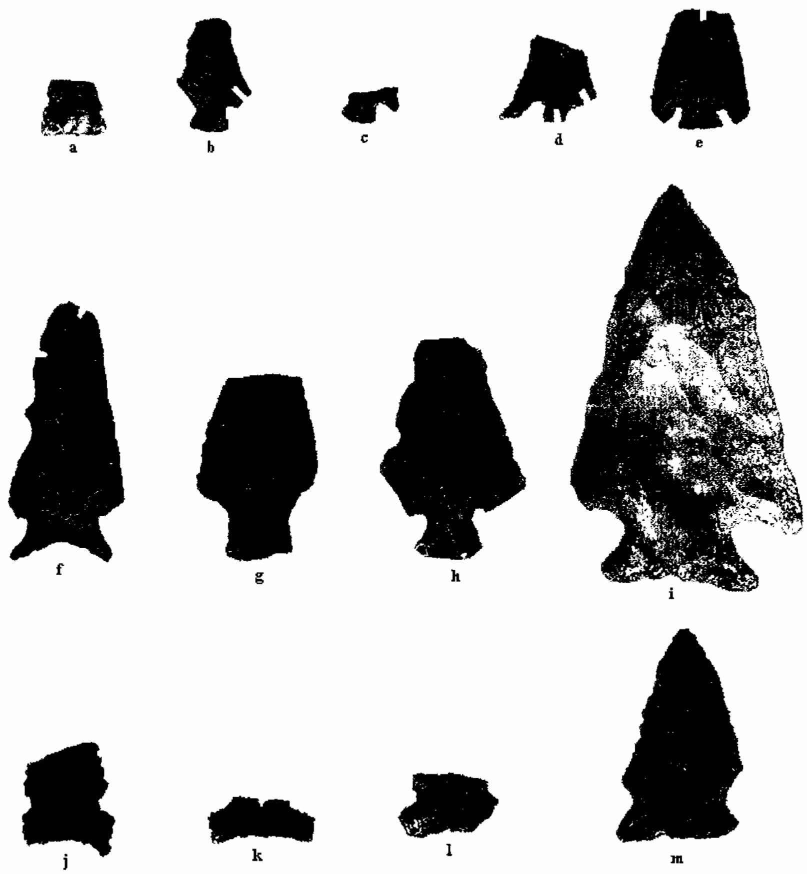

Figure 3.10. Selected projectile points from the Morgan site, actual size.
Metric attributes in Table 3.2.

the midsection so it was not possible to determine the maximum length of the artifact. The Cottonwood Series point was found within two meters of Feature 3, a hearth radiocarbon dated to 760 Cal. BP (Beta-88081) and three meters from Feature 4, a hearth dated to 1170 BP (Beta-88080). The point was recovered 15-20 cm higher in the deposits than the hearths and it is possible that it was not associated with either feature. The projectile point was not among the sample group analyzed for obsidian sources.

Rosegate Points. A total of six projectile points can be classified as Rosegate, characterized by their small size (weight <1.5 grams), expanding stems, and a basal width < 10 mm (Table 3.2). Thomas (1981:19) lumped the Rose Spring (Lanning 1963) and Eastgate (Heizer and Baumhoff 1961) point types together under one classification, but the two types are clearly dissimilar in both form and distribution, and in this report, Rose Spring and Eastgate are analyzed separately.

Three Eastgate points were recovered from the Morgan site. Of these, two occurred in the West Locus between 25 to 80 cm in depth (Specimens 977-23-E-B-6-1 and 977-23-L-A-16-1), and one in Level 9 (Specimen 977-23-U-D-9-1) of the East Locus. The Eastgate points are scattered vertically through the cultural deposits, but occur primarily in association with Elko Corner-notched points both in proximity and elevation, which may suggest that the two projectile point styles were used concurrently. Two of the Eastgate points were recovered near features. At the West Locus, an Eastgate point was recovered less than half a meter from Feature 1. At the East Locus, an Eastgate was collected a similar distance from Feature 4. Both of the Eastgate points located near features were analyzed for their obsidian sources. The point found near Feature 1 originated from the Burns source, and the point found with Feature 4 is from Dog Hill, near Burns Butte. The other Eastgate found at the West Locus was not located near a feature.

Three Rose Spring projectile points were collected from the East Locus of the Morgan site, all from the late component. Two of the points came from depths of 5 to 20 cm in Unit T (Specimens 977-23-T-B-2-1 and 977-23-T-B-4-1)), a 1x1 located approximately two meters from Feature 4. Specimen 977-23-T-B-2-1 was too small for obsidian source characterization. Specimen 977-23-T-B-4-1 was manufactured from Dog Hill obsidian; a source located near Burns Butte. The third point (977-23-Y-B-1-1) was found in the first level of Unit Y, approximately two meters from Feature 3 and about one meter from the Cottonwood Triangular point. This Rose Spring point is made of obsidian from the nearby Burns source. It is noteworthy that all of the geochemically identified Rosegate artifacts are from sources that are very close to the site. It is also interesting that the Rose Spring points were recovered from the first four levels (0-20 cm) while the Eastgate points, which are generally considered coeval with Rose Spring artifacts, were not encountered above ca. 30 cm depths.

Table 3.2. Metric attributes of projectile points: Morgan Site.

Type (977-23)	Catalog no. (mm)	Length (mm)	Width (mm)	Thickness (gr.)	Weight	Base Width	Neck Width	Source
				West Locus				
EE	A-A-4-1	43.3(C)	20.6	5.4	4.2	18.2	12.8	B
SSN	B-A-1-1	20.3	15.9	3.7	1.2	15.9	11.6	WWR
EG	E-B-6-1	20.9	1.71	3.4	1.2	7.3	6.3	B
SSN	F-D-6-1	10.5	18.0	4.7	0.8	---	12.3	---
ECN	G-B-6-1	32.9	21.6	6.5	4.2	12.0	11.1	UN
ECN	J-C-7-1	40.0	26.1	4.9	4.1	12.1	8.4	WC
EG	L-A-16-1	13.3	12.0	3.3	0.4	0.0	0.0	---
ECN	M-C-13-1	14.2	22.3	4.5	1.4	0.0	9.4	V
				East Locus				
Upper Component								
RS	T-B-2-1	10.8	5.6	2.1	0.2	0.0	0.0	---
RS	T-B-4-1	6.8	10.9	2.6	0.2	0.0	0.0	DH
RS	Y-B-1-1	20.5	13.9	2.3	0.5	7.3	5.8	B
CT	Y-C-2-1	10.1	11.9	2.1	0.2	11.9	0.0	---
Lower Component								
ECN	U-B-8-17	1.4(C)	42.1	9.1	23.5	28.3	19.0	---
EG	U-D-9-1	16.0	18.0	2.8	0.5	4.7	4.3	DH
LSN	Y-A-5-1	37.5(C)	21.6	5.6	3.7	22.4	16.5	OO
	Y-D-8-1	6.5	18.4	4.1	0.4	18.4	9.8	B

CT= COTTONWOOD
RS= ROSE SPRING
EG= EASTGATE
EE= ELKO EARED
SSN= SMALL SIDE-NOTCHED
LSN= LARGE SIDE-NOTCHED

B= BURNS
DH=DOG HILL
OO= DOUBLE O
UN= UNKNOWN
V=VENATOR
WC= WOLF CREEK
WWR= WHITEWATER RIDGE

(C)=COMPLETE

Elko Series Points. There were five Elko Series points collected from the Morgan site; one Elko Eared and four Elko Corner-notched. All five can be categorized as Elko points, based on the classification system established by Thomas (1981), or Side Notched-5 under the system developed by Dumond and Minor (1983:171). Elko Series points functioned as dart points used with the atlatl, or throwing stick. Elko Eared points are large, corner-notched dart points with a deeply indented base that, in conjunction with the corner-notching, form "ears" for hafting the projectile on to a wooden dart shaft. Elko Corner-notched points are similar in size, weight and overall morphology to Eared points except that they lack the deep basal indentation that gives the eared appearance. The widest portion of the projectile point in both varieties is just forward of the base. One Elko Corner-notched point collected at the Morgan site was made from CCS, the Eared point and the rest of the Corner-notched points were made of obsidian.

The Elko Eared tool (977-23-A-A-4-1) and three of the four Corner-notched points (Specimens 977-23-G-B-6-1, 977-23-J-C-7-1, and 977-23-M-C-13-1) were recovered from the West Locus, while a single Elko Corner-notched point (977-23-U-B-8-1) came from the East Locus. As was mentioned previously, Elko Corner-notched points and Eastgate points seem to be closely associated in the deposits. This is true in both the West and East Loci. The Elko Eared point was manufactured from Burns obsidian. The Corner-notched points that were analyzed for their obsidian sources included one from an unknown source, one from Wolf Creek, to the north, and one from Venator, to the east (see Table 2). Although the sample is very small, Elko Corner-notched points seem to originate further from the Morgan site than Rosegate points, particularly from the north and east. The fragmented nature of all but one of the points does not permit a discussion of general morphological attributes.

Side-notched (Large and Small). Thomas (1981:19) established a single classification for all side-notched points that were not attributable to the Desert Series. This scheme was based on only 15 points available (from the Monitor Valley in central Nevada) at the time of his study. Typological distinctions between Large Side-notched versus Desert Side-notched points involve a weight that is > 1.5 grams and a proximal shoulder angle > 150 degrees. This typology is limiting for the purposes of this report, since the three small projectile points recovered from the Morgan site can not be comfortably attributed to Northern Side-notched, Thomas' Large Side-notched, or the very small Desert Side-notched categories. The large side-notched point, on the other hand, does not fit the Northern Side-notched typology. As a result, the points here are categorized as either large or small side-notched points, without further attempt to tie them to a Great Basin classification.

The large side-notched point (977-23-Y-A-5-1) was recovered in Level 5 of Unit Y at the East Locus of the Morgan site. It was found less than two meters from Feature 3, a hearth dated to 760 BP, between 30-35 cm in depth. The obsidian point was manufactured from a triangular preform, with shallow notches placed just above the corners of the base providing almost a corner notched appearance similar to an Elko point. The point originated from the Double O obsidian source, approximately 50 km southwest of the Morgan Site.

One of the three Small Side-notched points (977-23-Y-D-8-1) was collected from Level 8 of Unit Y in the East Locus within three meters of Feature 3. The artifact is an obsidian side-notched point base, snapped off at the neck, which appears to have the deeply incised side-notches and concave base that is characteristic of a "classic" Northern Side-notched point. However, the fragment is much smaller than would be expected for a Northern Side-notched projectile point, and the absence of the majority of the artifact restricts further interpretation. The point was determined to have originated from the Burns obsidian source. The second Small Side-notched point (977-23-B-A-1-1) was made from Whitewater Ridge obsidian. This fragmentary artifact consists of the base and a good portion of the midsection. It has a concave base, shallow notches placed between 0.6-0.7 mm above the base, and serrated edges along the entire length of both sides. The tool was an isolate recovered approximately five meters west from Feature 1, and about two meters from an Elko Eared point. The third Small Side-notched base (977-23-F-D-6-1) was about the same width as the other two, but is thicker in cross section and appears to have been of a heavier construction. The point fragment was recovered from the screen in Quad D of Unit F and it is unclear whether it originated in the reworked trench deposits or the compacted silts adjacent to the trench. It is noteworthy that Quad D is less than two meters from Feature 1.

Point Fragments

Projectile point fragments consist of finely worked bifacial tool fragments that are not recognizeable as diagnostic tools, yet are clearly portions of finished projectile points. A total of eight projectile point fragments were recovered from the Morgan Site, consisting of six tips, one midsection and one base (Table 3.3). A midsection and three tips were collected in the West Locus, and a base and three tips from the East Locus. Only one fragment was manufactured from CCS (a tip from either a point or a drill); the others were made of obsidian. The tool fragments found at the Morgan site appear to have been constructed for use with both atlatl and bow and arrow technology. The six point tips from the Morgan site show considerable variation in size and apparent function. All are finely pressure flaked. The only CCS point tip in the assemblage is much rounder in cross section than the other point tips, which may indicate that the fragment originated from a drill or awl. The stem and base fragment is made from obsidian, and was clearly broken from an arrow point, judging by its small size. The base has an expanding stem suggestive of a Rose Spring point. The single midsection recovered during excavation is non-diagnostic. The fragment has like an arrow-like thinness, but a width similar to a dart point.

Table 3.3. Metric attributes of Morgan site projectile point fragments, (linear dimensions in millimeters).

Type	Type	Catalog No.	Material	Length	Width	Thickness	Weight
			West Locus				
tip	963-2423-TP1-2-4	Obs	27.3	13.3	4.9	1.8 g	
tip	977-23-B-B-2-1	Obs	18.2	11.5	3.0	0.5 g	
mid	977-23-E-B-4-1	Obs	21.7	16.2	3.2	1.0 g	
tip	977-23-G-B-6-2	Obs	9.1	8.4	2.5	0.1 g	
tip	977-23-H-D-6-2	CCS	13.3	5.9	3.0	0.2 g	
			East Locus				
tip	977-23-U-C-2-1	Obs	14.7	9.0	1.9	0.1 g	
tip	977-23-Y-D-1-1	Obs	47.6	16.1	7.1	5.6 g	
base	977-23-Y-D-5-1	Obs	5.3	5.3	1.8	<0.1 g	

Drills

A single obsidian artifact (977-23-Y-C-4-1) collected from the East Locus may have functioned as a drill or awl. Either hafted or held between thumb and forefinger, the tool was twisted back and forth to bore holes in moderately resistant materials.

The artifact consists of the midsection of what originally appears to have been a projectile point that was broken across the midsection, then flaked on both sides of the tip to create a finer, narrower point than previously existed. The artifact is smaller and thinner than drills or awls more commonly seen in similar site assemblages (length 11.1 mm, width 11.5 mm, thickness 3.1 mm), and it seems more likely that this tool functioned either as a graver for incising, or as an awl for use with materials less resistant than wood or bone.

Shaped Bifaces

This analysis employs a multistage biface classification system developed by Jenkins and Connolly (1990, Table 3.4). Since most of the artifacts considered here are large fragmentary bifaces that may have been preforms for other tools, the individual specimens are classified in terms of the portion they equate to on a leaf-shaped biface. Tips have pointed ends, and are thought to be the distal end of the artifact. Bases have rounded or squared convex ends and are thought to be the proximal portion of the artifact. Not all bifaces have rounded bases and pointed tips, of course, but it seems most appropriate to emphasize the most common shapes in the artifact category when only fragments exist (Figure 3.11). The functions of the fragments can only be implied.

Stage 1 bifaces. These bifaces have thick cross-sections and large, unpatterned flake scars. The artifacts exhibit only the most rudimentary shaping, with either rounded or lenticular profiles. The flaking pattern reflects use of the hard hammer percussion technique. Two crude obsidian biface fragments fit this classification. One fragment is the midsection of a large biface (Specimen 977-23-M-C-5-1) with a roughly lenticular cross section. One of the fractured ends of the artifact has a high degree of patination and the other does not, suggesting that the artifact may have been utilized during two separate episodes. The other fragment (Specimen 977-23-X-D-5-1) is the rounded base of a very crudely shaped medium-sized biface which appears to have been broken during the initial reduction process.

Stage 2 bifaces. Bifacial thinning was continued on these artifacts through the removal of contiguous hard hammer percussion flakes. The removal of the flakes resulted in the development of an artifact, which, although still crudely shaped, has a more pronounced form than Stage 1 artifacts. Stage 2 bifaces are considered to be quarry blanks. A total of seven artifacts fit this classification; four of obsidian and three of CCS. The four obsidian artifacts are all fragmentary, consisting of a base, a midsection, and two tips. The base (977-23-U-B-6-6) originally was part of a large, lanceolate blade with convex edges and a slightly convex base. It has retouched edges that have been shaped to give the base a squared appearance. The midsection (963-2423-P17-3-1) is missing the proximal and distal ends and one edge. The removal of broad, thin flakes across the body resulted in a well-thinned tool, and the single remaining edge appears to have been retouched. The two obsidian tips (Specimens 963-2423-P33-2-1 and 977-23-Z-C-4-1) have thick, lenticular profiles and were broken early in the reduction process. The CCS tool is made of brick-red material that is bipointed and has a thin but lenticular shape (Specimen 977-23-C-C-13-1). The tool has extremely sinuous edges formed by the removal of deep percussion flakes and the presence of bulbous areas where step-fracturing prevented further removal of lithic material. The broader of the ends has evidence of rounding and crushing that may be associated with usewear, but the remainder of the artifact does not appear worn.

Stage 3 bifaces These bifaces exhibit little or no evidence of pressure flaking and have sinuous edges characteristic of large percussion flake scars created during the initial stages of bifacial reduction. The entire artifact surface has been modified through the removal of flakes which can reach the middle of the artifact. Seven obsidian artifacts from the Morgan site fit this classification, including four bases and three complete artifacts. All of the bases are from large bifaces and include one which is rounded and two that are rectangular, with straight sides leading to sharp corners and flat bases. The rounded base (Specimen 977-23-S?-?-1 Backdirt) appears to have been manufactured using a series of both hard and soft hammer percussion strokes. A portion of the base is unworked cortex, oval in cross section, and extending slightly outward from the body of the artifact. The two rectangular bases (Specimens 977-23-Z-C-8-1 and


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977-23-Z-D-4-1) are primarily percussion flaked, although some portions of the edges have been modified through the removal of a series of parallel pressure flakes on both artifacts.

The two CCS tools include a complete tool and a base fragment. The two appear to have been made from the same deposit of tool stone; a beige colored material with medium-brown mottling. The artifacts were located within six meters of each other at the East Locus. The fragmentary piece (Specimen 977-23-Z-D-10-1) appears to have been a roughly oval artifact, broken during the thinning process. The complete biface (Specimen 977-23-U-B-9-1) has a lanceolate shape with convex edges and a slightly concave base. It is randomly flaked but thin in cross section, with slightly sinuous edges. The edges show strong evidence of usewear. This artifact was recovered from Quad B, Level 9, of Unit U, in association with the Elko Corner-notched and Eastgate points adjacent to the 1170 BP hearth.

Table 3.4. Metric attributes of Morgan site bifaces (complete and fragmented specimens), in millimeters.

Type	Catalog No.	Material	Length	Width	Thickness	Weight
			West Locus			
Stage 1:						
mid	977-23-M-C-5-1	obs	33.9	45.0	10.6	16.4g
Stage 2:						
mid	963-2423-P17-3-1	obs	22.3	35.5	6.3	6.0g
tip	963-2423-P33-2-1	obs	17.0	29.0	7.3	2.4g
biface	977-23-C-C-13-1	ccs	97.8	33.6	15.4	51.3g
Stage 3:						
biface	977-23-C-D-13-1	obs	47.6	20.8	7.4	7.2g
biface	977-23-F-D-12-1	obs	95.5	40.3	7.8	28.8g
base	977-23-S-?-?-1 (backdirt)	obs	30.3	35.6	9.7	11.0g
Stage 4:						
mid	963-2423-TP1-2-3	ccs	25.4	19.4	7.2	3.7g
mid	977-23-J-A-6-1	obs	25.4	18.4	5.7	2.8g
			East Locus			
Late Component:						
Stage 1:						
base	977-23-X-D-5-1	obs	33.8	26.9	9.4	7.5g
Stage 2:						
base	977-23-U-B-6-6	obs	24.7	36.7	7.4	8.1g
tip	977-23-Z-C-4-1	obs	45.9	31.0	8.9	8.9g
Stage 3:						
base	977-23-Z-D-4-1	obs	18.4	41.6	4.4	4.0g
Stage 4:						
tip	977-23-S-C-14-1	obs	19.0	11.9	4.0	0.9g
Early Component:						
Stage 3:						
biface	977-23-U-B-9-1	ccs	75.0	38.2	8.6	24.5g
base	977-23-Z-C-8-1	obs	52.7	36.5	8.3	15.1g
base	977-23-Z-D-10-1	ccs	60.7	48.7	10.3	32.2g
Stage 4:						
mid	977-23-AA-C-7-1	obs	15.5	14.3	4.2	1.0g

One of the two complete Stage 3 artifacts (Specimen 977-23-C-D-13-1) consisted of an oval piece that was manufactured through the use of percussion flaking and the removal of pressure flakes that ran up to the midline of the artifact in some areas. Two percussion blows on either side of the artifact have created a deep notch that shows no signs of usewear. Evidence of usewear is sporadically distributed along the edges of the artifact, suggesting limited use as a scraping tool.

Specimen 977-23-F-D-12-1 is a nicely crafted blade that may have served as a knife. Long, thin flakes driven across the body of the artifact have created a uniformly thin tool with a pointed tip, broadly convex sides, and a sharply rounded base. The removal of pressure flakes around the entire perimeter of the knife has resulted in a strong uniform edge that has signs of usewear on all portions. The artifact was found near Feature 2 (the groundstone cluster).

Stage 4 bifaces The use of both percussion and pressure flaking techniques results in bifaces with a more "finished" appearance than Stage 3 items. Flakes can reach the midline of the artifact or beyond, and frequently eliminate the large percussion scars from earlier reduction processes. Edges are strengthened by the removal of pressure flakes which increase the edge angle. Four Stage 4 artifacts were collected from the Morgan site, including one obsidian tip and three midsections; one of which was CCS, the other two obsidian. Two of the midsections, including the CCS fragment (963-2423-TP1-2-3), were tool fragments that had been broken across the body of the artifact and at the midline, leaving a single edged remnant. The third midsection (Specimen 977-23-J-A-6-1) was missing the tip and base. It had a thin, lenticular cross-section, with diagonal pressure flaking running across the artifact on one side, and a combination of pressure and percussion flaking on the other. The tip (977-23-S-C-14-1) was haphazardly pressure flaked and clearly not a completed tool at the time it was broken. All five stages of biface reduction were apparent at the West Locus, and in the late component at the East Locus. In the early component at the East Locus, only Stage 3 and 4 artifacts were present, which seems to indicate that initial reduction practices were occurring at a location removed from the Morgan site.

Edge-Modified Flakes

A total of 51 artifacts exhibit use wear characteristic of utilized flakes. Of these, seven are bifacially worked specimens and three can be classified as spokeshaves. There were seven CCS, one basalt, and 42 obsidian tools in the assemblage. One of the CCS tools was bifacially worked. The other six CCS tools and the single basalt tool were unifaces.

The highest concentrations of utilized flakes were found in the units of the East Locus, particularly from the area nearest to Feature 4. Unit W produced eight, of which one was a steep-edged scraping tool.

Two of the three spokeshaves are manufactured from obsidian. Specimen (977-23-Q-C-2-1) has a single crescent-shaped indentation that is unifacial, with very few use-generated pressure flakes removed from the edge, suggesting that the artifact was used only for a short time. Specimen (977-23-J-C-6-1) has two indentations located along the longest edge of the tool. The notches are unifacial, with the two worn edges on opposite sides of each other. A third tool 977-23-C-D-12-2, is manufactured from an orangish-brown tabular CCS cobble 145.1 mm in length, 67.2 mm in width, and 18.5 mm thick. The spokeshave has a single notch that is approximately 38.5 mm wide by 12.7 mm deep and large flakes have been driven off of one side only, suggesting that scraping occurred in only one direction. This artifact would be suitable for the manufacture or maintenance of digging sticks.

Two artifacts (Specimens 977-23-N-B-7-1 and 977-23-W-A-5-1) are steep-edged scrapers, both of which are bifacially flaked. The steep side has an edge angle that was initially established by pressure flaking, then enhanced through repeated use. The opposite side has incidental, unpatterned flaking that appears to be the result of use wear. The tools have obviously been prepared to some degree, but lack the deliberate shaping and edge modification of scrapers from other sites in the region, such as those reported from the Headquarters Site (Dugas and Bullock 1994:40

Cores

Five cores were collected at the site; three in the West Locus and two in the East Locus. Of these, three are CCS, one is obsidian, and one is basalt. Two of the CCS cores were excavated from adjoining units and appear to have originated from the same deep brown source material. One of these, Specimen 977-23-B-B-9-1, is a small triangular core which has had six flakes removed from one side. The second core is a large tabular specimen that was broken into at least three pieces, of which two were recovered (Specimens 977-23-C-D-11-1, and 977-23-D-D-12-1). Small flakes were removed around the sides, and larger flakes at an oblique angle to one of the planar surfaces. Specimen 977-23-L-D-7-1 is roughly half of a broken obsidian nodule, with flakes removed across the exposed surface and perpendicular along one edge. Specimen 977-23-Y-C-7-3 is a fine grained basalt nodule from which at least four large flakes have been removed at varying angles. Specimen 977-23-W-B-3-1 is a six-sided core made of a light orange-colored CCS. Flakes have been removed from all sides of the artifact.

Debitage

A total of 5108 pieces of obsidian debitage was analyzed; comprising the entire obsidian sample from the Morgan site (Figure 3.12). Mass analysis (Ahler 1986, 1989) was conducted by passing the debitage through a series of nested screens. The apertures of the screens were G1, 1"(35.9 mm); G2, ½" (18.0 mm); G3, ¼" (8.0 mm), and G4, 1/8" (3.6 mm). The flakes from each screen were counted, weighed, and examined for the presence of exterior cortex (Table 3.5). The data derived through the mass analysis process permits interpretations regarding lithic reduction activities ocurring at an archaeological site primarily through the quantification of size grades (see Ahler 1989; or Connolly 1999 for more detailed explication). The greatest quantity of debitage was recovered in the G4 screen, accounting for 78.1% of the total (3987 flakes). Grade G3 yielded 882 flakes, or 17.3%, and 227 flakes were collected in the G2 screen for 4.4 % of the total. A total of 12 flakes was recovered from the Size G1 screen, representing 0.2% of the debitage. Cortex flakes were limited in number (143 flakes, or 2.6% of the sample.

As can be seen in Tables 3.5 and 4.11, the percentage distributions of debitage counts and cortex flakes are quite similar between the Hoyt and Morgan sites. The percentage of debitage weight for the G1 class is considerably higher at the Morgan site than at the Hoyt site, but the disparity decreases in the G3 and G4 classes. The Morgan site G1 artifacts average 22.85 g/flake while those from the Hines site average 15.24 g/flake. In the G2 and G3 classes, Morgan flakes average 2.7 g and 0.36 g respectively, while Hoyt flakes average 1.94 g and 0.26 g respectively. The G4 flakes from both sites average 0.04 g. Because the G1 total is 12 flakes (a small sample size), the difference may simply mean that a few large nodules, cores, or quarry blanks were transported to the Morgan site for use.

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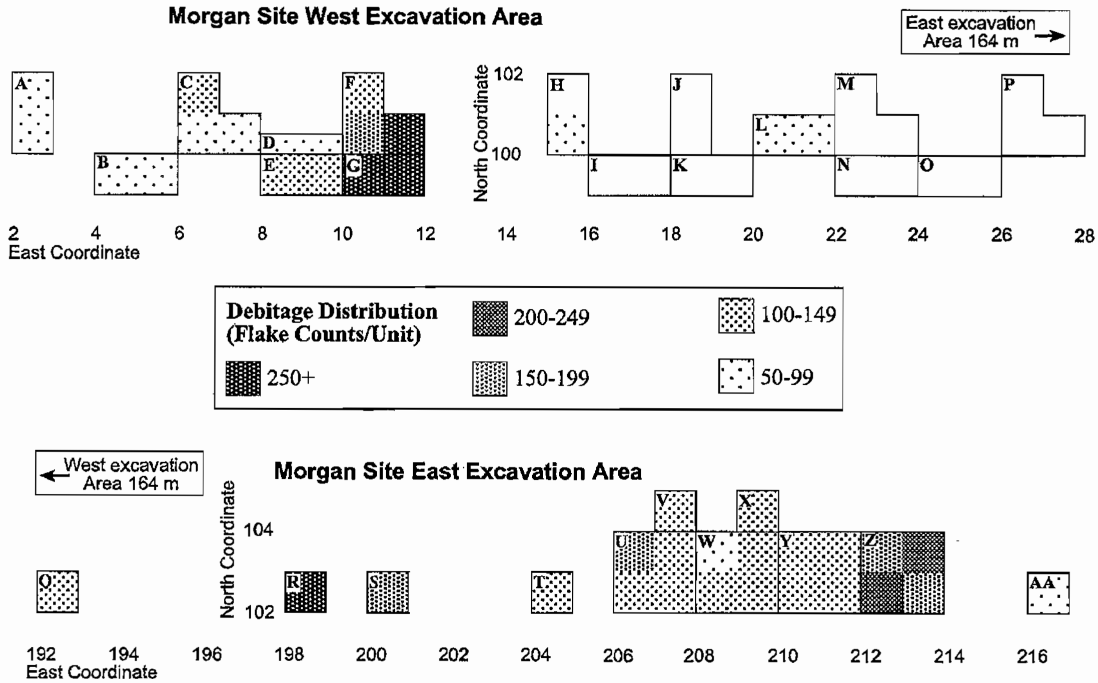

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Figure 3.12. Debitage distributions at the Morgan site.

Although there is evidence that an earlier and later component may exist at the East Locus, a study of the below-surface levels of debitage which underwent obsidian hydration analysis indicated considerable mixing of the deposits had occurred. For instance, Level 3 of Unit U produced two flakes with band measurements of 3.0 and 6.3 microns respectively, and Level 9 yielded two flakes with measurements of 5.6 and 3.2 microns respectively. When viewed in terms of the entire sample, the overall hydration results are quite telling. However, the debitage from earlier and later components is probably too mixed for suitable comparisons.

Table 3.5. Mass analysis of Morgan site obsidian debitage.

	Screen Size														
Unit	G1...(1")			G2....(1/2")			G3.......(1/4")			G4.....(1/8")			Totals		
	Ct.	Wt. (g)	Ctx	Ct.	Wt. (g)	Ctx	Ct.	Wt. (g)	Ctx.	Ct.	Wt. (g)	Ctx.	Ct.	Wt. (g)	Ctx.
A	1	10.78	0	8	26.11	1	24	10.04	0	62	3.53	0	95	50.46	1
B	1	20.22	0	8	23.23	0	15	6.73	0	88	3.95	0	112	54.13	0
C	0	0	0	17	51.5	2	34	12.64	2	61	3.16	0	112	67.3	4
D	1	19.41	1	8	17.3	1	14	5.23	1	81	3.93	1	104	45.87	4
E	1	65.09	1	8	45.15	2	29	7.57	2	171	7.71	0	209	125.52	5
F	0	0	0	24	55.5	1	82	33.15	6	393	15.02	6	499	103.67	13
G	1	14.36	1	16	41.01	7	60	23.31	2	334	13.35	2	411	92.03	12
H	0	0	0	13	39.35	4	27	11.33	3	74	3.18	0	114	53.86	7
I	0	0	0	1	1.33	0	16	4.72	0	27	1.43	0	44	7.48	0
J	0	0	0	6	9.52	1	13	5.03	1	23	0.91	0	42	15.46	2
K	1	43.15	0	3	8.81	1	10	2.93	1	21	0.69	0	35	55.58	2
L	0	0	0	9	23.52	0	18	7.93	2	99	4.45	2	126	35.9	4
M	0	0	0	6	21.67	0	24	6.83	0	49	1.84	0	79	30.34	0
N	1	19.87	1	5	36.21	2	14	10.49	3	34	1.46	1	54	68.03	7
O	0	0	0	1	2.73	0	16	4.53	0	35	1.39	1	52	8.65	1
P	0	0	0	7	14.26	1	28	15.47	5	68	3.62	0	103	33.35	6
Q	0	0	0	1	2.09	0	18	4.94	1	96	3.79	1	115	10.82	2
R	0	0	0	4	14.89	1	19	6.55	0	206	6.33	1	229	27.77	2
S	2	14.91	1	8	18.71	2	14	6.35	0	133	4.35	1	157	44.32	4
T	0	0	0	5	9.7	1	21	8.67	3	83	3.95	3	109	22.32	7
U	0	0	0	4	9.11	1	71	19.88	3	383	15.48	0	458	44.47	4
V	0	0	0	6	15.17	0	17	6.01	0	76	3.22	1	99	24.4	1
W	0	0	0	17	39.1	3	95	32.24	7	343	14.35	6	455	85.69	16
X	0	0	0	0	0	0	10	3.59	2	82	3.61	1	92	7.2	3
Y	2	53.93	2	21	43.19	2	71	21.95	9	347	15.19	4	441	134.26	17
Z	1	12.5	0	17	33.11	5	110	36.25	12	553	19.77	1	681	101.63	18
AA	0	0	0	4	8.01	0	12	4.06	1	65	2.65	0	81	14.72	1
Totals	12	274.22	7	227	610.28	38	882	318.42	66	3987	162.31	32	5108	1365.52	14
Weight/flake		22.85			2.7			0.36			0.04				
Percent	0.2	20.1	5.0	4.4	44.7	26.6	17.3	23.3	46.2	78.1	11.9	22.4			

Ground Stone Tools

A total of 18 ground stone tools were collected at the Morgan site, accounting for 16% of the tool assemblage (Table 3.6). The abundance of ground stone is one the most distinctive features of the Morgan site. In comparison, ground stone accounted for only 6 % of the tools at both the Hoyt and Hines sites.

The tools included 13 manos (68%), three metate fragments (16%), two abraders (11%), and one unidentified cylindrical tool fragment (5%). Eleven of the artifacts (58%) have substantial use wear in the form of well-polished grinding surfaces. Seven of the tools exhibit additional workmanship in the forms of multi-faceted, well shaped grinding surfaces on the manos, and pecked, symmetrical edges associated with flat, polished grinding surfaces on two of the three metates. The abundance and quality of the ground stone at the Morgan site may reflect periodic occupations of the camp for activities requiring the intensive use of milling stones; perhaps for either root or seed processing.

Seven complete manos were recovered from the Morgan site. The three manos from Unit G have already been described as Feature 2 above. An additional three manos (963-2423-SF2, 977-23-C-C-15-1, and 977-23-P-D-9-1) exhibited bifacial grinding surfaces, and like the manos from Feature 2, had edges shaped by pecking (Figure3.14). Specimen 963-2423-SF2 is a large mano with a unifacial grinding surface stained by reddish and gray materials along its leading edge. The gray staining appears as a discoloration of the worked surface that dissipates without a clear boundary. The reddish material has a granular texture and occupies a small, well defined area of the grinding surface, overlapping a portion of the gray staining.

Two edge fragments and one interior fragment of metates were collected. Specimen 977-23-P-A-11-2 was from a bifacial milling stone with an apparently symmetrical, rounded rim (Figure 3.13). Specimen 963-2423-TP2-3-2, another bifacial metate fragment, had a squared edge that was quite symmetrical. The interior fragment (977-23-Y-C-7-1) appears to be from a second bifacial metate, and one side has been worn concave through use.

Table 3.6. Metric attributes of ground stone from the Morgan site, in millimeters.

Catalog #	Type	L	W	Th	Wt	Notes
			West Locus			
963-2423-SF1*	mano (bifacial)	110.5	77.3	45.7	683.6g	-
963-2423-SF2*	mano (unifacial)	125.1	100.8	69.0	1180.6g	red/gray staining
963-2423-TP2-3-1	mano (trifacial)	60.9	57.4	51.4	223.8g	-
963-2423-TP2-3-2	metate frag.	86.8	61.1	40.6	308.7g	pecked edge
977-23-C-C-15-1	mano (bifacial)	89.4	79.6	43.4	401.5g	-
977-23-D-B-8-1*	abrader	47.6	33.0	25.0	35.8g	-
977-23-G-A-10-1*	abrader	58.6	40.3	31.8	38.6g	-
977-23-G-B-9-1*	mano (trifacial)	88.3	62.0	64.0	452.6g	-
977-23-G-B-9-2*	mano (bifacial)	76.9	69.2	35.7	277.5g	-
977-23-G-B-9-3*	mano (unifacial)	68.5	61.9	46.1	278.4g	-
977-23-H-D-6-1	mano frag.	16.6	46.0	42.8	28.3g	-
977-23-L-D-11-1	cylindrical frag.	33.0	26.0	25.5	39.3g	-
977-23-P-A-11-2	metate frag.	130.5	87.6	35.4	485.0g	pecked rim
977-23-P-D-9-1*	mano (bifacial)	116.5	92.3	34.2	553.6g	-
			East Locus			
Late Component						
977-23-X-D-6-1	mano (unifacial)	52.1	85.0	39.0	184.7g	-
Early Component						
977-23-W-B-8-1	mano frag.	32.7	57.9	55.2	135.9g	-
977-23-W-B-8-2	mano (unifacial)	57.5	75.7	45.1	148.6g	in 3 fragments
977-23-Y-C-5-1	mano edge frag.	9.9	47.7	29.8	10.0g	-
977-23-Y-C-7-1	metate frag.	76.8	53.5	64.5	349.9g	dished surface

* = complete artifact

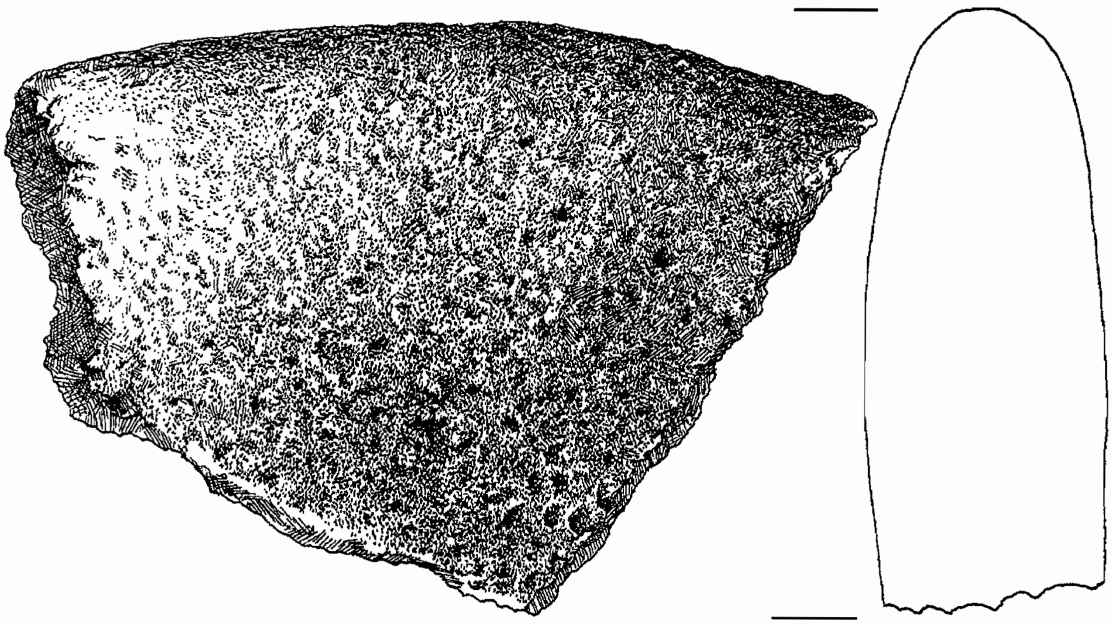


Figure 3.13. Specimen 977-23-P-A-11-2.

The two abraders are relatively small, oval stones, each having one surface that is flattened by wear. Specimen 977-23-G-A-10-1, made of welded tuff, is the only ground stone tool not made of basalt at the site. Both tools show minimal use.

Specimen 977-23-L-D-11-1 is the mid-section of an almost completely cylindrical artifact which may be a pestle (Figure 3.14). The artifact varies between 25.5 to 26 mm in diameter, and is made from very fine grained pinkish-colored rhyolite. The portion of the artifact originally resting against the ground has developed a thin calcium carbonate crust. Two shallow, possibly natural grooves are almost opposite of each other on the sides of the cylinder.

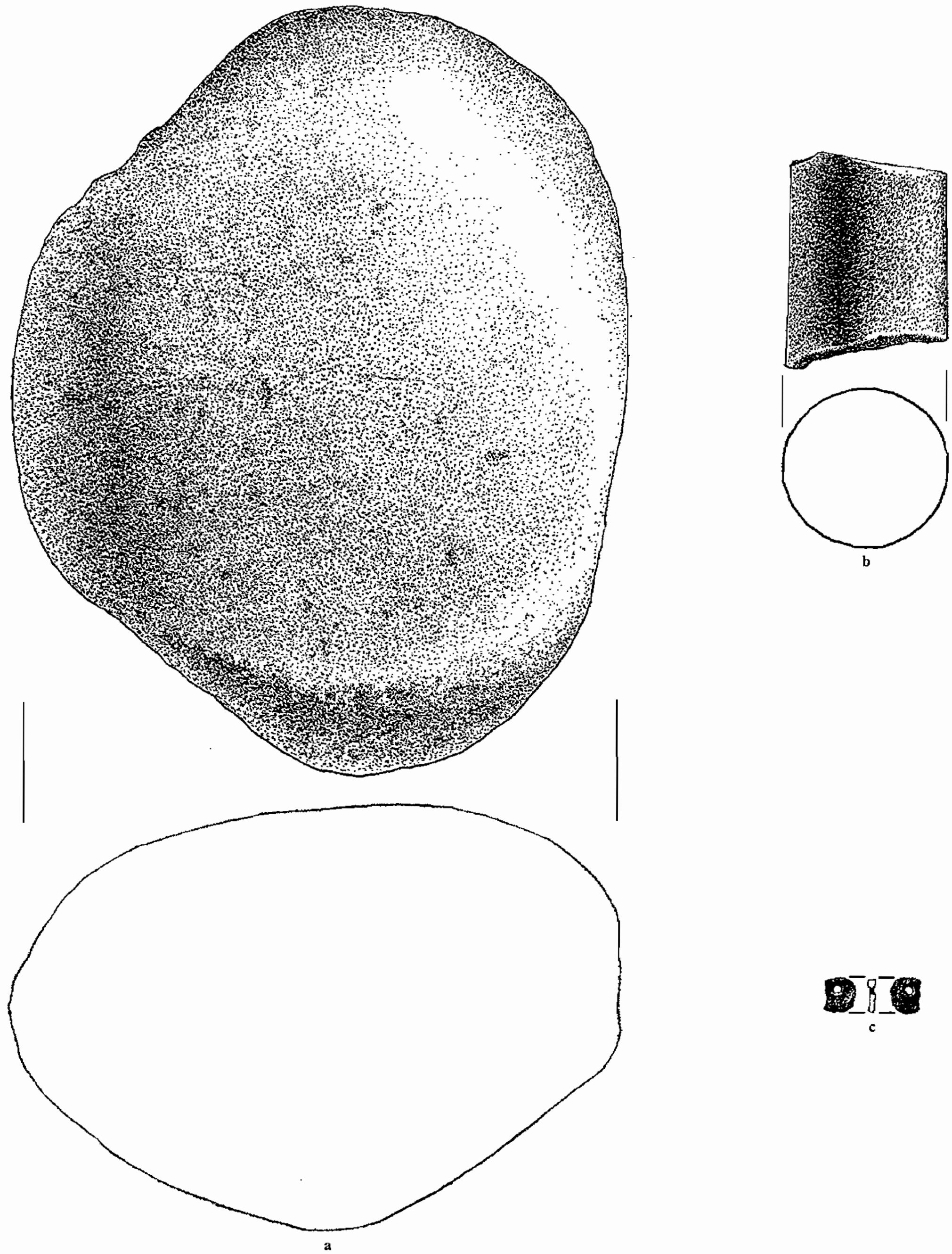


Figure 3.14. a) Mano 963-2423-SF2; b) pestle 977-23-L-D-11-1; c) stone bead 963-2423-P1-2.

Miscellaneous Lithic Artifacts

Stone Bead

A single stone disc bead (963-2423-P1-2) was recovered from a depth of 10-20 cm in Probe 1 during the testing phase (Figure 3.14). The bead has a generally oval shape, excepting a portion which has been broken from one side above the perforation. The type of stone that was used in its manufacture has not been identified. The artifact is 5.5 mm long, by 4.8 mm wide (the broken side), by 0.9 mm thick. The biconically drilled hole is approximately 1.7 mm in diameter. Probe 1 was located on the south side of the highway, in an area where artifact concentrations were minimal and excavations were not pursued beyond the testing phase. Elston et al. (1993:33) reported two stone disc beads from 35HA2222, a site on the west edge of Malheur Lake. One was manufactured from a "schist-like" material and the other from sandstone. Raymond (1994:77) noted a stone disc bead at Harney Dune, on the east side of Harney Lake. No radiocarbon dates were assayed on the cultural components at either site.

Hammer Stones

Two artifacts from the Morgan site appear to be hammerstones. They were collected in Unit F, quad D, less than two meters from Feature 1. Both are large cobbles with one or more surfaces that show evidence of abrading, chipping, and battering possibly related to lithic reduction or plant and animal processing activities. Specimens 977-23-F-D-11-1 (CCS) and 977-23-F-D-11-2 (basalt) were found in close association and may be related to a specific activity area located near Feature 1.

Choppers

One large, roughly half-moon shaped fragment of a CCS nodule (Specimen 977-23-G-D-2-1) exhibits flaking consistent with short term use as a chopping tool. The artifact essentially has four sides. The top and bottom are planar surfaces of the exposed nodule interior, and one side is a wide, straight band of the interior rock with sharply angled edges. The fourth side is a thick, rounded band of cortex. One of the long edges shows light percussion flaking that was most likely caused by chopping activity with an up and down motion of the hand. The other straight edge has a high degree of edge rounding that may also be associated with use wear.

Faunal Remains

Faunal remains from the Morgan site were analyzed by Vivien Singer of the Oregon State Museum of Anthropology. A total of 3010 vertebrate remains and five pieces of eggshell were identified (Figure 3.15), utilizing the comparative collection housed at the Museum and the comparative bird collection at the offices of Heritage Research Associates in Eugene. All faunal remains were identified to the lowest possible taxanomic level. Some of the mammalian remains were identifiable only to broad size classes due to their highly fragmented state (see Table 3.7). Singer categorized all postcranial rodent remains as "Unidentified Rodentia" because of the difficult, labor intensive nature of identifying an abundance of small rodent remains to a variety of similar species. The specimens were quantified through the use of the number of identifiable specimens per taxon (NISP) as described in Grayson (1984) and taxonomic designations are based on Corbet and Hill (1991). The specimens were examined further for cultural evidence of burning and/or butchering and skinning marks, and natural alterations caused by rodent and carnivore gnawmarks, weathering, and natural attrition. Such evidence may provide information about both the taphonomic history of the remains and possible subsistence practices of the occupants at the site.

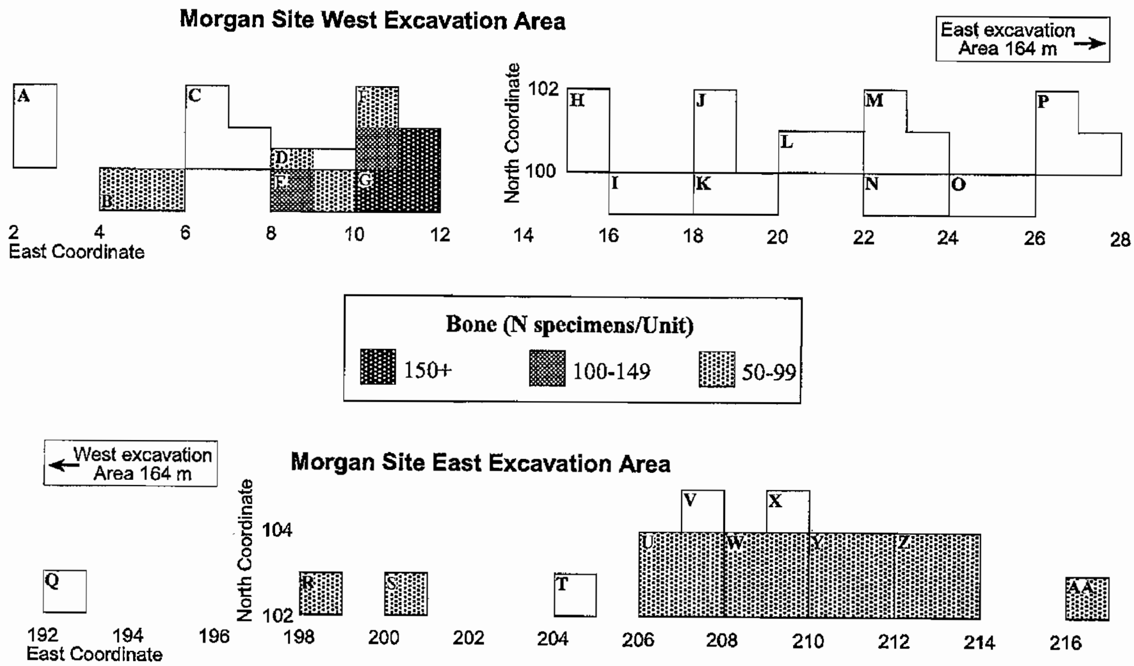


Figure 3.15. Animal bone distributions at the Morgan site.

Of the 3010 pieces of bone that were recovered, 71.7% (2160 pieces) were mammalian. Identifiable mammal bones represented seven genera from three orders which included Rodentia, Lagomorpha, and Carnivora. The most common taxon was Rodentia followed by Lagomorphs. Small rodents such as voles (*Microtus sp.*), pocket gophers (*Thomomys sp.*), and ground squirrels (*Spermophilus sp.*) were most abundant; a single marmot (*Marmota flaviventris)* tooth was the only evidence of larger rodents at the site other than lagomorphs. Lagomorphs recovered from the site included Pygmy Rabbits (*Syvilagus idahoensis*), Black-tailed Jackrabbits (*Lepus californicus*) and possibly White-tailed Jackrabbits. Lepus remains included adult and infant (possibly fetal) remains. A single canid bone was identified from the site. Artiodactyl remains were not specifically identified at the site, but 45 fragments (1.5%) were categorized as Class 5, which includes deer and antelope. One of the Class 5 bones was cut with a saw, indicating that it was probably of recent historic origin.

Table 3.7. Bone/animal size classes (modified after Thomas 1969 and Schmitt 1988).

Class/Level	Weight	Mammalian examples
1	<100 grams	mice, shrews
2	100-700 grams	squirrels, chipmunks, gophers
3	700 grams-5 kilograms	rabbits, hares, skunks
4	5-25 kilograms	coyote, bobcat
5	25-225 kilograms	deer, sheep, antelope
6	>225 kilograms	elk, horse, cow, bison
X		unidentifiable to size class

Bird remains accounted for 0.5% of the vertebrate assemblage. These included duck (*Anas sp.*), chicken (*Gallus gallus*), Great Horned Owl (*Bubo virginianus*), and Great Blue Heron (*Ardea herodias*), as well as a single passerine bone. Five fragments of eggshell were also collected at the Morgan site.

A total of 98 bones were from amphibians, including 53 that could be identified as Great Basin Spadefoot Toad (*Spea intermontana*). It is probable that most of the amphibian remains at the Hoyt site are the same.

Although much of the bone at the Morgan site was highly fragmented, it was noted that very little destruction of the actual bone structure had occurred, indicating that taphonomic processes at the site were limited. Singer found that the most of the whole bones at the site came from either rodents or amphibians, and these were probably attributable to natural deaths.

Burned or calcined bones accounted for 5.1% of the vertebrate assemblage (154 pieces). Of these, 65 (42.2%) were unidentifiable, 88 (57.1%) were mammalian, and one (0.6%) was leporid.

The distribution of various classes of animal remains was examined to identify possible patterns of use at the Morgan site (Fig. 3.3). Leporid and other rodent bones were common throughout the West and East Loci along with a general category of Class 3 mammalian remains. No fish remains were recovered at the Morgan site. Avian and large mammal remains were collected only from the areas of greatest occupational intensity. Bird remains and Class 5 mammalian remains were found in Units C-G surrounding Feature 1 in the West Locus, and Class 5 remains came from Units U, W, and Y of the east Locus where Features 3 and 4 were located. Bird bones were recovered from a depth of 15 to 45 cm in Unit C, and 10 to 55 cm in Unit D of the West Locus. Only four bird bones were identified at the East Locus. Class 5 bones were recovered from 20 to 80 cm in depth in Unit F, and 20-50 cm in depth in Unit G at the West Locus. Large mammal bone was found at a depth of 15 to 30 cm in Unit U, and 20 to 40 cm below the surface in Unit W of the East Locus. Two fragments were recovered 10 to 15 cm in depth from Unit Y. The large mammal bone appears to be associated with the late component in Unit U, and with the early component in Units W and Y.

The highest concentrations of bone at the Morgan site occurred in Unit G and Quad D of Unit F, where the total amount of bone per quadrant exceeded 150 pieces (Figure 3.7). Bone counts at the East Locus never surpassed 50 pieces per quadrant.

For the most part, the varieties and quantities of animal remains were quite similar between the Early and Late Component at the East Locus. Lepus (Hare) remains are the one exception, with 62 of the 63 specimens (98%) having been recovered from the Late Component. Verts and Carroway (1998) note that, while Black-tailed Jackrabbits (*Lepus californicus*) can be found in a variety of environments, they commonly inhabit locations which provide a combination of open grasslands for night time foraging and dense cover (such as *Artemesia tridentata*) for daytime refuge. The possible inclusion of recent bone in the sample may account for some of the increase in Lepus remains, but it seems evident that the area became more attractive to Lepus populations late in the Holocene.

In summary, the faunal assemblage at the Morgan site suggests that a variety of small mammal species (particularly rodents and lagomorphs) were being taken during all periods of occupation even if the possible presence of modern bone and naturally deposited remains are taken into account. Fish were not a component in the diet of the inhabitants at any time, and bird remains were very limited. Seasonal indicators included five pieces of eggshell and the presence of immature leporid specimens, which may be indicative of late spring to early summer use.

Table 3.8. Inventory of faunal remains recovered from the Morgan site.

Taxon	Common Name	Component: West Locus Early NISP	Early %	West Locus Late NISP	Late %	East Locus NISP	East Locus %	Non Locus NISP	Non Locus %	Totals NISP	Totals %
Mammalia											
Rodentia											
Spermophilus sp.	Ground Squirrel	12	0.8	2	0.3	5	0.6	-	-	190	0.6
Thomomys sp.	Pocket Gopher	19	1.2	3	0.5	4	0.5	-	-	26	0.9
Microtus sp.	Voles	15	1.0	3	0.5	2	0.2	-	-	20	0.7
Marmota flaviventris	Yellowbelly Marmot	1	0.1	-	-	-	-	-	-	1	0.0
Unident. Rodentia	Rodents(small-sized)	101	6.5	41	6.6	42	5.0	-	-	184	6.1
Carnivora											
Canis sp.	Coyotes, Dogs	1	0.1	-	-	-	-	-	-	1	0.0
Lagomorpha											
Lepus sp.	Hares	19	1.2	1	0.2	62	7.5	5	26.3	87	2.9
Syvilagus idahoensis	Pygmy Rabbit	3	0.2	2	0.3	1	0.1	1	5.3	7	0.2
Leporidae	Rabbits and Hares	21	1.4	7	1.1	12	1.5	-	-	40	1.3
Class I		2	0.1	-	-	-	-	-	-	2	0.1
Class II		3	0.2	-	-	1	0.1	-	-	4	0.1
Class III		39	2.5	9	1.5	8	1.0	2	10.5	58	1.9
Class IV		-	-	-	-	-	-	-	-	-	-
Class V		30	1.9	3	0.5	12	1.5	-	-	45	1.5
Class VI		-	-	-	-	-	-	-	-	-	-
Class X	Unident. Mammal	844	54.5	364	59.0	448	54.2	10	52.6	1666	55.3
Aves											
Anseriformes											
Anas sp.	Surface ducks	-	-	-	-	1	0.1	-	-	2	0.1
Anatidae(duck-sized)	Ducks, Geese, Swans	-	-	1	0.2	-	-	-	-	1	0.0
Ciconiiformes											
Ardea herodias	Great Blue Heron	1	0.1	-	-	-	-	-	-	1	0.0
Galliformes											
Gallus gallus	Domestic chicken	10	0.6	-	-	-	-	-	-	10	0.6
Strigiformes											
Bubo virginianus	Great Horned Owl	-	-	-	-	1	0.1	-	-	1	0.0
Passeriformes	Perching birds	-	-	-	-	-	-	1	5.3	1	0.0
Amphibia											
	G.B. Spadefoot	49	3.2	2	0.3	2	0.2	-	-	53	1.8
Anura	Frogs and Toads	36	2.3	4	0.6	5	0.6	-	-	45	1.5
Unidentifiable bone		339	21.9	177	29.0	220	26.6	-	-	736	24.4
Egg Shell		3	0.2	1	0.2	1	0.1	-	-	5	0.2
Totals		1548(51.3%)		62O (20.6%)		827	(27.4%)	19 (0.6%)		3014	

Botanical Remains

Paleoethnobotanical studies were conducted by Guy Prouty of the Oregon State Museum of Anthropology (Prouty 1996). Prouty found that archaeobotanical remains were very limited at the Morgan site, with only 0.72 gram of carbonized plant material recovered from both the West and East Loci combined.

At the West Locus, soil samples from Feature 1 yielded sagebrush wood fuel, two unidentified seed fragments, one fragment that may be processed edible tissue (PET), and possibly a fragment of a camas bulb (Table 3.9). Many of the plant remains were very small, deteriorated, and distorted, making clear identifications difficult. No evidence for camas ovens was noted at the Morgan site. The quantity of sagebrush wood fuel in Feature 1 increased with depth between 45-55 cm below the surface. A comparative sample taken from Unit E yielded only sagebrush fuel.

Soil samples were also analyzed from Features 3 and 4 at the East Locus. A trace of sagebrush was noted in the stained soil above Feature 3, increasing between 25-55 cm below the surface. Sagebrush was the only botanical material recovered from Feature 3. A comparative sample obtained near Feature 3 produced a small amount of sagebrush wood fuel, an unidentified charred seed, and another charred seed that may be Wigeon grass. Prouty (1996) reported that wigeon grass is a wetland variety, and further noted that despite a lack of ethnographic evidence for its use, grass seeds in general were always an important food resource.

Feature 4 soil samples yielded primarily sagebrush which increased in depth between 35-50 cm below the surface. The deepest sample, which was derived from the bottom of the hearth produced sagebrush wood fuel, juniper wood fuel, and a fragment of PET that may be camas.

Table 3.9. Botanical remains at the Morgan site.

Unit	Description	Flot. Volume	Carbon Wt. (Grams)	Taxa
West Locus				
E, Quad A Level 9/10	non-feature, comparative	1000	0.01	sagebrush wood fuel-0.01
E, Quad B	Feature 1, hearth	825	trace	sagebrush-trace unidentified seed-trace
G, Quad A Level 10	Feature 1	1000	0.07	camas-possible trace sagebrush-0.07
G, Quad A Level 11	Feature 1	1000	0.10	processed edible tissue?-trace sagebrush-0.10 unidentified seed-trace
		East Locus		
W, Quad B Level 3	charcoal st. above Feature 3	825	trace	sagebrush-trace
X, Quad D Level 5	Feature 3 hearth	1000	0.04	sagebrush-0.04
X, Quad D Level 6	Feature 3	825	0.10	sagebrush-0.10
X, Quad D Level 10	Feature 3	825	0.10	sagebrush-0.10
X, Quad D Level 11	Feature 3	800	0.11	sagebrush-0.11
U, Quad A Level 9	non-feature comp. sample	1000	trace	sagebrush-trace unidentified seed-trace Widgeon grass?-trace
U, Quad C Level 7	Feature 4 hearth	1000	0.02	sagebrush-0.02
U, Quad C Level 8	Feature 4	1000	0.05	sagebrush-0.05
U, Quad D Level 10	Feature 4	1000	0.09	Juniper-0.01 processed edible tissue-0.02 sagebrush-0.07

Summary

The Morgan site, about 11 kilometers east of the Hines site and 3/4 kilometer west of the Hoyt site, is located on the south slope of Sand Hill, a promontory that projects southward onto the Harney Basin floor overlooking the marshlands surrounding Poison Creek Slough. The site was topographically divided into two loci, an upper locus to the west which overlooks the marshland, and a lower one to the east that is tucked into a sheltered fold of Sand Hill. Cultural features in the West Locus included a hearth that was radiocarbon dated to 950 BP and a ground stone cluster located less than a meter to the east of the hearth. Two hearths were identified in the East Locus, one radiocarbon dated to 760 BP, the other to 1170 BP. The three dates appear to be associated with occupations occuring at the site between approximately 4000 years ago (based on the presence of Northern Side-notched points) and perhaps after 700 BP or later. The deposits in the West Locus were heavily disturbed by the excavation of cable trenches during two different episodes in the past. The East Locus was not disturbed.

A total of 15 diagnostic projectile points was recovered at the Morgan site, of which 7% were Cottonwood Triangular, 20% were Rose Spring, 20% were Eastgate, 33% were Elko series, and 20% were Large Side-notched. The high proportion of Elko and Large Side-notched points suggests that the site's first occupations may have occurred several millenia earlier than is indicated by the dated hearths. Eastgate and Elko Corner-notched points were found near each other throughout the site. Unfortunately, these associated points either originated from unknown obsidian sources or were not sourced. Rosegate points were of obsidian from Burns Butte and nearby Dog Hill, located approximately 10 kilometers to the northwest. Elko Series and Northern Side-notched points originated from several sources to the north, east, and south of the site. Edge-modified flakes comprised the largest category of tools at the site, at 40%. Formed tools (including projectile points and bifaces) accounted for 34%, ground stone 16%, cores 6%, hammerstones 4%, and a single stone disc bead was recovered as well.

The faunal assemblage at the Morgan site appear to reflect a marshland/grassland environmental setting. A total of 3010 bones were recovered from the site, of which the most abundant taxon was Rodentia, composing 8% of the total assemblage, followed by Lagomorphs at 4%. The difficulty of separating cultural from intrusive rodent remains may have affected these results. Large mammal bones accounted for 1.5% of the total assemblage, probably originating from Artiodactyls but not identifiable as such. Avian remains (including waterfowl) represented only 0.5% of the total. No fish remains were recovered at the Morgan site, and eggshell accounted for 0.1% of the assemblage.

The paleoethnobotanical evidence from the Morgan site was very limited. Sagebrush, probably used as fuel, was the dominant charred plant material in the cultural deposits. The 950 year old hearth contained small amounts of sagebrush charcoal and what may be a fragment of a charred camas bulb, although camas ovens were not identified at the site. The 1170 year old hearth yielded sagebrush charcoal, the only juniper charcoal found at the site, and another PET fragment that may be camas. The 760 year old hearth contained only sagebrush charcoal. Although there were several charred seed fragments found in the assemblage, none of these were identifiable. It does appear that seed harvesting and processing were important at the site, however, considering the relatively high quantities of ground stone at the site and its location adjacent to what once was a broad, marshy plain where a variety of floral resources could have been obtained.

Obsidian hydration analysis was conducted on 56 Burns Butte and Dog Hill artifacts, which comprised the two major sources for obsidian artifacts at the site. Hydration measurements revealed that two distinct occupation episodes probably occurred at the site. They consist of a late component associated with the 1170 BP radiocarbon date in the East Locus and with the 760 BP and 950 BP dates in West Locus, and an early component that is not represented by radiocarbon dates. The projectile point typologies – including both arrow points and dart points of earlier types - support this contention in both vertical associations and hydration measurements, and two peaks in measured artifacts occurred at 4.5 and 5.5 microns respectively.

In sum, the Morgan site appears to have been a multiple occupation site used both before 4000 BP and again between 1200 to 700 BP. Lithic reduction occurred at the site and it was also used as a temporary camp for processing marsh and grassland resources and for hunting small game. Although botanical evidence is limited, the presence of an abundance of ground stone (in excess of 16%) suggests that plant procurement and processing was a significant aspect of the site usage.

CHAPTER IV
HOYT SITE (35HA2422)

Data recovery excavations at the Hoyt site occurred in August of 1995. The site is located on Sand Hill, about 10 km from the community of Burns, Oregon, and approximately 800 feet east of the Morgan site. The excavations were guided by a data recovery plan developed for both the Hoyt and Morgan sites after testing took place in March of 1995 (Jenkins and Connolly 1995). Both backhoe trenches and manual unit excavations were employed to better understand the geomorphic and archaeological characteristics of the site. It was recommended in the data recovery plan that 65 m² of site deposits should be excavated at two locations; the North Locus and the South Locus, as they will be referred to in the following report. The two loci were established on both sides of the east-west bound highway at locations where peak quantities of cultural materials were recovered during the testing phase. The total area excavated was 89 m², resulting in the removal of 52.3 m³ of fill. From this, 329 tools, 92,152 pieces of debitage, and 16,797 pieces of bone were recovered.

Excavation Strategies

Testing

Test excavations at the the site included two 1 x 1 m test pits and 47 50 x 50 cm test probes placed 10 m apart, parallel to the highway (Jenkins 1997). Probes 1-23 were located on the south side of the highway and Probes 24-47 were north of the highway (Fig.4.1). Test Pit 1 was placed between Probes 1 and 2, where debitage and bone counts were among the highest on the south side of the highway. Test Pit 1 debitage counts reached a maximum of 368 flakes in Level 3 (3680/m³). The largest quantity of bone was 77 pieces collected from Level 5, at a depth of 40-50 cm. One utilized flake was also taken from Level 5 of Test Pit 1. Test Pit 2 was placed between Probes 42 and 43 due to the presence of high quantities of debitage and bone (including fish bone), along with the recovery of a biface from Probe 42 and a drill and Rose

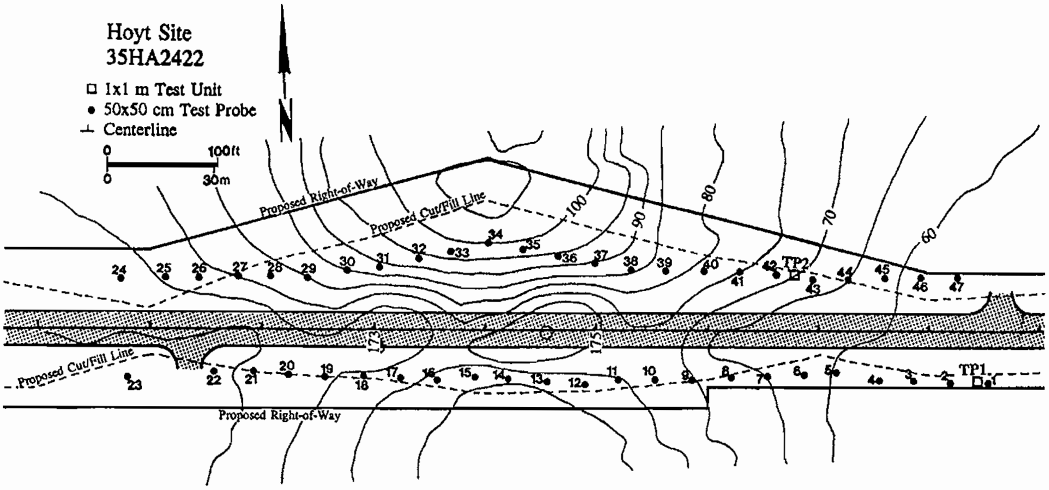


Figure 4.1. Locations of probes and test units at the Hoyt site.

Spring point base from Probe 43. Test Pit 2 produced 444 flakes in Level 6 (4440/m^3), with a peak count of 26 bone fragments in Level 7. Test Pit 2 also yielded a Rose Spring point from Level 3 (20-30 cm below the surface), another Rose Spring point in Level 4, an Elko point in Level 7 and a biface fragment in Level 8. The high counts of cultural materials confirmed that the test pits were situated at the most appropriate locations for the establishment of excavation blocks on the north and south sides of the highway.

Other temporally diagnostic artifacts from the testing phase included Rose Spring (4), Elko (2), and Northern Side-notched (1) projectile points, all made of obsidian (Jenkins and Connolly 1995). The Northern Side-notched point and one of the Elko points came from the south side of the highway, the others from the north side. The artifacts suggested that occupations in the site vicinity probably spanned the last 4000 years, at least. Temporally non-diagnostic tools included one expanding base drill, three projectile point fragments, three biface fragments, a metate fragment, three cores, a hammer stone, and 12 utilized flakes. Also recovered were burned and unburned faunal remains that included a variety of both large and small mammals with birds, fish and eggshell in much smaller quantities. Fire altered rock was noted but not collected. Observed flakes represented a range of lithic reduction activities, from small biface-thinning flakes to fragments of raw nodules with cortex.

Data Recovery

Data recovery excavations at the Hoyt site were confined to two 10 meter wide strips of land on the north and south sides of Highway 20. Excavations at the North Locus were established in a linear pattern running 18 m east to west alongside the highway. Excavations at the South Locus included five contiguous 2x2 m units and an isolated unit nearby (Figure 4.2). The Hoyt site was originally at least 3.5 acres in size. Earlier highway construction eliminated approximately 30% of the site and a sand mine located to the north destroyed an unknown portion (Jenkins and Connolly 1995). According to local sources, at least one human burial was disturbed by sand mining activities. The Hoyt site is located on the slope of Sand Hill, with the North Locus occupying a higher elevation setting than the South Locus (Figure 4.3). There is a decline of six meters in elevation from the westernmost unit in the North Locus to the easternmost unit in the South Locus; a distance of 54 m.

In addition to examining wall profiles in excavation units, a single trench (MD-1) was hand-excavated to assess the geomorphological relationships of cultural and non-cultural deposits

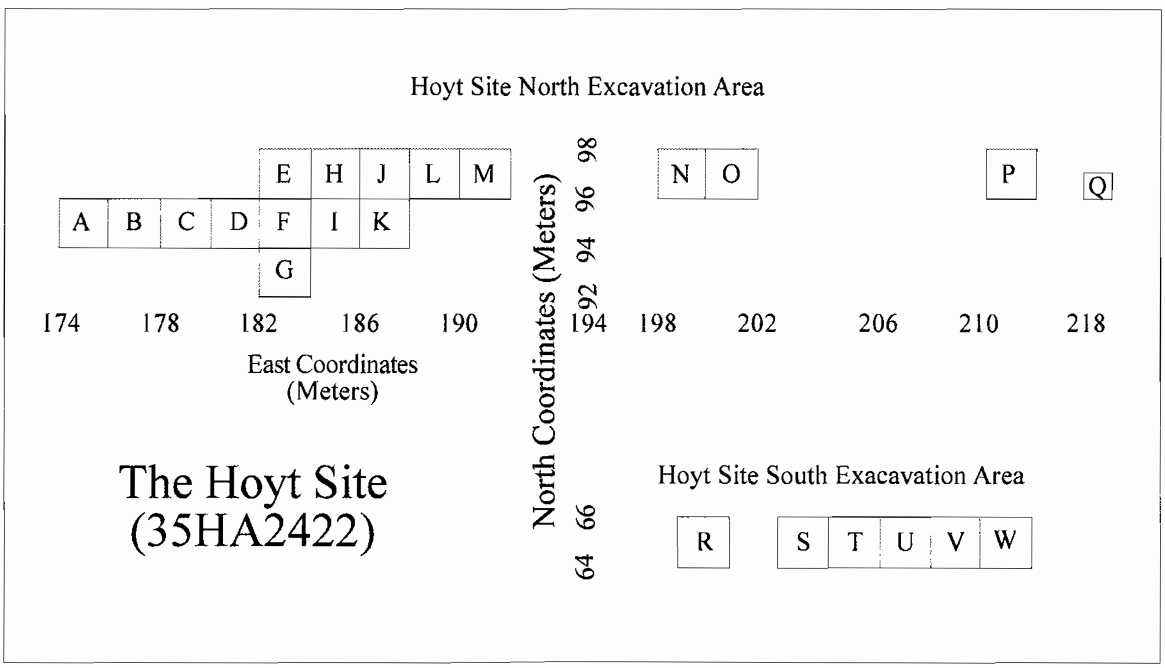


Figure 4.2. Plan view of data recovery excavation units at the Hoyt site.

Figure 4.3. The Hoyt site North Locus, facing eastward.

at the site. The trench was situated south of Unit B in the North Block, at a location adjacent to the road cut made by construction of the highway.

Prior to excavation, an arbitrary datum was established on a point from which a grid system could be created for the entire site. Using a Topcon GTS-203 total station, coordinates for the datum were set at 100N/100E, then the individual excavation units were tied into the overall grid system. The fortuitous location of a nearby U.S.G.S. benchmark allowed the use of actual, rather than arbitrary elevations during the excavation process. Unit coordinates have been replaced by letter designations for this report. Individual elevation datums were shot in for the excavation units and vertical control was maintained by the use of level lines attached to the datum stakes.

The total area excavated included 65 m^2 at the North Locus and 24 m^2 at the South Locus. Excavation units were expanded or terminated depending on the quantities of cultural materials collected during the data recovery process. Excavations were carried out following the natural topography of the landscape. Fill was removed in 5 cm increments. The results of the data recovery efforts at each locus are discussed below.

North Locus

One 1x1 and sixteen 2x2 meter units represent the extent of data recovery in the North Locus. These units have been given the letter designations A-Q for the purposes of this report. A series of five adjoining units was initially established near the location of Test Pit 2 (TP2) on the west (upslope) end of the Northern Locus and an additional four units were placed at locations of interest downslope to the east. As it became apparent that the excavations at the west end were of greater integrity and higher productivity, efforts became more focused at that locale. The west block ultimately grew to include a total of thirteen 2 x 2s.

Although excavators attained a depth of 1.2 m in one unit, the average depth of the excavations was 80 cm. Artifacts were most concentrated in Levels 5-16 of the block excavation; spanning approximately 60 cm of fill (Tables 4.1 and 4.3). Individual units had artifact concentrations ranging between 25-40 cm in thickness. Units not associated with the block excavation (downslope) showed less consistency in artifact concentrations, with cultural materials dispersed from the surface to approximately 65 cm in depth, and artifact concentrations ranging between 10-35 cm in thickness.

The upper stratigraphic layer at the site consists of a light grayish-brown silty sand, primarily of eolian origin, continuing to a depth of 25-40 cm below the surface (Figure 4.4). Underlying this silty deposit is a compacted deposit of dark grayish-brown silty sands with an increased content of small gravels. This layer is the primary source of cultural deposits at the site and the fill can range in thickness from 25-80 cm. Underlying this is a transitional zone where the lower portion of the cultural material-bearing deposit meets a zone of weathering sandstone bedrock, with occasional ventifacted cobbles from earlier surface deposits that are primarily volcanic in origin. At the juncture between these strata, the fill becomes a light tannish-gray sand mixed with small to medium sized sandstone cobbles. As the excavators approached bedrock, larger cobbles and slabs of sandstone marked the exfoliating rind of the underlying bedrock. The sandstone appears to be lacustrine in origin. Where the bedrock surface was found intact, it was pocked with vents created through the bioturbation of animals burrowing into the Pliocene/Pleistocene lake bed.

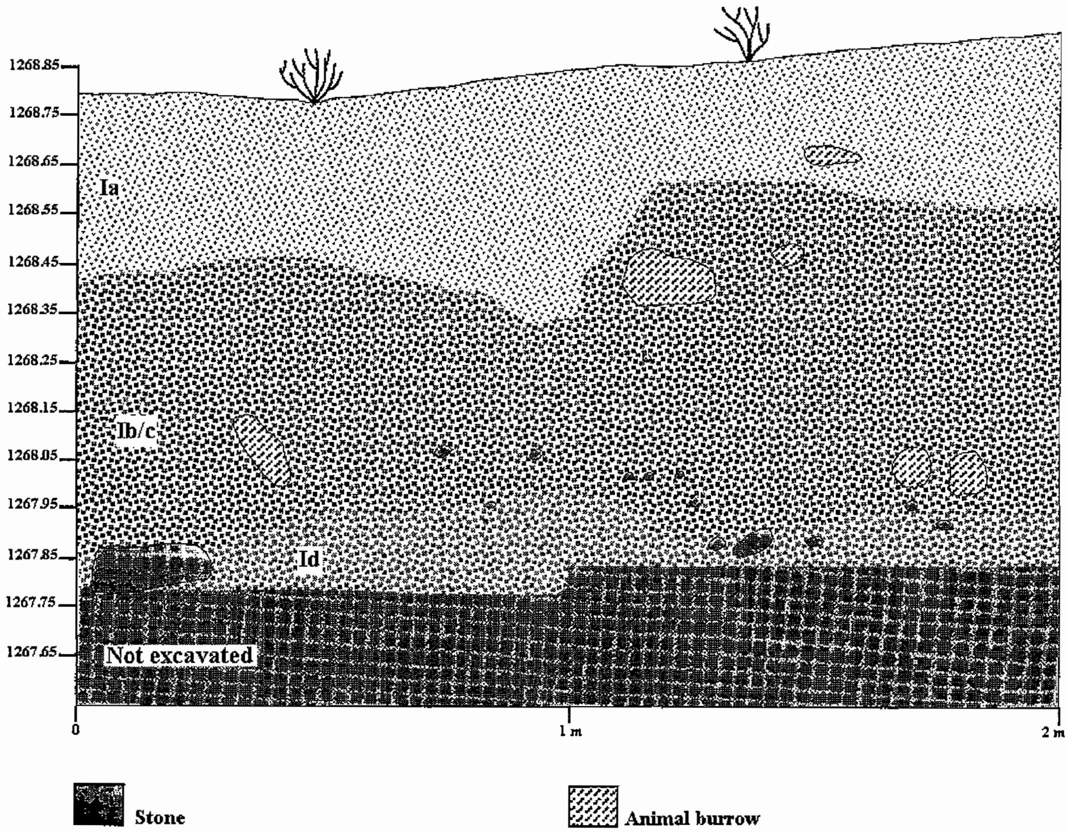


Figure 4.4. Hoyt site profile, north Locus, Unit E, west wall.

Legend

Ia – Light gray – brown coarse Aeolian sand, numerous roots and rootlets. Few cultural materials, extensively disturbed.

Ib/c – Compact dark gray – brown silty sands with some decomposed bedrock fragments.

Primary cultural deposit.

Id – Light grayish – tan decomposed bedrock with >5% angular to subangular gravels.

Table 4.1. Artifact distributions in the North Locus, Hoyt site.

	Unit									
Variety	A	B	C	D	E	F	G	H	I	J
<u>Chipped Stone</u>:										
Projectile Points										
Rose Spring	1	-	-	-	-	1	-	-	-	1
Eastgate	-	-	-	-	-	-	-	-	-	-
Elko Eared	-	-	-	-	-	-	-	-	1	-
Elko CN	1	-	-	-	-	-	1	-	-	1
CS-2	-	-	-	1	1	-	-	-	-	-
CS-3	-	-	-	-	-	-	-	-	-	-
CS-4	-	-	-	-	-	-	1	-	-	-
ES-4	-	-	-	-	-	-	-	-	1	-
Side- notched	-	-	-	-	-	-	-	-	1	-
Northern SN	-	-	-	-	-	-	1	1	-	-
Proj. Point Fragments										
Tips	1	2	1	1	2	-	-	1	2	3
Tangs/Stems	-	-	-	-	2	1	1	-	-	-
Bases	-	-	-	-	-	-	-	-	-	-
Other Tools										
Drills	-	-	-	-	1	-	-	-	-	-
Bifaces	1	2	7	1	5	5	-	4	3	2
Cores	2	1	-	2	2	-	-	-	1	2
Core and Flake	1	-	-	1	-	-	2	1	-	-
Util. Flakes	6	6	9	7	7	8	9	10	5	3
Debitage	5544	4446	4958	5992	5142	4466	2628	4849	4737	3910
<u>Ground stone</u>:										
Metates	-	-	-	-	1	-	-	-	-	-
Metate Frags	-	-	-	-	-	-	-	2	2	-
Manos	-	-	-	-	-	-	-	1	-	-
Mano Frags	-	-	-	1	-	1	-	-	-	-
Pestles	1	-	-	-	-	-	-	-	-	-
Fragments	-	-	-	1	-	-	-	2	-	-
Abraders	-	-	-	-	-	-	-	-	-	2
Atlatl weight	-	-	-	-	-	1	-	-	-	-
<u>Bone</u>:										
Tools	1	-	-	1	-	-	-	-	-	-
Fragments	826	775	1509	1381	1107	957	508	917	909	626

Table 4.1 (continued). Artifact distributions in the North Locus, Hoyt site.

	Unit										
	K	L	M	N	O	P	Q	Probes	TP-2	Surface	Total
<u>Chipped Stone</u>:											
Projectile Points											
Rose Spring	-	-	1	-	-	1	-	-	1	-	7
Eastgate	-	1	-	-	-	-	-	-	1	-	2
Elko Eared	-	-	-	-	1	-	-	-	-	-	2
Elko CN	-	-	-	-	-	-	-	-	1	1	5
CS-2	-	-	-	-	1	-	-	-	-	1	4
CS-3	1	-	-	-	-	-	-	-	-	-	1
ES-4	-	-	-	-	-	-	-	-	-	-	1
Humboldt	-	1	-	-	-	-	-	-	-	-	1
NSN	-	-	-	-	1	-	-	-	-	-	3
Small SN	-	-	1	-	1	-	-	-	-	-	2
Proj. Point Fragments											
Tips	-	-	-	1	-	-	-	-	-	-	14
Tangs/stems	-	-	-	-	-	-	-	-	-	-	4
Bases	-	-	-	-	-	-	-	1	-	-	1
Other Tools											
Drills	-	-	1	1	-	1	-	2	1	1	7
Bifaces	2	1	4	1	2	1	-	2	2	1	48
Cores	-	4	-	3	1	-	-	1	-	-	19
Core and Flake	-	-	-	-	-	-	-	-	-	2	7
Util. Flakes	1	6	6	4	1	4	-	-	-	-	92
Debitage	4261	3828	3757	2410	2202	2383	631	2706	-	-	68,850
<u>Groundstone</u>:											
Metates	-	-	-	-	-	-	-	-	-	1	2
Metate frags	1	-	-	-	-	-	-	-	-	-	5
Manos	-	1	-	-	-	-	-	-	-	-	2
Mano Frags	1	-	-	-	-	-	-	-	-	1	3
Pestles	-	-	-	-	-	-	-	-	-	-	1
Fragments	-	-	-	-	-	-	-	-	-	-	3
Abraders	1	-	-	-	-	-	-	-	-	-	3
Atlatl Weights	-	-	-	-	-	-	-	-	-	-	1
<u>Bone</u>:											
Tools	-	-	-	-	-	-	-	-	-	-	2
Fragments	852	266	575	327	346	385	59	-	-	-	12,325

Connolly (see Appendix) identified a single cultural component for the Hoyt site, based on a statistical analysis of hydration band thicknesses in obsidian artifacts from both the North and South Loci. Occupations at the site are best represented by materials recovered from the North Locus, where the majority of the cultural materials were collected. Artifacts recovered at the

North Locus included 242 tools in a variety of categories, 68,850 pieces of debitage, and 12,325 fragments of bone. Diagnostic projectile points included Rose Spring (5), Eastgate (2), Elko Eared (2), Elko Corner-Notched (4), Contracting Stem-2 (3), Contracting Stem-3 (1), Expanding Stem-3 (1), Humboldt (1), and Northern Side-notched (4). This point assemblage suggests that occupations at the locality may have occurred over the last 4000 years at least. It is intriguing that five (22%) of the 23 tools from this assemblage can be more easily attributed to the Plateau classifications of Contracting Stem and Expanding Stem points than to Great Basin typologies.

Most of the cultural materials were collected in Units A-I, where unit totals ranged between 2628 and 5992 flakes of debitage, and 508 to 1509 bones. However, the debitage and bone counts are elevated in different areas of the excavation block (see Figs. 4.11 and 4.14), possibly suggesting that activity areas were somewhat spatially defined at the North Locus.

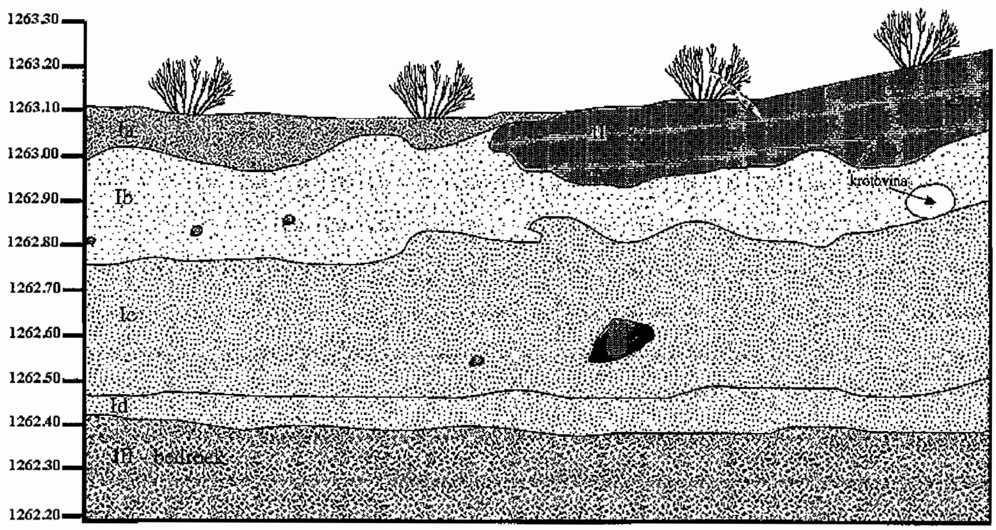
South Locus

The South Locus at the Hoyt site was across Highway 20 from the North Locus, and lower in elevation than either the North Locus or the roadbed (Tables 4.2 and 4.3, Figures. 4.2 and 4.5). The surface had been altered to varying degrees (depending on unit location) by the periodic grading and removal of vegetation and debris from the highway edge, as well as by slopewash, and continual deposition of road gravel, glass, metal, plastic and other materials from highway traffic. Testing on the south side of the highway consisted of 23 50 x 50 cm probes established at 10 m intervals running east to west, and one test pit adjacent to Probe 1. Testing produced 2661 pieces of debitage, 276 pieces of bone, a utilized flake, a scraper, and two diagnostic points including a Northern Side-notched and an Elko Corner-notched. More than half of the debitage (1397 flakes) and bone (173 pieces) came from Test Pit 1. Of the cultural materials collected from the probes, 62% of the debitage (789 flakes) and 81% of the bone (83 pieces) were collected from Probes 1-4.

Figure 4.5. The Hoyt site South Locus, facing westward.

Data recovery excavations at the South Locus consisted of six 2 x 2s (Units R-W), arranged in a linear pattern running west to east. Unit R was located two meters west of the other five adjoining 2 x 2s (Units S-W). Probe 1 from the testing phase was located in Quad D of Unit W, and TP-1 was in the center of Unit V. The entire data recovery operation at the South Locus occurred between Probes 1-3 from the testing phase, where peak concentrations of cultural materials were found on the south side of the highway.

A layer of loose, grayish-brown silty sands occupied the first 15-20 cm of deposits over the entire South Locus (Figure 4.6). The surface layer was followed by more compact, light grayish-brown sands ranging in thickness between 15-25 cm, which varied in gravel content from 5-40%. This fill contained an abundance of cultural materials. The fill became lighter in color, sandier, and laden with gravel to cobble-sized rocks which were sub-angular to angular in shape below 25 cm. This cobble-laden fill averaged approximately 30 cm in thickness and contained the primary cultural deposits.. The material below the cobble-filled layer varied considerably, with patches of an orange colored clay material, crusts of calcium carbonate, or bedrock appearing in the lowest levels of excavation at the locus. Although there was a limited coherence to the deposits, it was apparent that much of the stratigraphic sequence was disturbed by both human and rodent activities. Historic debris was found in the first 30 cm of all units in the South Locus,



Ia – Grayish-brown fine grained Aeolian sand. Few cultural materials.
Ib – Light gray – brown coarse grained sand with slope washed gravels. Some roots and rootlets. Abundant cultural material.
Ic – Light brown-gray fine grained sand with few gravels, few rootlets. Primary cultural deposits.
Id – Very light brown-gray fine sand, decomposing in place from underlying bedrock. Few cultural materials.
II – Very light cream colored overburden deposited by ODOT, gravels, roots, decomposing lake bed sand and silts. Abundant prehistoric and historic artifacts.
III – Cream colored sandstone bedrock covered with calcium carbonate crust, very soft.

Figure 4.6. Hoyt site, South Locus, Unit S, east wall profile.

Table 4.2. Artifact distributions in the South Locus, Hoyt site.

	Unit									
	R	S	T	U	V	W	P-5	P-16	Other	Total Probes
Chipped Stone:										
Projectile Points										
Elko Eared	-	1	-	-	-	-	-	-	-	1
Elko CN	-	-	-	-	-	-	-	1	-	1
Northern SN	-	-	-	-	-	-	1	-	-	1
Proj. Point Fragments										
Tips	-	1	1	-	-	-	-	-	1	3
Midsections	1	-	-	-	-	-	-	-	-	1
Other Tools:										
Bifaces	2	2	3	2	2	1	-	-	1	13
Cores	-	-	-	1	-	3	1	-	-	5
Util. Flakes	4	8	3	5	1	6	-	-	10	37
Debitage	5851	4569	3019	3878	3764	4927	82	7	2447	28,544
Ground stone:										
Metate Frags	-	1	-	-	-	-	-	-	-	1
Bone:										
Tools	1	-	-	-	-	-	-	-	-	1
Fragments	1081	1068	575	597	784	804	-	-	295	5204

Table 4.3. Vertical distribution of tools Recovered from the Hoyt site, by level*.

	Unit																				
Lev.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	W
1	-	-	St 2 St 3	-	-	-	-	-	-	-	-	-	-	-	-	St 3	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	RS	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	core	-	drl	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	drl	core	EE CS-2	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	St 1	mid	-	tip	-	-
7	tip	-	-	-	-	-	cr/fl	St 3	-	abrd	-	-	RS St 1	drill	-	-	-	-	St 3	St 4	-	core
8	cr/fl	St 1	St 4	cr/fl	-	St 2	-	gs gs	RS St 3	-	abrd St 3 mte	-	St 2	-	-	-	-	bntl St 4	tip	-	-	core
9	bntl St 3	-	-	-	-	RS	cr/fl	mte	SN mte	tip abdr	-	-	-	St 4 tip	SSN	-	-	-	St 3	St 1 St 3	-	core
10	core	-	St 4	tip	St 1 core mte	-	-	cr/fl mte	EE St 4 mte	RS	St 1	mano	SSN St 1 St 2	core core	core	-	-	-	-	-	-	St 4
11	pstl	-	-	CS2 core core mano	-	St 3	ECN ES3	tip	-	core	mano	core core	-	-	-	-	-	-	-	EE	St 4	-
12	-	-	-	gs	St 4 St 4	St 2	NSN	NSN St 1	St 4 tip	ECN St 4	CS3	core	-	-	NSN St 1 St 2	-	-	St 2	mte	-	-	-
13	RS	tip	-	-	CS2 St 3 tip tang	St 2 mano	-	St 3	UNK St 3	-	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	St 3 St 3 Tip	-	St 3 core tip	-	tang	St 2	core tip	-	-	St 1	HUM-		-	-	-	-	-	-	St 4	-
15	-	core	St 1	-	tang	at wt St 2 tang	-	mano-		tip	-	core	-	-	-	-	-	-	-	-	core	-
16	core	-	-	-	-	-	-	-	-	core	-	-	EG	-	-	-	-	-	-	-	-	-
17	-	tip	-	-	awl	-	-	-	-	tip	-	-	-	-	-	-	-	-	-	-	-	-
18	RS		-	-	bn tl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	-	-	-	-	St 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22	-	St 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Key:
Bifaces: St 1, St 2, St 3, St 4 (reduction stage 1, 2, 3, and 4)
Projectile point fragments: tip, tang, mid(section)
Ground stone: mano, mte=metate, abdr=abrader, gs=ground stone fragment, at wt=atlatl weight
Other tools: cr/fl=core/flake tool, bn tl=bone tool
Projectile points:
RS=Rose Spring
EG=Eastgate
EE=Elko Eared
ECN=Elko Corner-notches
NSN=Northern Side-notched
HUM=Humboldt
CS=Contracting Stem
ES=Expanding Stem
UNK=Unknown
SN=Side-notched
SSN=Small Side-notched
* This table does not include tools found in probes, test units, or surface finds.

and as deep as 60 cm in Units R, S and W. Because the disturbance was so pronounced, Units T,U,V and W had the top 30 cm of fill shoveled off to reach less churned deposits.

A total of 26,008 pieces of debitage (between 3019 and 5851 pieces per unit) and 4454 pieces of bone (517 to 1068 pieces per unit) was recovered at the South Locus (Table 4.1). Also collected were 18 formed tools, two pieces of ground stone, 45 utilized flakes, two cores, and one bone tool. A single Elko Eared projectile point from Level 11 (50-55 cm) of Unit S was the only temporally diagnostic tool found at the locus during data recovery. This artifact, along with the Northern Side-notched and Elko Eared points found during testing, suggest a middle Holocene period of occupation at the locus. Unfortunately, the high degree of site disturbance makes radiocarbon dates at this locus questionable.

Features

Two cultural features were unearthed at the Hoyt site. Feature 1 was located in Unit E of the North Locus (Figure 4.7). Feature 2 was located in Unit T of the South Locus.

Figure 4.7. Feature 1: A metate, its working surface stained with charcoal

Feature 1 consisted of a basalt metate surrounded by a sandy fill containing high concentrations of charcoal, which may have been a shallow hearth (Figure 4.7). The feature was located in the south portion of Quad D, Unit E between Levels 7 - 9, at an elevation of 1268.07-1268.18 m. A fire-cracked rock fragment was located 50 cm northeast of the metate, in Quad D. The triangular-shaped metate, measuring 34.2 cm in length, 33.7 cm in width, and 11.6 cm in thickness, was found with the faceted side upright. The working surface was darkened by charcoal staining, but the margins surrounding the faceted area were much lighter in color, providing a clear contrast between used and unused surfaces. Fill recovered from the possible hearth was analyzed for evidence of paleo-ethnobotanical remains by Guy Prouty. The analysis yielded high quantities of "...sagebrush wood fuel, ...a trace of unidentified bark, and ...two unidentified grass seed fragments..." (Prouty 1996:18). The metate was located roughly in the center of the principal occupation area at the site, identified during the course of excavations. The area includes high concentrations of debitage, bone, and a variety of artifacts which are outlined in detail below.

Feature 2 consisted of a circular charcoal stain, 25 cm in length by 20 cm in width, located in Quad B of Unit T. The stained earth was encountered approximately 40 cm below the surface, between 1262.67-1262.71 meters in elevation. The feature was not radiocarbon dated. Paleoethnobotanical analysis of the feature revealed the presence of small amounts of sagebrush wood fuel, five unidentified seed fragments, and questionable evidence of processed edible tissue fragments (Prouty 1996:19).

Radiocarbon Dates

The Hoyt site yielded two radiocarbon dates, both of which were accelerator mass spectrometry assays (AMS) on charcoal collected from units in the North Block (Table 4.4). Because of the high degree of disturbance noted in the South Locus, no radiocarbon assays were attempted there. Specimen 977-22-E-D-7-F1 was a charcoal sample collected from Feature 1, (Level 7 of Unit E) in the area where a large metate was recovered in association with a possible hearth. The charcoal was collected *in situ* from fill surrounding the metate found at an elevation of 1268.11 meters (approximately 35 cm below the surface). The sample of sagebrush charcoal returned an AMS radiocarbon date of 1890±60 BP (Beta-88082), calibrated to ca. 1830 BP.

Specimen 977-22-C-C-14 was a small, composite charcoal sample collected in Level 14 of Unit C, at an elevation of 1268.25 meters (approximately 70 cm below the surface). The sample was collected in an area where two utilized flakes, a CCS biface fragment, fire-cracked rock, and an abundance of burned bone was noted. An AMS radiocarbon date of 220±60 BP was returned on the material, calibrated to 280 BP at the one sigma level. The date is not consistent with the 1830 BP date from Feature 1, which is much earlier, but much higher in the deposits. There were no diagnostic artifacts found in direct association with the material dated to 280 BP. Variable deflation and deposition episodes on the hillside where the site is located may have contributed to the burial of late-dating materials under deeper deposits than those covering the 1830 BP sample. It seems more likely that the late date is anomalous, probably due to intrusive rodent activity.

Table 4.4. Radiocarbon dates from the Hoyt site.

Lab. #	Radiocarbon date	Dendrocalibrated Years Ago	Material
Beta-88082 AMS-LL	1890±60 BP	1879(1825)1727 BP	composite charcoal (0.4g)
Beta-88083 AMS-LL	220±60 BP	303(284)0 BP	composite charcoal (0.2g)

AMS-LL = Accelerator mass spectrometry-Lawrence Livermore Laboratories

Artifact Assemblage

Chipped Stone

This category includes all of the flaked stone tools recovered during excavations at the Hoyt site. Bifacial tools have been subdivided into two categories; shaped and unshaped bifaces. Shaped specimens show evidence of having been reduced through percussion and pressure flaking to a distinct form, such as oval or leaf-shaped preforms (among others), or further into typologically defined tools such as projectile points. The shaped bifacial tools have been classified according to the system based on five stages of manufacture that was employed by Jenkins and Connolly (1990) for Indian Grade Spring, and also used for the Morgan and Hines sites. Unshaped bifaces have bifacial modification of at least one edge of a flake, but have not been further worked into a more defined shape.

Unifacial tools are those which exhibit edge modification to a single side of the flake, generally with a clear pattern of wear from extensive use. Scrapers and notched spokeshaves fall into this category, reflecting use at an angle transverse to the material being processed (Jenkins and Connolly 1990). Edge-modified flakes are those which have been applied to expedient cutting and scraping tasks. They exhibit wear patterns reflective of systematic use, but have not been purposefully shaped or modified for use other than by the activity to which they were applied. Research has shown that trampling of lithic materials can produce patterns of flaking similar to what has been seen on utilized flakes (Mc Brearty et al. 1998), so only those flakes with uniform patterns of nibbling along the edges have been considered for this analysis.

Projectile Points

A total of 32 diagnostic projectile points were recovered from the Hoyt site. Of these, 28 were manufactured from obsidian, two from basalt and two from CCS (Table 4.5, Figure 4.8). The projectile points have been classified according to the system established by Thomas (1981) for the Great Basin region of central Nevada, with consideration given to Columbia Plateau typological sequences proposed by Dumond and Minor (1983). Researchers have suggested

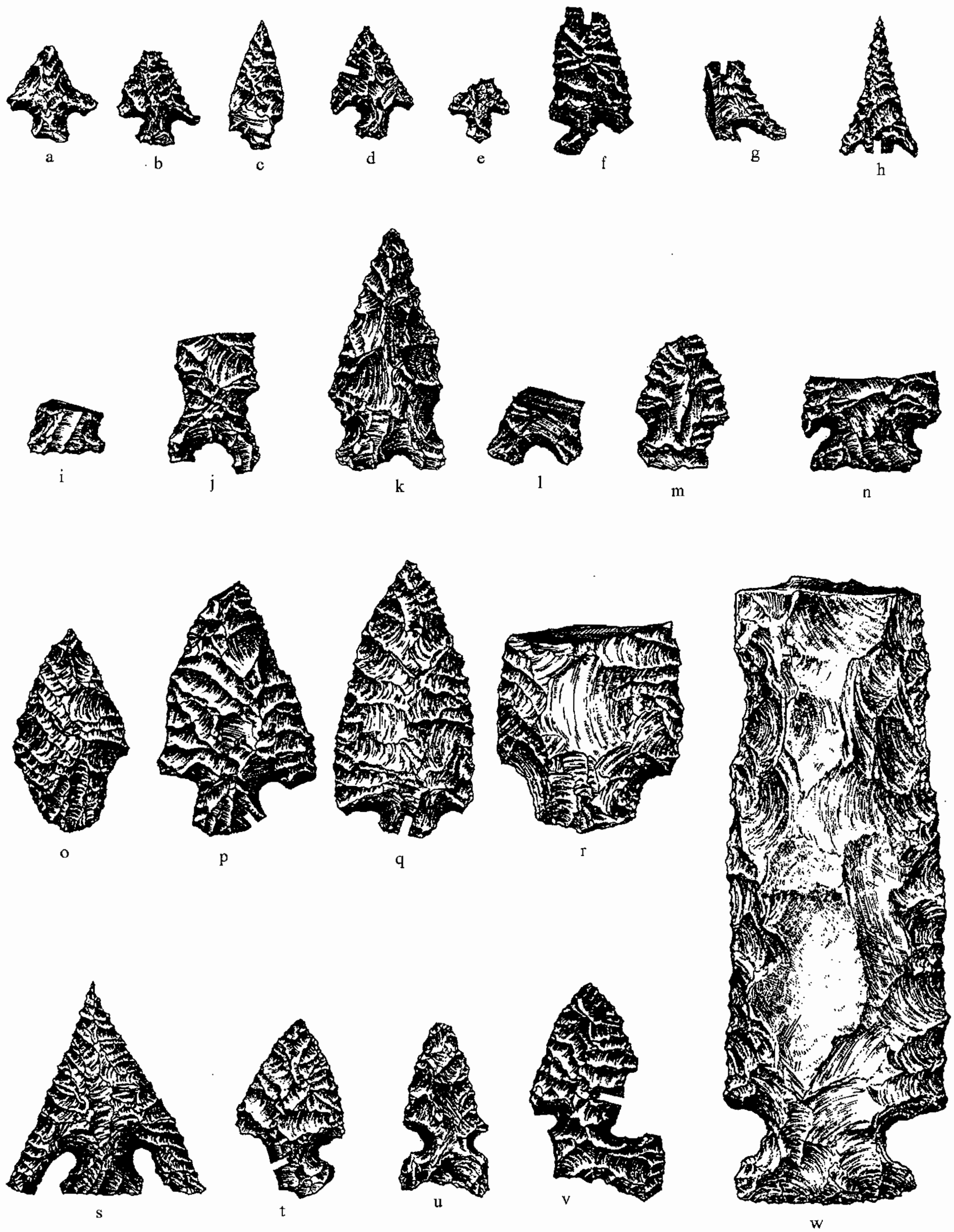


Figure 4.8. Projectile points from the Hoyt site: Rose Spring, a-f; Eastgate, g-h; Elko Series, i-n; CS-2, o-q; CS-3, r; ES-4, s; Small side-notched, t; Large side-notched, u-w (a. 977-22-Ad-13-1;b. 977-22-Fa-9-1; c. 977-22-Jc-10-1; d. 977-22-Mc-7-1; e. 977-22-Pa-3-1; f. 963-2422-TP2-4-1; g. 977-22-La-16-1; h. 963-2422-TP2-3-1; 1. 977-22-Ad-18-1; j. 977-22-Ic-10-1; k. 977-22-Od-5-1; l. 977-22-Sb-11-1; m. 977-22-Gc-11-2; n. 977-22-Jc-12-1; o. 977-22-Db-11-2; p. 977-22-Oa-5-1; q. 977-22-Ec-13-1; r. 977-22-Kb-12-1; s. 977-22-Gc-11-1; t. 977-22-Ma-10-1;u. 977-22-Oa-9-1; v. 977-22-Ha-12-2; w. 977-22-Oc-12-1).

possible cultural associations between Northern Great Basin region and Columbia Plateau populations based on the lengthy archaeological record of occupations in the basin and a possible late arrival of Numic speakers into the area (Aikens 1985; Aikens and Witherspoon 1986; Connolly 1999). The Klamath and Modoc tribes are both linguistically and culturally tied to the Columbia Plateau. They currently occupy areas adjacent to the northern Great Basin, and may have inhabited portions of the Harney Valley in the past (Kelly 1932:186). For these reasons, and the fact that artifacts are occasionally seen in the Northern Great Basin which suggest connections to Plateau cultures, Plateau typologies need to be considered when Harney Basin projectile points are being analyzed.

Obsidian was the principal material used for manufacturing projectile points at the Hoyt site. Only two diagnostic points were made of CCS and two from basalt. The projectile points include two Eastgate (6%), seven Rose Spring (22%), three Elko Eared (9%), five Elko Corner-notched (16%), one Humboldt Concave Base (3%), four Northern Side-notched points (13%), two small side-notched points (6%), and one indeterminate side-notched point base (3%). Three point types were designated in Plateau terminology, including one Expanding Stem-3 (3%), four Contracting Stem-2 points (13%) and one Contracting Stem-3 (3%). An additional large, notched point fragment could not be identified with certainty as either side-notched or corner-notched.

Temporal associations between these artifact types and radiocarbon dated features across Northern Great Basin archaeological sites generally suggest that the Hoyt site may have been occupied over the past four thousand years or more. Elko, Humboldt, Contracting Stem-2, Expanding Stem-3, and Northern Side-notched points were designed for use with the atlatl, or throwing stick. Rose Spring and Eastgate points were manufactured for use with the bow and arrow, which probably did not arrive in the region until sometime after 1900 BP (Wegener 1998:17). The high numbers of dart points (18) in relation to arrow points (8) in the Hoyt assemblage seems to indicate that the site was occupied before and after the arrival of bow and arrow technology, but with greater intensity prior to that time.

Rosegate Series Points. A total of nine projectile points collected at the Hoyt site can be classified under the Great Basin Rosegate typology. They are characterized by their small size (weight <1.5 grams), expanding stems, and a basal width less than 10 mm (Thomas 1981:19). The Rosegate class of projectile points can also be placed in the Expanding Stem 1 and Expanding Stem 2 categories proposed by Dumond and Minor (1983) for the Plateau. Rose Spring and Eastgate projectile point types are treated separately in this report (see the Rosegate section in the Hines chapter for a brief explanation).

Two Eastgate points were recovered from the North Locus of the Hoyt site. The Eastgate points are vertically separated through the cultural deposits, with one specimen (963-2422-TP2-3-1) occurring between 20-30 cm in Test Pit 2 (Units F and G), and one in Level 16 (75-80 cm) in Unit L (977-22-L-A-16-1). Neither of the points are directly associated with features, but both occur near the locations where the highest amounts of debitage and bone were identified. The Eastgate collected from Unit L was made from Whitewater Ridge obsidian and the point in Test Pit 2 was from the Burns obsidian source.

Seven Rose Spring projectile points were also collected from the North Locus of the Hoyt site, occurring between 15 and 65 cm in depth. Six of these points were recovered from the block excavation at the North Locus, including four that came out of units surrounding Feature 1 (963-2422-TP2-3-1, 977-22-F-A-9-1, 977-22-I-D-8-1, and 977-22-J-C-10-1). One point came from Unit P, at the eastern end of the North Locus (977-22-P-A-3-1). Rose Spring projectiles from the Hoyt site represent five obsidian sources, two of which are currently unidentified. The three identified sources are Burns, Dog Hill, and Wolf Creek, all of which are located to the north and west of the Hoyt site.

Elko Series Points. There were eight Elko Series points collected from the Hoyt site; three Elko Eared and five Elko Corner-notched. All eight can be categorized as Elko points based on the classification system established by Thomas (1981). Under Dumond and Minor's (1983:171) Plateau classification system, the corner-notched points would be considered Side Notched-5, and the eared points would be ESI-2, ESI-3, or ESI-4 (Expanding Stem, Indented).

Table 4.5. Projectile point attributes: Hoyt site.

Type	Catalog No. 963-2422 or (977-22)	Length (mm)	Width (mm)	Thickness (mm)	Wt. (Gr.)	Base Width	Neck Width	Source
				North Locus				
EG	TP2-3-1(T)	22.8	12.6	2.7	0.3	12.6	5.0	B
RS	TP2-4-1(T)	24.5	13.8	2.7	0.9	-	4.8	DH
ECN	TP2-7-1(T)	21.8	16.5	6.3	2.0	16.5	10.6	-
ECN	A-B-18-1	85.0	13.0	4.1	0.4	13.0	-	-
RS	A-D-13-1	16.8(C)	15.2	4.3	0.7	6.3	5.5	UNK
CS-2	D-B-11-2	34.6(C)	19.1	6.3	3.6	10.1	15.4	DH
CS-2	E-C-13-1	46.8(C)	23.1	6.6	6.4	9.2	10.3	DH
RS	F-A-9-1	16.2(C)	14.3	3.3	0.5	6.9	4.9	WC
ES-3	G-C-11-1	35.9(C)	33.2	5.8	3.5	13.9	9.9	UNK-A
NSN	G-C-12-1	15.2	29.2	6.4	2.6	29.2	17.7	-
ECN	G-C-11-2	23.7	14.5	5.0	1.6	-	10.7	B
NSN	H-A-12-2	33.5	19.0	4.0	2.4	-	8.6	B
SN	I-C-9-1	9.1	13.0	5.6	0.4	13.0	8.4	CCS
EE	I-C-10-1	24.4	14.9	4.8	1.9	15.9	10.8	UNK-A
RS	I-D-8-1	18.0	12.3	2.0	0.4	7.0	6.1	-
?	J-B-13-1	31.7	26.3	6.0	5.8	17.1	-	BAS
RS	J-C-10-1	21.4	8.9	2.3	0.4	-	6.0	UNK-B
ECN	J-C-12-1	16.3	22.8	4.9	2.0	18.8	14.4	BTY
CS-3	K-B-12-1	35.1	30.5	6.2	8.0	17.4	20.0	WWR
EG	L-A-16-1	14.9	11.8	3.2	0.4	-	-	WWR
HUM	L-C-14-1	22.9	21.2	6.8	4.2	21.2	-	-
RS	M-C-7-1	19.6(C)	14.0	2.8	0.5	5.7	4.9	B
SSN	M-A-10-1	29.9	18.0	4.4	1.9	-	9.1	B
CS-2	O-A-5-1	43.5(C)	25.5	5.8	6.0	10.8	9.6	B
SSN	O-A-9-1	27.3(C)	15.6	4.4	1.6	15.8	9.1	UNK
NSN	O-C-12-1	107.6	37.2	11.2	57.8	31.0	21.0	BAS
EE	O-D-5-1	41.3(C)	18.7	7.2	5.4	18.8	14.6	CCS
RS	P-A-3-1	10.9(C)	9.4	1.9	0.1	3.8	3.6	-
				South Locus				
NSN	P5-1-1(T)	44.0	16.1	6.5	4.6	-	10.0	LBC
EE	S-B-11-1	13.7	15.8	5.1	0.9	15.8	11.3	-
				Surface				
CS-2	SF-5	37.3	20.4	6.1	4.8	12.3	12.0	-
ECN	SF-5(T)	20.6	13.8	5.2	1.4	13.2	-	-

RS=ROSE SPRING
EG=EASTGATE
ES-3=EXPANDING STEM 3
CS-2=CONTRACTING STEM 2
EE=ELKO EARED
ECN=ELKO CORNER-NOTCHED
HUM=HUMBOLDT
NSN=NORTHERN SIDE-NOTCHED

B=BURNS
BTY=BEATYS BUTTE
DH=DOG HILL
LBC=LITTLE BEAR CREEK
UNK=UNKNOWN SOURCES
WC=WOLF CREEK
WWR=WHITEWATER RIDGE
BAS=BASALT
CCS=CRYPTOCRYSTALLINE SILICATE

C=COMPLETE
T=TESTING PHASE

Elko Eared points are large, corner-notched dart points with a deeply indented base that, in conjunction with the corner-notching, form "ears" for hafting the projectile on to a dart shaft.The Elko Eared points found at the Hoyt site came from deposits occurring between 25 and 55 cm in depth. Elko Corner-notched points are similar in size, weight and overall morphology to Elko Eared points except that they lack the deep basal indentation that gives the eared appearance. Elko Corner-notched points primarily occurred 55 to 90 centimeters below the surface (cmbs), and one was surface collected during the testing phase. The widest portion of the projectile point in both varieties occurs across the tangs of the point above the neck. One Elko Eared point collected at the Hoyt site was made from CCS, the two additional Eared points and the five Corner-notched points were made of obsidian.

Two of the Elko Eared points were collected from the North Locus. A single Elko Eared point came from the South Locus. The only Elko Eared point analyzed geochemically was manufactured from "Unknown A" obsidian, meaning that obsidian from this source, still not identified on the ground, has appeared with enough frequency at archaeological sites to be recognized as a distinctive variety. All of the Elko Corner-notched projectile points were recovered from the North Locus. The Corner-notched points that were analyzed for their obsidian sources included one from the local Burns source and one from Beaty's Butte, approximately 135 kilometers to the south. One Elko Eared (977-22-I-C-10-1) and two Elko Corner-notched points (977-22-G-C-11-2 and 977-22-J-C-12-1) were collected from the most concentrated area of cultural materials at the North Locus; just east of Feature 1. These three tools were found at 45-60 cm depth, in association with ES-3, CS-2, and CS-3 points.

Expanding Stem - 4. Having no equivalent typological designation in the northern Great Basin, a single projectile point was more readily classifiable under the Expanding Stem-4 (ES-4) typology established for the Columbia Plateau by Dumond and Minor (1983). The ES-4 type is characterized by a neck width $\geq$ 10 mm, a stem length of 4-9 mm, a length of 28-58 mm, and a width of 19-38 mm (Dumond and Minor 1983:170). The length divided by width should be 1.2-2.0 mm, which is a condition not met by the Hoyt specimen. None the less, the Hoyt specimen meets the criteria for ES-4 projectiles in all but the last condition and is too large for the smaller, but similar ES-3 classification. This dart-sized point with basal-notching resembles an Eastgate point, but for its size. Jenkins (1994) notes the presence of ES-4 points in the Fort Rock Basin from contexts dated between 5000 and 4000 BP. The ES-4 point was recovered from Unit G, Level 11in the North Locus, adjacent to an Elko Corner-notched point. It came from the same general depth where the majority of the Elko points were collected (45-60 cmbs).

Contracting Stem Points. Contracting Stem projectile points are another of the Columbia Plateau classifications developed by Dumond and Minor (1983). These include a series of dart-sized points which lack the expanding stems and bases more common among Great Basin assemblages. Two varieties of Contracting Stem points have been identified from the Hoyt site, including Contracting Stem-2 (CS-2) and Contracting Stem-3 (CS-3). The following descriptions are derived from Dumond and Minor (1983:172).

CS-2 (4 specimens). Stem is less than 2/5 of the total length, less than ½ of the total width. The butt is squared, with a stem that is forcefully set off from the blade element by either sharp shoulders or barbs.

L=26-48 mm

W= 9-26 mm

L/W= 1.3-2.2 mm

CS-3 (1 specimen). Stem is 2/5 (or less) of the total length and more than ½ of the total width. The butt is squared and the stem is forcefully set off from the blade by pronounced shoulders or sharp barbs.

L=50-89 mm

W= 28-35 mm

L/W= 1.5-3.0 mm

The nearest Great Basin typological equivalent would be the Gatecliff Contracting Stem points first described by Thomas (1981:23). Gatecliff points are generally corner-notched with distinct barbs, however, while the Hoyt site artifacts have the squared shoulders and an appearance of basal-notching that is evident in the CS Series point typology.

Two CS-2 points (Specimens 977-22-D-B-11-2 and 977-22-E-C-13-1) and one CS-3 (977-22-K-B-12-1) point were recovered in the North Locus. An additional CS-2 point (977-22-SF-5) was surface collected in the same general vicinity. Two CS-2 and one CS-3 points were recovered within three meters of each other in a roughly circular area surrounding Feature 1, the radiocarbon dated 1830 year old hearth. These artifacts were located in Levels 11-13, in close vertical proximity with ES-4 and Elko Series points. The fourth Contracting Stem point (977-22-O-A-5-1) collected during excavations was taken from a depth of 20-25 cm in Unit O; associated with an Elko Eared projectile point. Two side-notched points were also collected at a depth of 45-60 cm in the unit, well below the two later points. The obsidian sources for the Contracting Stem points included the nearby Burns (1) and Dog Hill (2) sources, and Whitewater Ridge (1) to the north (Connolly, Appendix A).

Humboldt Series. These points are described by Thomas (1981:17) as "...unnotched, lanceolate, concave-base projectile points of variable size...",. The single Humboldt Series point fragment was collected in Unit L near Feature 1, in Level 14 at the Hoyt site where the most intensive occupations seem to have occurred. The artifact was found at about the same depth as the Elko Series, Expanding Stem Series, and Contracting Stem Series dart points. The point was not geochemically analyzed for its obsidian source.

Side-notched Points (including Small Side-notched and Northern Side-notched). A total of seven Side-notched points were recovered at the Hoyt site, including four Northern Side-notched (NSN), two of the Small Side-notched variety (SSN), and one side-notched base that could not be classified further because its overall dimensions could not be determined.

While Northern Side-notched points are well known in the northern Great Basin, the two Small Side-notched points do not fit the classification system developed by Thomas (1981). They are well suited for classification through the SN-4 typology established by Jenkins and Connolly for the Heath Cliffs site (1996:86), which is located to the north on the Southern Columbia Plateau: "...the basal element ("stem") is narrower in proportion to the blade element, with the butt significantly narrower than the barbs". One Small Side-notched point was encountered in Unit M of the North Locus in an area that was 6-7 meters from the 1830 BP hearth. The point was derived from the Burns obsidian source, located to the west of the site. A second SSN point was recovered in Unit O, Quad A, at a depth of 40-45 cm, some distance from the main excavation block at the Northern Locus. This specimen consisted of a small complete point with narrow, but deep notches, and was manufactured from an unknown obsidian source (977-22-O-A-9-1).

The four Northern Side-notched points were collected from both the North and South Loci. The Northern Side-notched point collected from Unit O (between 45-50 cm in depth in Quad D), consisted of a large basalt midsection and base which measured 107.6 mm in length despite its fragmentary state (977-22-O-C-12-1). The Unit O points were located approximately one meter apart. Unfortunately, their provenience is suspect due to the presence of a domestic dog cranium and cervical vertebrae 25-30 cm in depth, and plastic bag fragments as deep as 60 cm in the same quad. Two NSN points came from the main excavation block at the North Locus. One was from Unit G (977-22-G-C-12-1) and one from Unit H (977-22-H-A-12-2). Both were recovered between 55-60 cm in depth. The Unit G artifact was not analyzed for obsidian source, but the Unit H NSN was made from Burns obsidian. A fourth Northern Side-notched point (963-2422-P5-1-1) was encountered in the first level of Probe 5 (South Locus) during the testing phase. Probe 5 was located approximately 30 m west of the Phase 3 excavation block in the South Locus. The point was not found in association with other evidence of cultural activity, and further excavation was not deemed necessary at that particular location. This artifact was made from Little Bear Creek obsidian.

One base was also recovered which could be attributed to the general category of side-notched points, but could not be identified as either Small Side-notched or Northern Side-notched because only a small fragment was found. Both SSN and NSN points can have broad bases and wide necks, so it is often necessary for side-notched fragments to include both the base and a portion of the body to enable specific determinations. Specimen 977-22-I-C-9-1 is a white CCS base with a small portion of the stem attached. The artifact is clearly side-notched, and its size suggests that it may be a Small Side-notched point.

Projectile Point Fragments. The 17 point tips recovered from the Hoyt site show considerable variation in size (Table 4.6). Many are quite large, suggesting that they may have originated from dart points. A total of 13 tips could be reasonably attributed to dart points, two to arrow points, and two were too fragmentary for assignment. The majority of the tips originated from units surrounding the Feature 1 hearth. All are finely pressure flaked. One artifact consisted of the midsection of a finely flaked basalt dart point (977-22-J-B-13-1) from which the tip and the stem and base were broken. The barbs are still intact but jut only slightly out from the body of the projectile point and give no clear indication about whether the artifact was corner-notched or side-

Table 4.6. Metric attributes of Hoyt site projectile point fragments, in millimeters.

Type	Catalog No.	Material	Length (mm)	Width (mm)	Thickness (mm)	Weight (gms)
			North Locus			
tip	977-22-A-B-7-1	obs	12.8	8.7	2.7	0.2g
tip	977-22-B-B-13-1	ccs	4.8	4.7	1.5	<0.1g
tip	977-22-B-D-17-1	obs	7.0	4.5	2.1	<0.1g
tip	977-22-C-C-14-1	ccs	14.3	11.2	4.3	0.4g
tip	977-22-D-B-10-1	obs	6.4	4.9	1.3	<0.1g
tip	977-22-E-A-13-1	obs	6.5	6.3	3.0	0.2g
tang	977-22-E-A-15-1	obs	7.9	6.2	3.0	0.1g
tang	977-22-E-B-13-1	obs	11.9	8.1	2.9	0.3g
tip	977-22-E-B-14-1	obs	13.4	9.3	2.9	0.3g
tang	977-22-F-A-15-1	obs	15.1	6.5	3.2	0.3g
tang	977-22-G-C-14-1	obs	14.4	8.1	3.7	0.5g
tip	977-22-H-B-11-1	obs	6.2	6.1	1.7	<0.1g
tip	977-22-I-C-14-1	bas	15.6	13.4	5.0	0.8g
tip	977-22-I-A-12-1	obs	7.5	7.5	3.0	0.2g
tip	977-22-J-B-15-1	obs	13.5	14.8	3.1	0.5g
tip	977-22-J-D-9-1	obs	17.3	11.2	3.0	0.5g
tip	977-22-J-B-17-1	obs	7.2	4.7	2.0	<0.1g
tip	977-22-N-C-9-1	obs	8.4	8.7	3.5	0.2g
base	963-2422-P43-3-1	obs	5.9	4.9	2.5	0.1g
			South Locus			
mid	977-22-R-A-6-1	obs	5.8	7.0	2.0	<0.1g
tip	977-22-S-D-8-1	ccs	7.2	8.8	3.0	0.3g
tip	977-22-T-C-6-3	obs	5.0	6.2	1.5	<0.1g
tip	963-2422-TP1-4-1	obs	6.8	6.5	2.1	0.1g

notched. The stem width could be attributable to either the SSN or NSN type. The single obsidian midsection (977-22-R-A-6-1) recovered during excavation appears to be broken from the upper portion of a projectile point. It is small and thin, and would have tapered to a fine, sharp tip.

The four tangs (or barbs) collected at the Hoyt site are all large enough to have originated from dart points. One of the tangs has a rounded end, and the others are squared. In general, the angle of the fracture where the squared tangs were broken from the body of the projectile point suggests that the points were corner-notched. The rounded tang (977-22-F-A-15-1) may be a fragment of an Elko Eared base (the "ear").

The single base fragment is made from obsidian, and was clearly broken from an arrow point, judging by its small size. The artifact was fractured in such a way that the identification of diagnostic attributes (such as expanding stems or basal notches) is not possible.

Drills and Awls

Seven tools from the Hoyt site may be classified as drills, punches, or awls, based on either diagnostic or functional attributes (Table 4.7). Two of the artifacts are quite clearly shaped for the purpose of either being hafted or held between thumb and forefinger and twisted back and forth to bore holes in materials such as wood, bone, or leather. The remaining five artifacts are elongated, shaft-like tools that would have served well for boring or punching holes in various materials. The drills and punches were recovered across the Northern Locus, and were not identified in discrete activity areas or work stations.

Specimen 977-22-SF-2 is a well-made drill manufactured from white CCS. The artifact has a wide, thin base that has been corner-notched; ostensibly to create spurs for lashing the tool to a handle. The base contracts to a narrow, ovate tip which is broken. This drill was surface collected at the eastern-most portion of the North Locus. Specimen 963-2422-P43-2-1 is a complete drill manufactured from obsidian. It has a thick, lenticular base that tapers to an almost cylindrical drill tip 18.8 mm in length. Because of its thick, rounded construction, the base seems more suited for gripping than for hafting.

Specimen 977-22-P-C-4-1 is a beige colored CCS drill tip, probably broken from an expanding base. The artifact consists of a 24 mm long tip fragment that is almost cylindrical in cross-section, and would have been well suited for boring holes in wood, bone or other hard materials.

Specimen 963-2422-P42-4-1 is a thin, lenticular biface with a squared base that tapers slightly towards the distal end of the artifact. The distal portion is missing, but it seems likely that the artifact would have tapered to a point possibly useful as an awl for piercing holes in leather and other relatively soft materials.

Specimen 977-22-E-A-17-1 is a "triface" created by (probably unintentional) snapping off the edge of a large biface to create a long obsidian tool with a triangular cross-section. A combination of percussion flaking and use wear have contributed to shaping the third face of the artifact, and it appears to have served well as an awl.

Table 4.7. Metric attributes of Hoyt site drills and awls, in millimeters.

Type	Catalog No.	Material	Length	Width	Thickness	Weight
base	963-2422-P42-4-1	obs	26.0	9.7	3.3	1.0g
drill*	963-2422-P43-2-1	obs	41.6	14.3	7.6	3.2g
drill	977-22-SF-2	ccs	32.3	25.8	5.1	3.4g
awl*	977-22-E-A-17-1	obs	64.4	10.4	10.8	6.7g
mid	977-22-M-C-5-1	obs	21.4	17.0	7.8	3.5g
mid	977-22-N-B-7-1	obs	8.6	21.0	6.6	1.4g
tip	977-22-P-C-4-1	ccs	24.0	7.7	5.7	1.1g

*=complete

Two other artifacts that may be portions of drills or punches were found at the Hoyt site. They consist of midsections with rounded cross sections inconsistent with the shape of projectile points. Because of their fragmentary nature, it is not possible to classify them with a great degree of certainty, but their size, shape, and thickness is more in keeping with other drills or large punches seen in the Northern Great Basin.

Shaped Bifaces

This category is based on the multi-stage biface classification system employed by Jenkins and Connolly (1990). Stage 1-4 bifaces are dealt with here (Table 4.8, Figure 4.9). Stage 5 bifaces are generally considered to be projectile points, and have been treated separately in a previous portion of the text. Most of the artifacts are fragmentary. They are considered in terms of a generalized leaf-shaped biface morphology because many share similar characteristics. Tips have pointed ends, and are thought to be the distal ends of artifacts. Bases have rounded or slightly convex squared ends and are thought to be proximal portions of artifacts. Midsections are frequently tapered to some degree. Of course, not all bifaces have rounded bases, pointed tips, and show clear signs of tapering, but it seems most utilitarian to emphasize the shape of a common artifact form when only fragments exist. The function of the bifaces can only be implied, with the aid of use wear evidence in some cases.

Stage 1 bifaces. These bifaces have thick cross-sections and large, unpatterned flake scars. They exhibit only the most rudimentary development, with rounded or thick lenticular shapes and cross-sections. The flaking pattern reflects use of the hard hammer percussion technique, and the edges of these tools can be very sinuous. A total of one CCS and 11 obsidian bifaces and fragments fit this classification. Two are complete, roughly leaf-shaped tools that exhibit unpatterned flaking with numerous deep flake scars and step fractures. One of these, Specimen 977-22-H-C-12-1 is very thick in cross section (12.2 mm), with cortex showing on one side and areas of heavy use wear along the edges. The other, Specimen 977-22-O-C-12-2 is thinner, with more sinuous edges that also show use wear. A total of two pointed end fragments (tips), six rounded end fragments (bases), and two midsections (both are edge fragments) account for the remaining Stage 1 artifacts.

Stage 2 bifaces. Bifacial thinning is continued on these artifacts through the removal of contiguous hard hammer percussion flakes. The removal of the flakes results in the development of an artifact, which, although still crudely shaped, has a more pronounced form than stage 1 artifacts. Stage 2 bifaces are considered to be quarry blanks. A total of 13 artifacts fit this classification; 12 of obsidian and one of basalt. All of the artifacts are fragmentary. Specimen 977-22-H-A-14-1 is missing a large portion of one side, but retains enough of its overall integrity to determine that it was an ovoid biface 59.3 mm in length with strong evidence of use wear on all of its remaining edges. The other Stage 2 artifacts consisted of five rounded base fragments, two midsections, and five tips. The bases are primarily short, wide fragments of large convex-sided bifaces. The flaking is unpatterned percussion flaking, though considerable thinning generally occurred prior to breakage. One of the two midsection fragments is a single edged portion which probably originated from a large biface. The five tips include four of obsidian and one of basalt. The basalt tool (Specimen 977-22-R-C-12-1) is a relatively narrow (maximum width 27.3 mm) and long (61.3 mm) fragment tapering to a flattened tip that was broken through utilization. The tool displays unpatterned flaking which produced a deeply notched, sinuous edge. The edges of the artifact are very rounded, possibly indicating heavy use. The four obsidian tips appear to be derived from large bifaces. Three of the four tips show moderate to heavy use wear, and one does not appear to have been used. A noteworthy concentration of Stage 2 bifacial fragments occurs in Quad B of Unit F in the main concentration of cultural materials, between Levels 8-15. Four Stage 2 artifacts were recovered from the location, none of which can be joined together.

Figure 4.9. Selected biface fragments. Stage 1, a-d; Stabe 2, e-g; Stage 3, h-j; Stage 4, k-m.
a. 977-22-C-B-5-2 b. 977-22-L-C-14-2 c. 977-22-H-C-12-1
d. 977-22-O-C-12-2 e. 977-22-R-C-12-1 f. 977-22-H-A-14-1
g. 977-22-C-B-1-3 h. 977-22-J-B-13-1 i. 977-22-H-B-13-1
j. 977-22-E-C-13-1 k. 977-22-E-D-12-1 l. 977-22-W-B-10-1
m. 977-22-J-D-12-1

Table 4.8. Metric attributes of Hoyt site bifaces and fragments, in millimeters.

Type	Catalog No.	Material	Length	Width	Thickness	Weight
Stage 1:						
			North Locus			
tip	977-22-B-C-8-1	obs	24.3	30.8	9.7	5.3g
mid-e	977-22-B-B-22-1	obs	52.5	22.8	12.9	7.8g
base	977-22-C-B-15-2	obs	32.3	31.6	6.9	10.1g
mid-e	977-22-E-D-10-1	obs	29.5	25.1	9.4	7.0g
biface*	977-22-H-C-12-1	obs	53.4	24.7	12.2	14.7g
base	977-22-K-B-10-1	obs	43.0	37.2	11.9	18.1g
base	977-22-L-C-14-2	obs	29.6	31.5	8.5	9.6g
base	977-22-M-C-7-2	obs	37.4	30.0	8.2	5.4g
tip	977-22-M-D-10-1	obs	18.3	33.1	8.5	3.7g
biface*	977-22-O-C-12-2	obs	47.5	26.2	9.3	8.9g
base	977-22-Q-D-6-1	obs	42.0	56.3	14.3	27.1g
			South Locus			
base	977-22-T-B-9-1	ccs	22.4	42.6	16.7	13.7g
Stage 2:						
			North Locus			
tip	963-2422-TP2-8-1	obs	18.7	31.6	11.2	3.9g
base	977-22-C-B-1-3	obs	31.2	41.7	7.6	8.7g
mid-e	977-22-F-B-8-1	obs	26.1	13.1	6.2	1.3g
mid	977-22-F-B-12-1	obs	20.3	36.1	6.9	6.2g
tip	977-22-F-B-13-1	obs	18.1	23.0	8.0	2.0g
tip	977-22-F-B-15-1	obs	34.7	31.5	6.7	5.9g
biface	977-22-H-A-14-1	obs	59.8	35.7	11.1	21.6g
tip	977-22-M-B-8-1	obs	44.2	28.4	8.6	9.2g
base	977-22-M-C-10-2	obs	16.5	25.9	6.1	1.9g
base	977-22-O-D-12-1	obs	18.0	40.4	6.5	4.1g
			South Locus			
tip	977-22-R-C-12-1	bas	60.7	27.4	12.2	22.2g
base	977-22-V-A-17-1	obs	17.2	40.0	6.4	4.6g
base	963-2422-P8-5-1	obs	27.5	9.7	6.4	1.5g
Stage 3:						
			North Locus			
base	963-2422-P28-2-1	obs	10.5	20.3	5.0	0.8g
mid-e	963-2422-P42-3-1	obs	24.5	9.8	6.4	1.5g
base	963-2422-TP2-6-1	obs	5.7	17.4	3.7	0.3g
mid	977-22-A-B-9-1	obs	25.1	27.7	5.9	4.5g
mid-e	977-22-C-A-1-1	obs	19.8	11.2	3.8	0.6g
mid-e	977-22-C-B-14-2	obs	41.0	4.4	5.5	3.1g
mid-e	977-22-C-D-14-1	ccs	28.5	8.9	8.1	1.7g
base	977-22-E-C-13-1	obs	41.5	33.1	8.2	12.6g
tip	977-22-E-D-14-1	obs	30.8	21.1	8.1	4.3g
tip	977-22-F-C-11-1	obs	15.5	20.1	4.8	1.0g
base	977-22-H-A-7-1	obs	10.4	22.2	5.2	0.9g
base	977-22-H-B-13-1	ccs	52.1	44.8	8.2	19.4g
mid-e	977-22-I-A-8-1	obs	27.5	30.8	6.9	4.1g
base	977-22-J-B-13-1	obs	16.9	28.8	7.4	4.3g
mid	977-22-K-C-8-1	ccs	22.3	21.2	7.7	4.2g
base	977-22-P-D-1-2	obs	19.2	22.9	15.9	2.5g
South Locus						
mid-e	977-22-S-B-7-1	obs	23.3	10.8	5.8	1.3g
tip	977-22-S-D-9-1	obs	22.4	21.9	4.3	1.9g
biface	977-22-T-B-9-1	obs	41.5	15.8	6.1	3.8g

Table 4.8, (continued). Metric attributes of Hoyt site bifaces and fragments, in millimeters.

Type	Catalog No.	Material	Length	Width	Thickness	Weight
Stage 4:						
			North Locus			
tip	977-22-SF-4	obs	32.5	26.1	10.3	7.2g
	977-22-C-B-8-2	obs	9.4	8.4	2.3	0.1g
tip	977-22-C-B-10-1	obs	13.5	10.8	4.8	0.4g
base	977-22-D-D-19-1	obs	12.3	27.8	5.3	1.9g
tip	977-22-E-C-12-1	obs	15.5	18.6	5.1	1.0g
biface	977-22-E-D-12-1	obs	59.8	17.7	8.5	7.7g
base	977-22-I-A-10-1	obs	10.6	17.2	4.6	0.6g
base	977-22-I-D-12-1	obs	22.3	21.9	4.8	2.8g
base	977-22-J-D-12-1	obs	36.3	15.1	5.4	3.5g
base	977-22-N-A-9-1	obs	9.8	14.0	4.5	0.5g
			South Locus			
tip	977-22-R-D-8-1	obs	14.4	11.3	3.6	0.5g
mid	977-22-T-A-7-1	obs	14.7	14.2	4.6	0.8g
mid	977-22-U-B-11-1	obs	10.3	13.9	4.1	0.6g
mid	977-22-U-D-14-1	obs	33.5	15.7	9.9	5.8g
mid	977-22-W-B-10-1	obs	38.4	15.2	6.8	4.2g

key: e=midsection edge fragment
c=complete

Stage 3 bifaces. These bifaces exhibit little to no evidence of pressure flaking and have the slightly sinuous edges characteristic of large percussion flake scars created by the initial stages of bifacial reduction. The entire artifact surface has been modified through the removal of flakes which can reach the middle of the artifact. It is at this stage that major thinning of the artifact occurs, often leading to breakage. A total of 19 biface fragments fit this classification, of which 16 are obsidian and three are CCS. All of the artifacts exhibited fine pressure flaking along some edges, with varying degrees of percussion flaking along other edges and across the body of the artifact.

Three of the fragments are tips. All of the tips are made of obsidian and have broadly convex edges tapering to a sharp point. Two of the tips are well-thinned in cross-section; the third has a rather thick, plano-convex cross-section. The eight midsections included six edge fragments. Two of the midsection fragments were manufactured from a brownish-tan CCS, including one of the edge fragments. The rest are made from obsidian. The base fragments include five rounded bases, two squared bases (977-22-I-C-13-1 and 977-22-P-D-1-2), and an almost complete rectangular biface. The rounded bases included one large, semi-translucent, tannish-white CCS fragment (977-22-H-B-13-1). The biface 977-22-T-B-9-1 is plano-convex in cross-section, with the convex surface displaying a combination of pressure and percussion flaking, and the flat surface entirely pressure flaked. The flat surface shows patination, and evidence of rounding along the ridges between flake scars, suggesting that weathering due to surface exposure may have affected the artifact. The roughly rectangular biface was slightly tapered on one end, and evidence of use wear was most pronounced on the tapered portion.

Stage 4 bifaces. The continuation of percussion and pressure flaking techniques after Stage 3 results in bifaces with a more "finished" appearance than Stage 3 tools. Pressure flakes can reach the midline of the artifact or beyond, and frequently eliminate the large percussion flake scars from earlier reduction. Edges are strengthened by the removal of pressure flakes which increase the edge angle. Fifteen Stage 4 artifacts were collected from the Hoyt site, including five tips, four midsections, five bases, and an almost complete biface. The biface is a long (59.8 mm) and narrow (17.7 mm) leaf-shaped artifact that is missing the tip and a small portion of the base. It is almost entirely pressure flaked, with parallel flake scars meeting at the midline. The slightly serrated edges show minimal use wear on the peaks between flake scars. The five tips included three relatively small fragments that may have originated from dart-sized projectile points, one medium sized fragment, and one large fragment. The latter artifact (977-22-SF-4) has a thick, lenticular cross-section and is almost entirely pressure flaked, with flake scars running diagonally across the body on one side, and meeting at the midline on the other. Use wear is almost uniform along the edges of the tool; in part due to the straight, well prepared edge angles. The three "dart-like" tips are not flaked with the refinement of a Stage 5 biface, but the combination of thinning, edge preparation, and sharply pointed tips suggest that these artifacts would have made suitable projectile points. The four midsection fragments include one edge fragment from a very large biface and a substantial portion of a long, thick tool that may have been a drill or an awl (977-22-W-B-10-1). Among the four bases are two fragments which appear to be partial stem and base portions of corner-notched points (977-22-I-A-10-1 and 977-22-N-A-9-1), a fragment of a large, square-based biface, and a long, thin, square-based tool fragment that tapers slightly towards the distal end (977-22-J-D-12-1). This tool has diagonal flaking across the body, and evidence of use wear increases away from the proximal end.

Edge-modified Flakes

These artifacts include expedient flake tools, spokeshaves, and flakes that have prepared edges suited to a variety of cutting and scraping tasks. The former commonly have unifacial chipping on one side of the artifact which is the result of unintentional modification through use, with flakes being removed from the far side of the tool as it is held perpendicular to the worked object and drawn towards the user (Kiigemagi 1989:148). In some cases, bifacial chipping is exhibited due to the use of both sides of the flake for such tasks. This type of edge modification can occur along the same edge or at separate locations on the artifact. Artifacts with prepared edges include scrapers with at least one edge strengthened by steep pressure-flaking for long term use. Spokeshaves generally have a narrow crescentic notch ideal for scraping curved or rounded surfaces.

A total of 129 artifacts exhibit use wear characteristic of edge-modified flakes. Of these, 96 are unifaces, 15 are bifacially worked specimens, 14 are transversely flaked, and four can be classified as spokeshaves. There were four CCS, five basalt, and 120 obsidian tools in the assemblage. The CCS tools included two transversely flaked specimens and two unifaces. Basalt tools included two spokeshaves, two unifaces and one bifacially flaked specimen. The highest concentrations of utilized flakes were found in the units of the North Locus, particularly from the area surrounding Feature 1.

Two of the four spokeshaves are manufactured from obsidian. Specimen 977-22-H-D-13-1 has a slight, crescent-shaped indentation 15.9 mm long and 2.9 mm deep. The worked surface is unifacial, and the few use-generated pressure flakes removed from the edge suggests that the artifact was used for only a short time. Additional flakes removed from elsewhere along the notched edge seem to indicate that the artifact was initially a flake tool which saw secondary use as a spokeshave. Specimen 963-2422-TP2-9-1 has a deep, well rounded notch which tapers to a sharp spur on one side that may have been used for incising material such as wood or bone. The curved surface is 18.7 mm long and 7.8 mm deep.

The two basalt spokeshaves were made on substantially larger and thicker modified flakes than the obsidian tools. Because basalt is such dense material and holds an edge better than obsidian, it is possible that these artifacts were being used in the manufacture of larger tools or perhaps tools constructed of a denser material for which obsidian was not suitable. Specimen 977-

22-D-B-11-3 has a single shallow crescentic surface that is 22.4 mm long and 4.5 mm in depth Specimen 977-22-B-A-11-1 is more deeply notched, with a sharp spur at one end that may have been used as a graver for incising. The working surface is 21.5 mm long and 5.5 mm deep.

Cores

A total of 19 cores was collected at the Hoyt site (Table 4.9). Cores are angular, tabular, or naturally rounded nodules of stone from which flakes have been removed for the manufacture of projectile points, knives, and other chipped stone tools. Depending on the original characteristics of the chosen material, flake removal can be haphazard in appearance as the most suitable pieces are removed, or quite systematic as flakes are removed along edges prepared

Table 4.9. Metric attributes of cores from the Hoyt site, in millimeters.

Specimen	L.	W.	Th.	Wt(gms)	Material	Notes
		North Locus				
977-22-A-A-10-2	64.7	63.2	25.7	78.3	basalt	blocky
977-22-A-D-16-1	38.5	37.0	11.7	13.3	obsidian	discoidal
977-22-B-C-15-1	65.0	60.0	28.3	130.1	basalt	nodule
977-22-D-B-11-1	143.3	74.8	46.5	458.0	basalt	blocky
977-22-D-B-11-5	91.7	45.7	35.0	159.3	basalt	blocky
977-22-E-B-10-2	67.5	49.9	24.2	61.4	obsidian	nodule
977-22-E-B-14-2	88.9	43.2	28.2	98.9	ccs	tabular
977-22-I-D-14-1	98.3	78.7	34.5	376.3	ccs	tabular
977-22-J-A-11-3	102.4	71.9	38.8	292.2	basalt	blocky
977-22-J-A-16-1	109.7	95.7	18.1	221.4	obsidian	lg. flake
977-22-L-B-12-1	62.7	37.6	18.5	38.6	basalt	tabular
977-22-L-C-11-1	47.0	39.2	17.2	34.4	basalt	blocky
977-22-L-C-11-2	56.1	46.0	16.8	41.5	basalt	blocky
977-22-L-C-15-1	82.8	54.1	19.5	76.6	basalt	tabular
977-22-N-D-5-1	75.1	42.4	55.8	240.7	basalt	blocky
977-22-N-B-10-1	108.2	78.2	47.5	373.4	basalt	nodule
977-22-N-C-4-1	62.4	26.1	22.6	36.3	obsidian	nodule
977-22-O-A-10-1	92.2	67.8	71.1	455.5	basalt	blocky
963-2422-P45-2-1	77.4	63.4	39.6	255.1	basalt	blocky
		South Locus				
977-22-U-B-15-1	48.8	43.2	22.0	42.5	obsidian	nodule
977-22-W-A-8-2	66.0	45.4	31.7	76.2	basalt	blocky
977-22-W-B-7-2	48.5	37.9	25.4	36.1	basalt	cobble
977-22-W-B-9-1	67.6	49.2	20.8	66.6	basalt	cobble
963-2422-P5	76.8	72.1	45.2	255.1	basalt	blocky

in advance. Cores may be disposed of when exhausted, but can also be utilized as tools for other purposes with the removal of additional flakes to enhance their suitability for cutting and chopping tasks. Concentrations of cores occurred at one location in the North Locus and one in the South Locus. Six cores were recovered in adjoining Units J and L, to the east of Feature 1. Other units in the North Locus produced one or two cores, but the presence of six between 50-80 cm in depth in an eight square meter area suggests that a lithic reduction activity area may have existed at that location, somewhat removed from the principal occupation area. At the South Locus, three cores were collected in Unit W, indicating that similar activities may have occurred there.

Core and Flake Tools

Core and flake tools are large, unshaped to roughly shaped tools exhibiting unpatterned flaking and edge damage associated with the performance of tasks such as cutting, scraping, and chopping (Table 4.10). The used edges may exhibit additional modification to improve cutting ability, but often the edges are altered only by wear associated with use. Core and flake tools can be either unifacial or bifacial. As a group, large core and flake tools differ from either utilized flakes or Stage 1 bifaces in two ways. First, their overall size and mass suit them best for work that would damage thinner, more refined tools, suggesting that they were designed for hard use in tasks such as shaping wood, scraping hides, or butchering large game animals. Second, they are frequently made of very dense lithic materials including CCS and basalt, capable of holding an edge under heavy use conditions. There are characteristics which core and flake tools share with other tool categories such as edge-modified flakes, but, as a whole, they belong to a distinct class of tools designed for specific activities. All seven of the tools were recovered from the North Locus. Four of the seven tools were recovered from Units D, G, and H, surrounding Feature 1. These include a chopper from Unit D, two flake tools from Unit G, and a scraper from Unit H.

Three specimens are basalt flake tools which were probably used for various cutting tasks. Specimen 977-22-A-C-8-1 is bifacial, rectangular, and has cutting edges on three of its four sides. Microflakes have been removed bifacially through use, and one edge has a crescentic-shaped notch rounded by use as a spokeshave. Specimen 977-22-G-B-7-1 is also roughly rectangular in shape, with use wear visible on both of its shorter sides. One of the used edges is bifacial, and the

Table 4.10. Metric attributes of core and flake tools from the Hoyt site, in millimeters.

Specimen	L	W	Th	Wt(gms)	Material	Notes
			North Locus			
977-22-A-C-8-1	56.8	48.3	10.5	37.0	andesite	flake tool/spokeshave
977-22-D-B-8-1	90.9	63.1	20.6	96.6	rhyolite	chopper
977-22-G-B-7-1	82.5	54.2	10.0	67.6	basalt	flake tool
977-22-G-D-9-1	91.3	44.3	16.2	62.2	basalt	flake tool
977-22-H-C-10-1	104.8	48.8	22.3	161.6	basalt	elongated scraper
977-22-SF3	96.0	88.2	25.5	222.1	andesite	lg. discoidal chopper
963-2422-SF4	76.1	68.5	23.9	115.8	ccs	lg. domed scraper

other is unifacial. Specimen 977-22-G-D-9-1 is a triangular-shaped tool with a bifacial cutting edge along the longest side

Two tools appear to be scrapers. Specimen 963-2422-SF4 is a CCS core which has been altered to make it suitable for use as a scraper. The tool has a rectanguloid shape with worked surfaces on all sides except for a small portion of one edge. A series of long, thin flakes have been driven off towards the center of one side of the artifact, creating a steep-edged working surface. The other side is unworked, save for sporadic flake removal attributable to use wear. Specimen 977-22-H-C-10-1 is an elongated rectangular artifact made of basalt, which has wear on one end and along one long side. The tool could have served well as an end scraper and possibly as a cutting tool or side scraper.

The two tools identified as choppers have use wear on all edges. Specimen 977-22-D-B-8-1 is a somewhat triangular shaped unifacial tool made of tuffaceous material, with extensive crushing on both of the long edges from intensive use. Specimen 977-22-SF-3 is a very fine grained andesitic biface which has a discoidal shape. Bifacial micro-flaking from use is evident around the entire circumference of the tool.

Debitage

A total of 89,473 pieces of obsidian debitage were analyzed for this study. Mass analysis (Ahler 1989) was conducted by passing the debitage through a series of nested screens which were 1", 1/2", 1/4", and 1/8" (G1-G4 respectively); metrically sized at 35.9 mm, 18.0 mm, 8.0 mm, and 3.6 mm. The contents of each screen were counted, weighed, and examined for the presence of exterior cortex (Figure 4.10, Table 4.11).

The data derived through the mass analysis process permits interpretations regarding lithic reduction activities ocurring at an archaeological site primarily through the quantification of size grades. Early tool production strategies such as core reduction and the preparation of quarry blanks commonly involves the removal of larger flakes through percussion flaking. Late stage lithic reduction may require the use of both percussion and pressure flaking, but flake size tends to decrease as the emphasis shifts from bulk removal to thinning and final shaping of the artifact. In terms of size-graded artifacts, early stage lithic reduction would be evident through an emphasis on G1 and G2 flakes in the assemblage while late stage reduction activities would be apparent by a shift to grades G3 and G4.

The G1 and G2 classes accounted for four percent of the obsidian debitage at the Hoyt site, with G1 providing only 0.08% and 3.2% identified as G2. The G3 material comprised 20.4%, and the vast majority of the debitage was of the G4 class, accounting for 76.3 % of the total. Less than three percent (2.84 %) of the flakes had cortex, most of which (2.1%) were identified as G3 or G4. Overall, the limited quantities of G1 and G2 flakes and cortex flakes in any size grade, in conjunction with the high quantities of G3 and G4 debitage seems to indicate that late stage reduction activities were most prevalent at the Hoyt site.

Table 4.11. Mass analysis of Hoyt site obsidian debitage.

	G1			G2			G3			G4			Total	
Unit	Ct	Wt	Ctx	Ct	Wt	Ctx	Ct	Wt	Ctx	Ct	Wt	Ctx	Ct	Wt
A	3	43.44	2	267	451.76	52	1407	368.33	52	3146	160.89	55	4823	1024.42
B	5	85.02	3	188	369.36	43	1066	277.55	66	2947	114.63	27	4206	846.56
C	3	36.24	2	135	229.94	31	786	205.72	59	3345	119.45	40	4269	591.35
D	11	195.86	8	188	347.96	43	866	230.87	63	4821	162.63	108	5886	937.32
E	6	50.22	2	219	380.68	49	1080	289.1	99	4099	144.8	49	5404	864.8
F	5	49.91	4	165	321.12	38	938	259.4	593	256	121.61	13	4364	752.04
G	1	6.34	0	85	152.82	19	521	144.81	31	1862	70.94	11	2469	374.91
H	6	144.31	4	218	445.0	36	882	258.13	50	3533	130.41	56	4639	977.85
I	6	77.52	5	172	306.35	32	1640	200.79	56	3540	126.93	30	5358	711.59
J	4	70.38	2	218	427.94	38	1002	295.22	60	2751	113.68	48	3975	907.22
K	3	39.03	1	172	365.2	38	896	243.75	41	3185	122.41	37	4256	770.39
L	3	36.1	2	163	334.22	41	850	233.51	55	2549	104.91	30	3565	708.74
M	6	60.44	3	190	399.12	32	941	264.75	51	2396	102.81	32	3533	827.12
N	3	85.31	3	60	121.83	17	378	97.27	24	1909	63.58	19	2350	367.99
O	3	36.92	0	41	69.56	9	286	68.72	14	1794	55.61	14	2124	230.81
P	1	23.36	1	15	107.76	15	291	84.61	23	1967	63.65	22	2274	279.38
Q	0	0	0	11	20.64	4	68	19.82	5	545	16.7	5	624	57.16
R	1	5.93	0	74	156.65	19	946	289.8	83	4811	204.14	71	5832	656.52
S	1	14.38	1	82	167.34	19	801	234.24	46	3782	150.33	44	4666	566.29
T	0	0	0	44	72.95	10	489	142.54	25	2429	101.42	27	2962	316.91
U	1	14.19	0	70	126.13	17	851	225.65	69	2980	131.01	18	3902	496.98
V	0	0	0	44	92.69	12	523	150.01	36	2897	113.6	30	3464	356.3
W	2	51.66	0	75	142.03	18	765	218.4	52	3686	147.4	41	4528	559.49
Totals	74	1127.46	43	2896	5609.05	632	18,273	4802.99	1119	68,230	2643.54	827	89,473	14,182.14
	2621													
%	0.08	7.9	1.6	3.2	39.6	24.1	20.4	33.9	42.7	76.3	18.6	31.6		

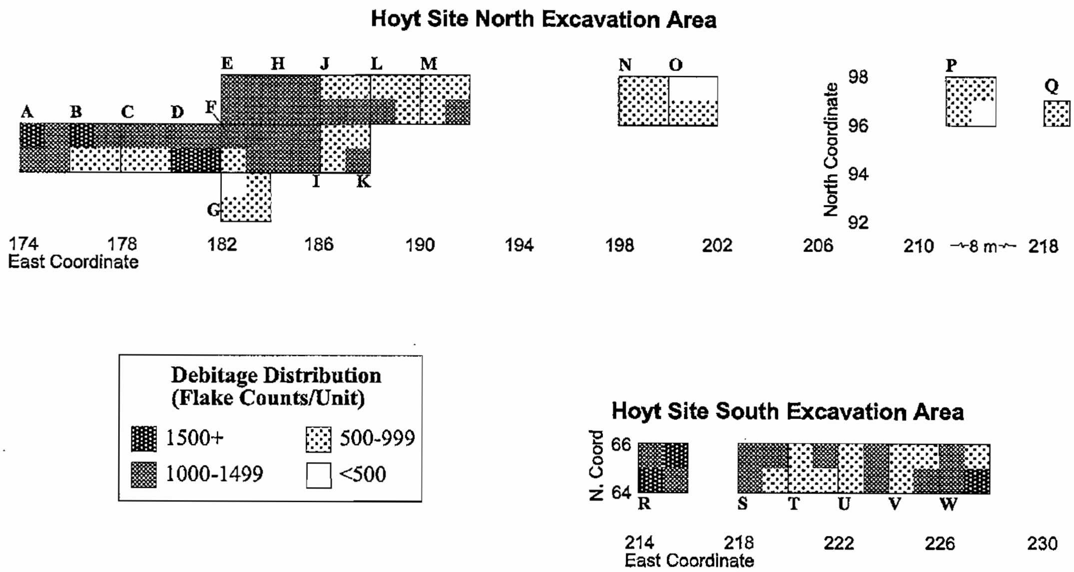


Figure 4.10. Distribution of debitage at the Hoyt site, all units.

Ground Stone Tools

The limited quantity of ground stone recovered from the Hoyt site is noteworthy, particularly with consideration to the overall variety of tools the site yielded. A total of 24 fragmented and unfragmented ground stone artifacts was collected, including nine metates, six manos, three abraders, one atlatl weight, one pestle, and three unidentifiable pieces (Figures 4.11 and 4.12, Table 4.12).

Manos

Six manos were recovered from the Hoyt site, all of which were found in the North Locus (Figure 4.12). Three of the implements are bifacially faceted with pecked edges and have the appearance of tools that would have been curated and used regularly. Specimen 977-22-D-B-11-1 is an end fragment from a bifacial basalt mano which has pecked edges on all but one side, where opposing grinding surfaces have worn together. Specimen 977-22-H-A-15-1 is a rectangular

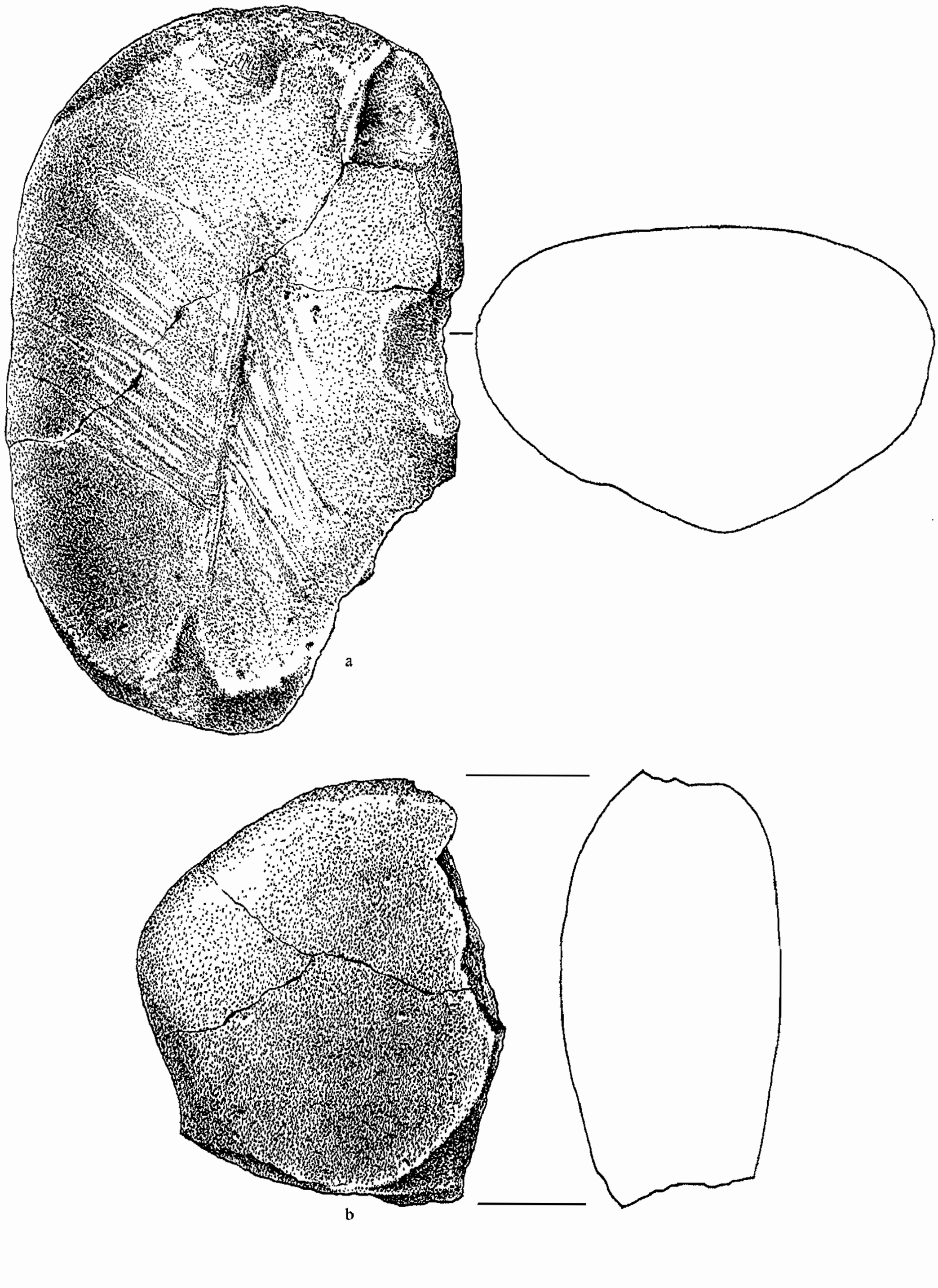


Figure 4.11. Selected manos from the Hoyt site. Metric attributes in Table 4.12.
Note striations on a.
a. 977-22-K-D-11-1,2,3,4;
b. 977-22-T-B-10-1

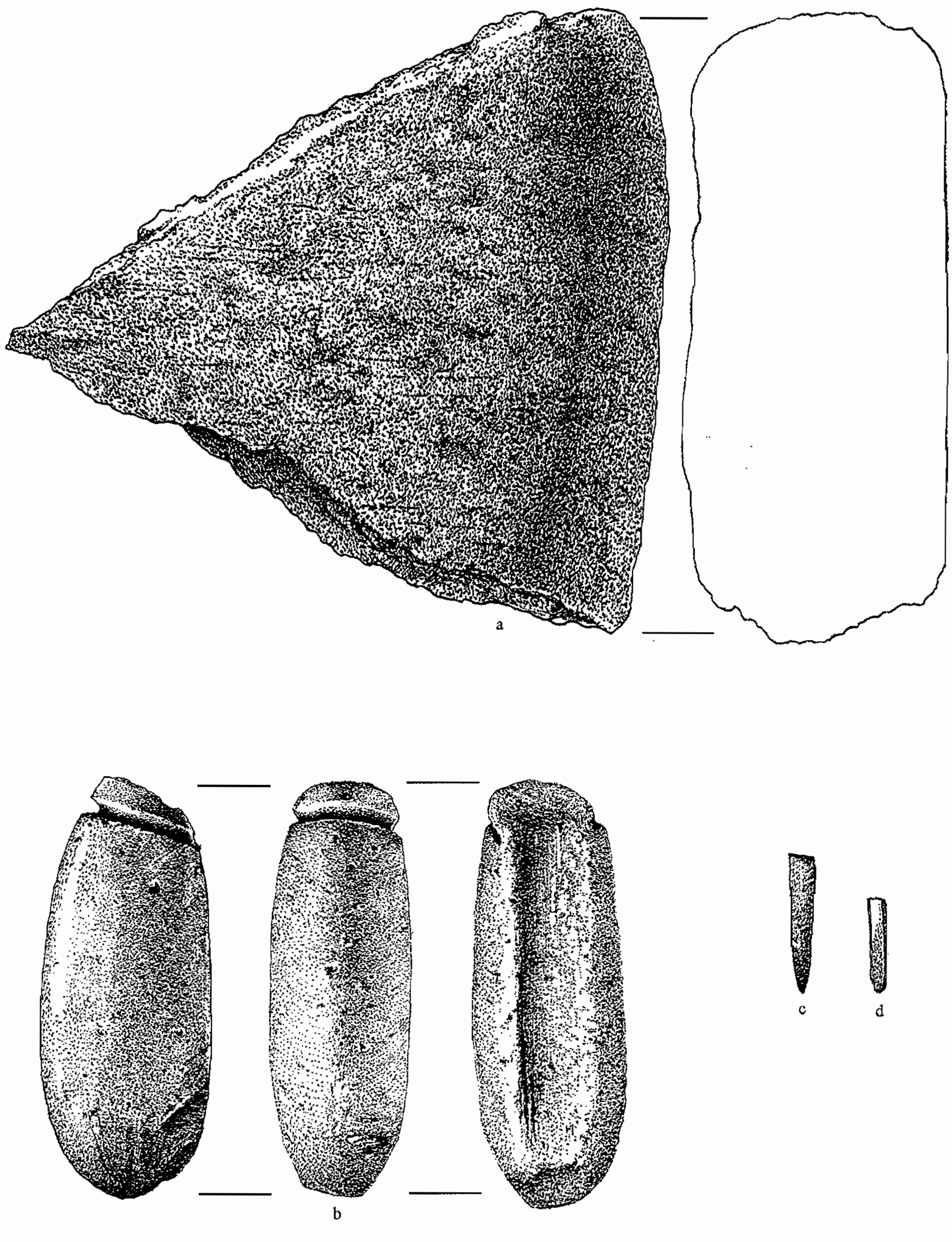


Figure 4.12. Selected artifacts from the Hoyt site, metric attributes in table 4.11.
a. metate, 977-22-R-B-8-1 b.atlatl weight, 977-22-F-C-15-2
c. bone gorge, 977-22-D-D-18-1 d. bone tool fragment, 977-22-R-D-8-1

Table 4.12. Metric attributes of ground stone tools and fragments from the Hoyt site, in millimeters.

Specimen	Type	L	W	Th.	Wt(gms)	Notes
			North Locus			
977-22-A-B-11-1	pestle	125.0	70.9	33.5	431.2	w/indentation
977-22-D-B-11-1	mano	86.2	50.7	51.8	267.5	bifacial end frag.
977-22-F-C-13-1	mano	114.2	88.5	37.0	411.1	unifacial
977-22-H-A-15-1	mano*	116.7	71.8	37.8	517.7	bifacial
977-22-K-D-11-1	mano	129.1	83.0	50.4	444.0	bifacial, one facet incised
977-22-L-C-10-1	mano*	151.0	86.5	71.7	1188.3	bifacial
977-22-E-D-10-2	metate*	342.0	337.0	116.0	-	Feature 1
977-22-H-C-9-1	metate	33.2	22.6	38.6	29.9	one intact side
977-22-H-C-10-3	metate	172.0	122.8	40.0	922.6	unifacial
977-22-I-B-10-1	metate	93.9	90.0	38.5	299.2	bifacial
977-22-I-D-9-1	metate	38.2	35.1	24.6	31.6	unifacial
977-22-K-B-8-1	metate	110.3	109.2	42.6	627.2	pecked edge
977-22-F-C-15-2	atlatl wt.	73.0	25.6	27.9	46.4	red scoria
977-22-J-A-7-1	abrader	56.9	38.4	18.6	31.3	small, grooved
977-22-J-D-9-2	abrader	115.5	101.7	37.8	219.6	large, w/central groove
977-22-K-D-8-1	abrader	63.6	29.4	25.4	41.3	small, grooved
977-22-D-B-12-2	fragment	54.3	17.8	39.7	37.9	edge/end frag.
977-22-H-C-8-1	fragment	61.5	36.5	27.2	79.6	only one intact side
977-22-H-C-8-2	fragment	65.2	37.0	39.0	80.2	only one intact side
			South Locus			
977-22-S-B-12-1	metate	66.3	64.1	27.4	181.4	bifacial, w/pecked edge
			Surface Collected			
963-2422-SF3	mano	99.1	92.6	52.8	523.5	unifacial
963-2422-SF-1	metate	82.7	86.4	26.1	189.6	unifacial
977-22-SF-1	metate	277.0	229.0	98.0	-	lightly used

* = complete artifact

basalt mano with pecked ends, one pecked edge, and one edge where two opposing grinding surfaces have worn together to create a wedge-like appearance. One facet of the mano is flat and the other is keeled slightly off center, indicating that the user utilized two distinct grinding surfaces on that side. Specimen 977-22-K-D-11-1 is a bifacial mano with ground edges made of volcanic tuff. One of the grinding surfaces has numerous striations from secondary use as an abrader. One unifacially faceted mano (977-22-L-C-10-1) was manufactured from a large basalt cobble which required no shaping to become a useful tool. The grinding surface is only moderately worn.

The other two manos are made from dense volcanic material (rhyolite?) and are of a more expedient nature, in that they have not been shaped by pecking, grinding, or use. Specimen 977-

22-F-C-13-1 is a naturally rounded, hand-sized cobble which has minimal evidence of use on one side. Light striations are visible, but grinding activity did not penetrate the calcium carbonate crust covering the surface to the stone below. The striations run perpendicular to the length of the artifact. Specimen 963-2422-SF3 is a portion of an oval to rectangular shaped rhyolitic cobble that was broken along one end, removing much of one side in the process. The unbroken side shows limited evidence of use, probably as a mano. The broken portion of the opposite side has been darkened either by proximity to a hearth or by a processing activity involving materials which were later baked on by heat.

Metates

The nine metates found at the Hoyt site show considerable variation in size, shape and manufacture. All but one were collected in the North Locus. Four are fragmentary (977-22-F-B-10-1, 977-22-H-C-9-1, 977-22-I-D-9-1, and 977-22-S-B-12-1), and little can be said about them other than they all are basalt and have flat, well worn grinding surfaces. Specimens 963-2422-SF1, 977-22-H-B-8-1 and 977-22-H-C-10-3 are all large fragments which have pecked, rounded edges. These fragments are made of scoria, basalt, and welded tuff, respectively. Two metates were fashioned from large bedrock slabs. Specimen 977-22-E-D-10-2 is a large basalt metate with a well worn grinding surface, identified as the principal component in Feature 1 at the North Locus. Specimen 977-22-SF1, made from reddish-colored welded tuff was surface collected at the North Locus. The artifact shows limited grinding use. The surface patination has been

removed from a 10x12 cm area, though the worn area shows minimal polishing. A small depression in one corner of the faceted surface may be evidence of occasional use as a hopper mortar.

Abraders

Abraders are implements used for a variety of tasks involving the shaping and sharpening of wood, bone, and stone tools. Four abraders were collected at the Hoyt site (Fig. 4.13); three of

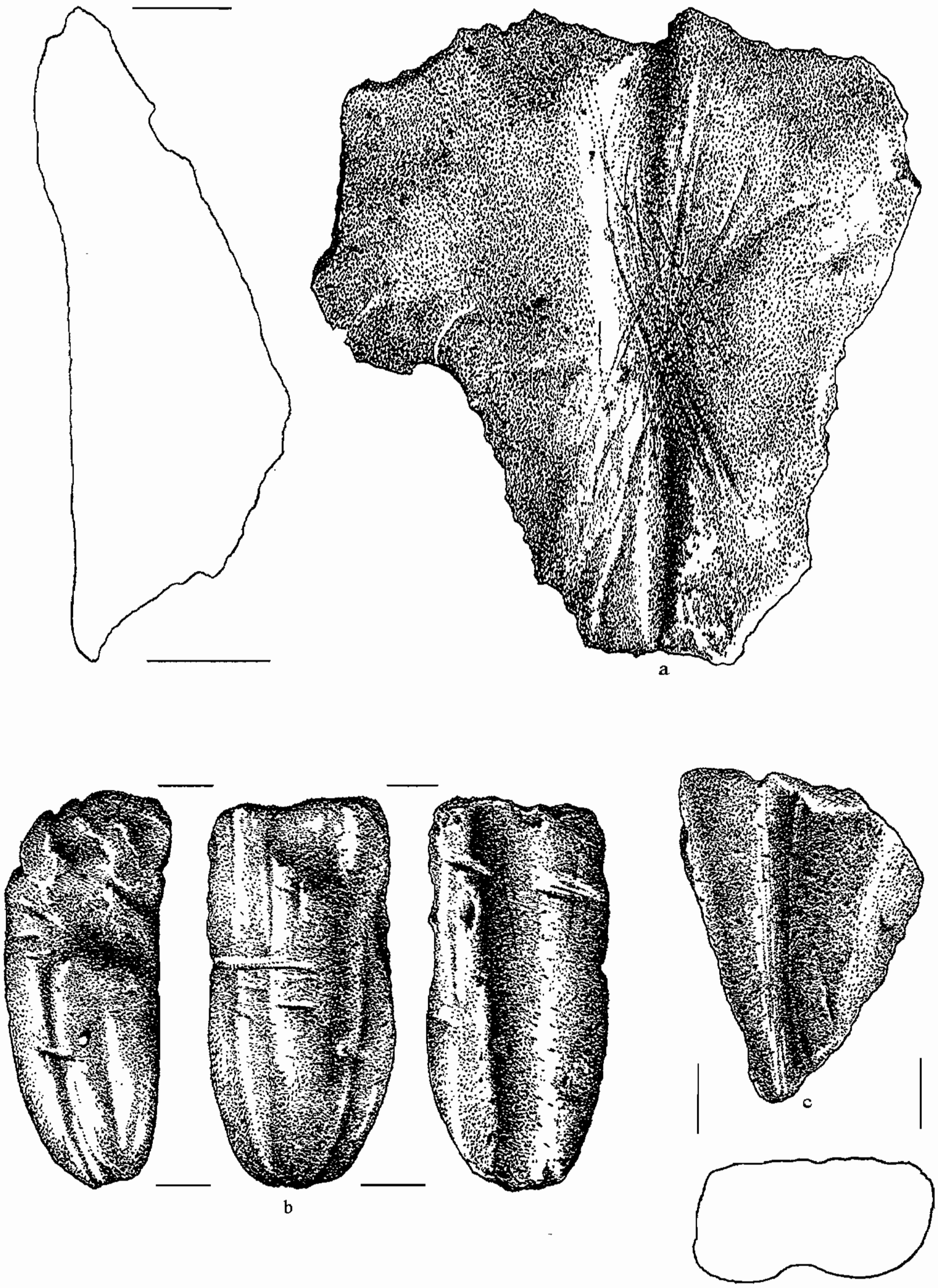


Figure 4.13. Abrading Stones from the Hoyt site, metric attributes in Table 4.11.
a. 977-22-J-D-9-2; b. 977-22-K-D-8-1; c. 977-22-J-A-7-1.

which were used specifically for abrading tasks, and one which was a mano that had a series of striations across one of its faceted surfaces. All abrading tools were manufactured from light, relatively soft tuffaceous material. Specimen 977-22-J-A-7-1 is a roughly triangular shaped fragment of welded tuff, unshaped except for a single smoothed surface with a U-shaped groove 11 mm wide and 2.5 mm deep running longitudinally across the artifact. The tool appears to have been hand-held, with abrading activities being conducted in a bidirectional motion. Specimen 977-22-J-D-9-2 is a relatively broad, flat fragment of tuffaceous material which has not been shaped by any means other than through abrading activities. The worked surface consists of a series of deep striations which have created a broad, shallow trough extending longitudinally across the surface of the artifact. Additional striations cross the main groove diagonally, overlapping it and creating an X-like pattern. The juncture where the striations meet is worn more deeply than the rest of the surface, perhaps suggesting that abrading activities were performed from the edge of the artifact inward and involved the sharpening or smoothing of small tool surfaces.

Specimen 977-22-K-D-8-1 is a narrow, tapered abrader with a longitudinal groove that is approximately 11.5 mm in width and 3 mm in depth. A narrow, incised notch runs transverse to the groove approximately 9 mm from the distal end. The grooved surface is smooth and level. The distal end of the abrader is a relatively flat, rough surface incised by three grooves crossing each other at varying angles. The remaining portion of the artifact is rounded, tapering toward the proximal end. Two crudely incised grooves extend longitudinally along both sides of the abrader, radiating from the proximal end and continuing to the distal end of the artifact. A single groove cuts perpendicularly across the longitudinal grooves on one side near the midline of the artifact. The other side is too battered to detect the presence of a similar mark. A mano (977-22-K-D-11-(1-4)), is mentioned here because it has striations on one surface that correspond to marks seen on more conventional abrading tools. The striations extend diagonally across the length of the artifact, radiating outward from a more concentrated area at one end of the mano Fig. 4.11). The mano was well made, with bifacial faceting and pecked and ground edges. Abrading was clearly a secondary use for this artifact.

Pestle

A single pestle fragment was recovered from Level 11 (50-55 cm) of Unit A in the North Locus. It is from a pestle that probably broke in half, then cracked lengthwise, leaving a fragment that may be representative of slightly more than a quarter of the original artifact. One end of the artifact is battered and flattened, the other end has an uneven surface due to unintentional fracture, with an edge that has either been pecked or worn to a slightly rounded smoothness. The surface of the pestle fragment has an indentation approximately 80 mm long, 45 mm wide, and 5-9 mm in depth, created by wear unrelated to its function as a pestle. The wear may have occurred after the artifact was broken. Pestles of a similar nature have been found at other locations in the Northern Great Basin and Plateau, including the Heath Cliffs site (Jenkins and Connolly 1996) Wildcat Canyon (Dumond and Minor 1983) and Lake Abert (Oetting 1989). Oetting (1989) noted the presence of red ochre on a similar pestle at Lake Abert, but does not specify if the pigment was found in relation to the surface depression.

Atlatl Weight

A single atlatl weight (977-22-F-C-15-2) was recovered from the North Locus, in Level 15 (elevation 1267.84 m) of Unit F (Fig. 4.12). The artifact is made of a reddish-orange welded tuff which has been fashioned into a somewhat cylindrical form through grinding and abrading. The atlatl weight has a ventral groove that extends the entire length of the artifact, varying between 1-3 mm in depth and 10-11 mm in width. The groove would have been positioned against the surface of the atlatl, with lashing around the rounded artifact exterior to hold it in place. The surface of the non-grooved portion has a smooth, almost polished appearance in places and fine striations run lengthwise. An incised notch is located 6 mm from the proximal end of the artifact. The notch is 3.3 mm wide and approximately 2 mm deep, and is the only demarcated lashing point on the weight. Two utilized flakes and three biface fragments were the only artifacts recovered in close proximity to the artifact.

Fragments

Three pieces are too fragmentary for classification to a particular category of ground stone. Specimen 977-22-D-B-12-2 is a well smoothed basalt fragment with a rounded edge and a flattened end. Specimens 977-22-H-C-8-1 and 977-22-H-C-8-2 are conjoining fragments of the same artifact which share one rounded edge and a flat, smooth surface.

Bone Tools

Three artifacts recovered from the Hoyt site appear to be bone tools (Table 4.13, Figure 4.12). Two of them are quite similar. Specimens 977-22-A-B-9-2 and 977-22-R-D-8-1 are small, thin fragments of very light-colored bone that have been shaped into tools of an indeterminate use. Both are highly polished and have rounded tips as well as rounded edges, which seems to indicate that they were not crafted for use as fish gorges.

The third tool is a fragment of a sharply pointed cylindrical artifact that has the appearance of a very large fish gorge. Manufactured from antler, the tool has a number of deep striations running primarily along the length of the artifact, but others which have the appearance of cut marks are incised diagonally across the artifact.

Table 4.13. Metric attributes of bone tool fragments from the Hoyt site.

Specimen	L	W	Th	Wt(gms)	Notes
977-22-A-B-9-2	10.6	2.8	1.0	<0.1	light colored polished bone
977-22-D-D-18-1	23.8	4.5	4.0	0.5	antler, gorge?
977-22-R-D-8-1	15.8	3.3	1.8	0.1	light colored polished bone

Botanical Remains

An analysis of botanical remains from the Hoyt site was conducted by Guy Prouty (Prouty 2006). The following information has been adapted from his original report. The sample was derived through the flotation of 12 bulk soil samples that were collected during excavation of the site as feature and column samples.

Preservation of botanical remains was considered to be poor in all portions of the site. Prouty attributes this to the effects of deflation, erosion, bioturbation, and other natural site formation processes, but also suggests that sporadic occupations may have limited the amount of material initially deposited. Sagebrush fuel wood was the only clearly identified material from the site. Bark, grass seeds, and other seeds were fragmentary or distorted, and thus were not identifiable to the species level. Potential food items such as processed edible plant tissues (PET) and biscuit root were not identified with certainty, only at trace levels (Table 4.14).

Feature 1, the hearth around which the majority of the cultural materials are concentrated, produced small amounts of sagebrush fuel wood. A bark fragment and two grass seeds were also noted in the hearth samples, but were not identified as clearly being cultural material. Although sporadic occupation of the site is considered as a possible reason for the general lack of plant materials, the abundance and diversity of cultural materials, including the recovery of over 17,000 pieces of bone at the Hoyt site suggests otherwise. Plant processing tools were found in limited quantities at Hoyt, but were relatively abundant at the nearby Morgan site where botanical remains were similarly low. It is possible that the Hoyt site was occupied at a time when plant species were not being targeted, but that does not explain the lack of those materials at the Morgan Site, where a considerable number of ground stone fragments were collected. It seems more plausible that the preservation qualities of the Sand Hills are not good for long term deposition of plant remains.

Table 4.14. Plant remains at the Hoyt site.

Locus	Provenience	Taxa	Use	Quantity
North	Unit E, hearth	sagebrush	fuel	0.25 grams
		unidentified bark	-	trace
		unidentified grass seeds	-	2
	Unit E, Column 3	sagebrush	fuel	trace
		unidentified charred seed	-	1
		possible biscuit root	food	trace
South	Unit T, Feature 3	sagebrush	fuel	0.20 grams
		unidentified seed frags	-	5
		possible PET	food	13 frags
	Unit T, Column 1	sagebrush	fuel	trace
		possible PET	food	trace

PET=processed edible tissue

Faunal Remains

Vivien Singer conducted the zooarchaeological analysis of 17,394 vertebrate faunal remains and nine pieces of eggshell recovered from the Hoyt site, utilizing the Oregon State Museum of Anthropology comparative collection and the comparative avian collection housed at Heritage Research Associates. Singer used a system of classification that incorporated identification to the lowest possible taxonomic level when possible, or identification to a particular size class (Figure 4.14, Table 4.14). The faunal remains were quantified by the number of identifiable specimens per taxon (NISP). Postcranial remains of rodents were classified as "Unidentified Rodentia" due to the difficult and time consuming nature of further identification. All of the bones were examined for indications of burning, rodent and carnivore gnawing, butchering scars, and weathering or other natural taphonomic alterations.

The majority of the bone from the Hoyt site was mammalian. A total of 12,196 specimens (70.1% of the assemblage) was assignable to the mammalian class, including 10,623 that could not be identified further (87.1% of the mammalian bone). Most of the bones were extremely fragmented. There were 502 pieces of mammal bone (4.1%) that could be further categorized into bone/animal size classes and 1071 (8.8%) were identified at least to the taxonomic level of order.

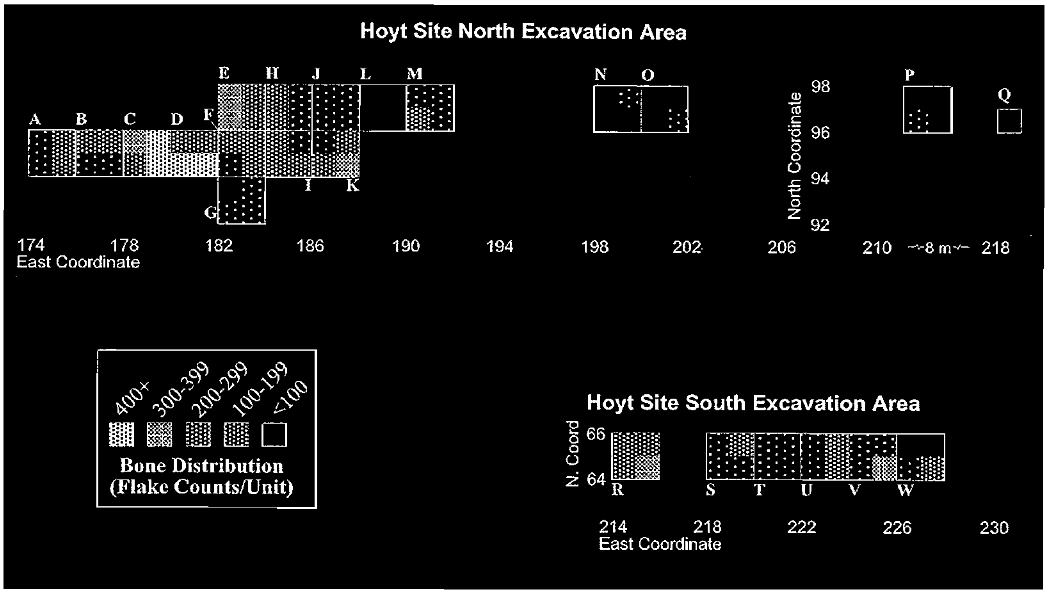


Figure 4.14. Distributions of faunal remains, all units.

Rodent and leporid remains were ubiquitous at the Hoyt site. Rodent bones, including ground squirrels (*Spermophilus* sp.), pocket gophers (*Thomomys* sp.), voles (*Microtus* sp.), mice(*Perognathus* sp.), and Ord's Kangaroo Rat (*Dipodomys ordi*) were the most common specimens identified at the site. Lagomorphs, including cotton-tails (*Syvilagus* sp.), Pygmy Rabbits (*Syvilagus idahoensis*), Black-tailed Jackrabbits (*Lepus californicus*), and possibly White-tailed Jackrabbits (*Lepus townsendii*) were the second most common taxon at the Hoyt site. These were followed by artiodactyls, canids, and insectivores.

Although only 12 artiodactyl bones were identified, there were 361 Class 5 (large mammal) bone fragments, which are generally associated with deer, pronghorn antelope, or mountain sheep. This size class can be problematic due to the location of the site on livestock pasturage where large domestic animal bones may be incorporated into the archaeological deposits. However, at the Hoyt site, the majority of the large mammal bones were recovered from the main excavation block at the North Locus, including all but one of the artiodactyl fragments. The outlying units at the east end of the North Locus (which are located in the same pasture land as the main excavation block) yielded only two pieces of Class 5 bone and none of the identified artiodactyl remains.

Avian remains included surface-feeding ducks (Anas sp.), diving ducks (Aythya sp.), grebes (Podiceps sp.), and passerines (Passeriforms). Bird remains were never concentrated, but they were recovered from all units in the main excavation block at the North Locus, and from four of the six units at the South Locus. No bird bones were collected from Units N-Q; the outlying units at the North Locus.

Only 20 fish bones were recovered from deposits at the Hoyt site, half of which were identified as Tui Chub (*Gila bicolor*). Fish remains were concentrated in the main excavation block at the North Locus, particularly in Units B, C, and D. The South Locus produced only a few specimens.

Over half of the 492 amphibian remains were identified as Great Basin Spadefoot Toad (*Spea intermontana*), and the rest of the amphibian bones were probably the same. Two reptile bones could not be identified further.

Table 4.15. Inventory of faunal remains recovered from the Hoyt site.

Taxon	Common Name	Totals NISP	%
Mammalia			
Artiodactyla			
Unidentifiable Artiodactyla		12	0.07
Rodentia			
Spermophilus sp.	Ground Squirrel	153	0.9
Perognathus sp.	Pocket Mice	3	0.02
Thomomys sp.	Pocket Gopher	12	0.07
Microtus sp.	Voles	46	0.3
Dipodomys ordi	Ord Kangaroo Rat	2	0.01
Sciuridae	Squirrels	4	0.02
Unidentified Rodentia	Rodents (small-sized)	724	4.2
Carnivora			
Canis familiaris	Domesticated Dogs	6	0.03
Lagomorpha			
Lepus sp.	Hares	35	0.2
Syvilagus idahoensis	Pygmy Rabbit	11	0.06
Syvilagus nuttalli	Mountain Cottontail	4	0.02
Leporidae	Rabbits and Hares	57	0.3
Insectivora			
Scapanus sp.	Moles	2	0.01
Class I		2	0.01
Class II		16	0.09
Class III		117	0.7
Class IV		6	0.03
Class V		361	2.1
Class X	Unidentifiable Mammal	10623	61.0
Aves			
Podicipediformes			
Podiceps sp.	Grebes	2	0.01
Anseriformes			
Anas sp.	Surface-feeding Ducks	7	0.04
Aythya sp.	Diving Ducks	1	0.0
Anatidae (duck-sized)	Ducks, Geese, Swans	9	0.05
Falconiformes			
Accipitridae	Hawks, Kites, Eagles	1	0.0
Passeriformes	Perching Birds	12	0.07
Unidentifiable Bird	14	0.08	
Pisces			
Cypriniformes			
Gila bicolor	Tui Chub	10	0.06
Unidentifiable Fish		10	0.06
Amphibi			
Spea intermontana	Great Basin Spadefoot Toad	260	1.5
Anura	Frogs and Toads	232	1.3
Reptilia			
Reptilia	Reptiles	2	0.01
Unidentifiable Bone		4638	26.6
Egg shell		9	0.05
Totals		17403	

Summary

The Hoyt site is located on the south side of Sand Hill. Its placement provides a commanding view of the marshland surrounding Poison Creek Slough, facing southward and continuing from near the crest of the hill downslope to the east and south. Excavations at the site included an upslope North Block and downslope South Block, which were examined for possible differences in occupation functions based on their topographical locations. None were found, and it appears that the site has a single major component. Calibrated radiocarbon dates of 280 BP from a charcoal stain in the South Block, and 1830 BP from a hearth associated with a blackened metate may reflect the major period of possible occupation episodes at the site, though these dates probably do not reflect the entire range of occupations.

A total of 32 projectile points was collected, which included 27% Rose Spring, 6% Eastgate, 22% Side-notched points (including both large and small side-notched), 25% Elko Series, and 3% Humboldt Concave Base. Two types of projectile points fit more readily in Columbia Plateau typologies, including an Expanding Stem-3 which comprised 3% of the total, four Contracting Stem-2 points (13%), and one Contracting Stem-3 at 3%. All of the diagnostic points were collected in the North Block except for one Northern Side-notched and one Elko Eared point. Projectile types were vertically mixed, especially around the hearth (Feature 1). All of the sourced Rose Spring, Side-notched, and Contracting Stem-2 obsidian artifacts originated from the Burns source or from sources further north. The Elko Series points came from the Burns source, two unidentified sources, and from the Beaty's Butte and Massacre Lake/Guano Valley sources far to the south.

Utilized flakes were the most abundant tool category at the Hoyt site, accounting for 40% of the assemblage. Formed tools comprised 38%, followed by ground stone at 7%, cores at 6%, and abraders at 1%. Bone tools accounted for 1% of the total, and one atlatl weight was collected. The diversity of tools, especially the inclusion of bone tools and abraders along with well-formed ground stone fragments, suggests that the Hoyt site may have hosted occupational episodes that were more prolonged in duration than the other temporary camps included in this report.

Obsidian hydration analyses conducted on 108 Burns Butte and Dog Hill artifacts from the Hoyt site revealed a similar pattern to those analyzed from the Morgan site. Hydration occurred much faster at these locations in comparison to other similarly aged Northern Great Basin sites due to the rapid adsorption characteristic of obsidian from the two sources. Rim measurements ranged from 3.2 to 6.2 microns, with peaks at 4.5 and 5.5 microns, and a mean frequency of 4.9 microns.

The Hoyt site faunal assemblage is characterized by an orientation towards primarily terrestrial species and big game, with a lesser emphasis on marshland and aquatic species. A total of 17,394 animal bones were collected at the Hoyt site, along with nine pieces of eggshell. Rodent remains were the largest category of identified remains at the site, making up 63% of the total, followed by artiodactyl and large mammal bones at 25%. Lagomorphs comprised 7%, and birds, including both surface feeding and diving ducks made up 3% of the assemblage. Fish remains were recovered in small quantities (<1%), of which half were tui chub. Eggshell accounted for <1% of the remains, and may indicate some use of the site during the spring. The vast majority of the large mammal, bird, and fish bones were recovered in the North Block, while rodent and leporid bones dominated the South Block.

Botanical remains from the site were very limited. Feature 1, the 1890 year old hearth associated with a metate, produced an abundance of sagebrush charcoal probably used as fuel and a few unidentifiable seed fragments. The charcoal stain dated to 220 BP produced similar materials. A fragment of what appears to be charred biscuitroot was the only other identifiable material recovered from the macrobotanical samples.

Overall, the Hoyt site appears to have been occupied primarily for the exploitation of both large and small game, with an emphasis on terrestrial species. Aquatic species were very limited, but included both surface and diving ducks, and some fish. The diversity of both projectile point types and formed tools, the high quantities of large mammal bone, the limited assemblage of ground stone and the lack of identifiable plant food remains all seem to support the notion that the Hoyt site served as a foraging base camp from which forays for the procurement of animal and (to a lesser degree) plant resources originated.

CHAPTER V
HINES SITE (35HA2692)

Data recovery excavations at the Hines site (Fig. 5.1) occurred in September of 1997. Pettigrew (1986) recorded two sites in the vicinity; H-1 and H-2. The Hines site is H-2 under Pettigrew's designation. The H-1 locality, approximately 0.4 km to the north, was destroyed by commercial developments. The data recovery excavations reported here were guided by a data recovery plan based on the results of testing at the site in May of 1997 (O'Grady et al. 1997). Backhoe trenches and unit excavations permitted archaeologists and geomorphologists to interpret the site in both cultural and physical contexts. It was recommended in the data recovery plan that up to 60 m^2 of deposits be excavated at three locations; the North, Central, and South Loci, as they will be referred to in the following report. The three loci were established in concentrations of cultural materials identified by the testing phase. Cultural materials proved to be limited vertically in the North and South loci. Consequently, efforts were concentrated on two excavation blocks in the Central Locus, termed the North and South Blocks. The total area excavated was 54 m^2, resulting in the removal of 24.0 m^3 of fill.

Excavation Stategies

Testing

Test excavations at the the site in May, 1997 included three 1 x 1 meter test pits and twenty-six 50 x 50 cm probes (Jenkins 1997). The surface and upper 5-10 cm of deposits had been previously disturbed when shrubs and other vegetation were removed and the surface of the site leveled with a grader to create a parking lot used for observing Fourth of July fireworks displays over the sewage treatment ponds in the 1970s.

The remaining upper levels of the site, in which most cultural materials were found, consist of a medium gray to brown sandy silt, ranging from 35 to 70 cm in depth. Underlying this silty deposit is a very compact, sterile deposit of light colored, bedded layers of gravelly,

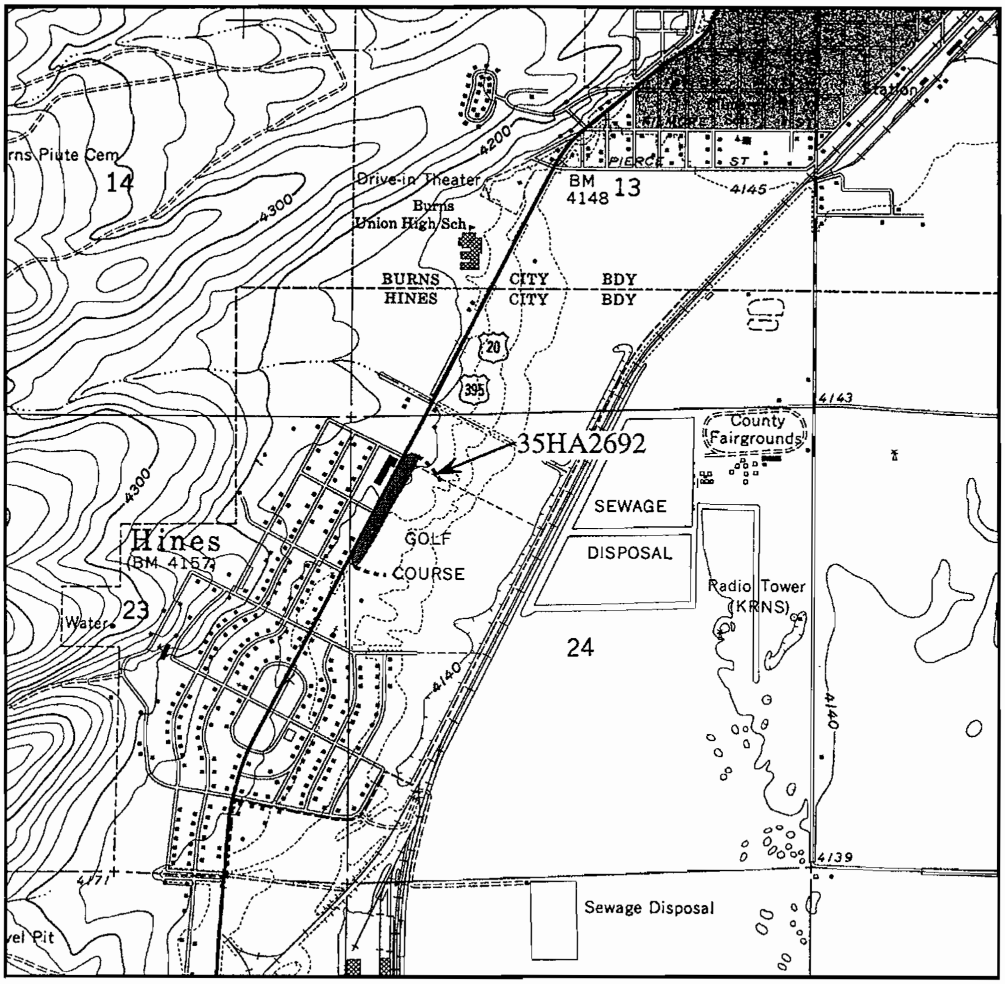


Figure 5.1. Location of the Hines site (35HA2692).

sandy-silt "hard-pan", possibly of Pleistocene lake origin. These bedded layers appear to represent lacustrine deposits from a time when Pleistocene lake levels rose above the elevation at which the site occurs. They have since been slowly buried by Holocene fluvial and eolian activity. Archaeological testing confirmed that significant cultural deposits at the Hines site were located between the Central and South Loci (Figure 5.2). While lithic debitage counts seldom exceeded 400 flakes per cubic meter in the 50 x 50 cm probes, two of the three test pits produced greater quantities.

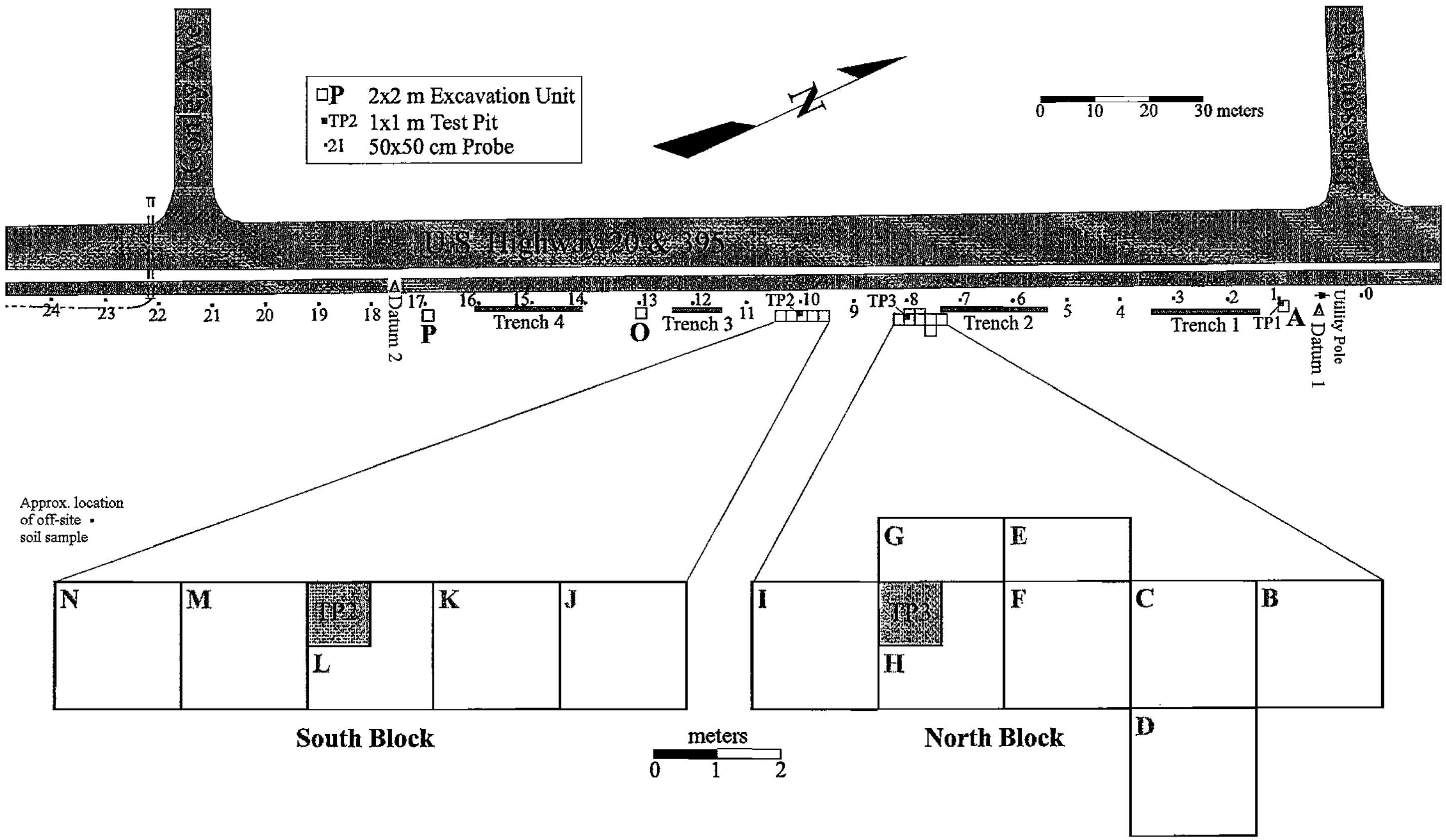


Figure 5.2. Hines Site trenches, probes, and excavation units.

Test Pit Two yielded 322 flakes in Level 6 (up to 3220 flakes/m^3) and Test Pit Three produced 109 pieces of debitage (up to 1090 flakes/m^3), a CCS projectile point tip, and a CCS utilized flake in Level 2 alone.

Temporally diagnostic artifacts from the testing phase included one Rose Spring and one Eastgate projectile point made of obsidian, and one basalt Elko Eared projectile point. Another Elko Eared point made of obsidian was collected from the surface. It was found in an area where the soil had been amended with fill from a motel development 0.4 km to the north, and the point may have been transported from that location. The projectile points suggest that occupations in the site vicinity may have spanned the last several thousand years. Other artifact types included one obsidian biface fragment, one CCS projectile point tip, one obsidian and one basalt uniface, two obsidian utilized flakes, one core, and 1332 pieces of lithic debitage. Also recovered were burned and unburned faunal remains, including bones of various small mammals and birds. Charcoal from an apparent hearth that was collected and submitted for radiocarbon dating yielded an age determination of 1160 ± 50 BP (Beta-105663). Fire altered rock was noted but not collected. Observed flakes from lithic reduction activities ranged from small biface-thinning flakes to fragments of raw nodules with cortex.

Data Recovery

Data recovery excavations at the Hines site were located in the right-of-way established for improvements to U.S. Highway 20. The right-of-way consisted of a 10 meter wide strip of land that paralleled Highway 20 and the adjacent bicycle path. Trenching and excavations were established in a linear pattern alongside the bike path. A vacant lot is located east of the site between the highway and the golf course. The majority of the site deposits are believed to lie to the west, covered by the bike path, highway, and the parking lot of a motel.

Four backhoe trenches were excavated to assess geomorphological relationships between cultural and non-cultural deposits at the site (Figure 5.2). The trenches were established at selected locations between the excavation blocks and more isolated excavation units. A small amount of debitage was evident in the backhoe backdirt piles, but there was no evidence that trenching had affected obvious cultural features at the site. Trench 1 was the northern-most, extending 25 meters between Unit A and Trench 2. Trench 2 was 20 meters south of Trench 1 and 20 meters in length, with its south end adjacent to Unit B in the North Block of the Central Locus. Trench 3, nine meters south of the South Block of the Central Locus, was nine meters in length. Trench 4 was 17 meters south of Trench 3 between Unit O and Unit P, extending for 20 meters. All trenches were dug four meters south of the bike path, following the path of the test probes.

The four trenches cut across the toe of a substantial alluvial fan upon which the Hines site is situated, originating on the slopes of nearby Burns Butte. Gravel lenses within the deposits suggest that a small channelized stream now located approximately 0.8 km to the north once passed through the location. The site also appears to be situated at the edge of an ancient lake shoreline (according to Pettigrew [1986] Pluvial Lake Malheur filled Harney Basin as recently as 9000 years ago), but fluctuations in precipitation levels over the course of the Holocene make it difficult to determine what the lake level might have been at the time of site occupation.

Prior to excavation, an arbitrary datum was established on the bike path, a high point from which a grid system could be controlled for the entire site. Using a Topcon GTS-203 total station, coordinates for the datum were set at 500N/500E, with an initial elevation of 100 meters. The individual excavation units and backhoe trenches were then tied into the overall grid system. Unit coordinates have been replaced by letter designations for this report. Individual elevation datums were shot in for the excavation units and vertical control during excavation was maintained by the use of level lines attached to the datum stakes.

A total of 16 units was excavated during data recovery at the Hines site, including thirteen 2x2s meter pits, two 1x2s, and one 1x1. A single 2x2 was dug at the Northern Locus. The Central Locus was composed of both the North Block, a cluster of six 2x2s and two 1x2s, and the South Block, which consisted of five 2x2s. The South Locus included one 2x2 and one 1x1 meter unit. Excavation loci were expanded or terminated depending on the quantities of cultural materials that were collected during the process of excavation. The investigation of peaks in artifact quantities noted at the North and South Loci during the testing phase revealed thin deposits containing no diagnostic artifacts. Units at these loci were consequently terminated so that efforts could be concentrated on the more productive excavation blocks in the Central Locus. The results of the data recovery efforts at each locus are described in detail below.

The Northern Locus

The North Locus was sampled by three probes and a 1x1 test pit during the testing phase (Fig. 5.2). A Rose Spring projectile point was recovered from Probe 1. The upper 5-10 cm of deposits were heavily compacted due to the unit's location in a driveway leading on to the property and historic materials infiltrated the first 20 cm of fill. The subsequent excavation of Test Unit 1, adjacent to Probe 1, resulted in the recovery of 96 pieces of lithic debitage scattered through one cubic meter of deposits. Probe 0, 10 meters north of Probe 1, yielded the third highest peak in debitage during testing. Probe N1 was located 90 meters north of Probe 0, where a light scattering of debitage was observed. No formal artifacts were recovered from the excavation. The results from the above mentioned test excavations led to the determination that data recovery was necessary in the vicinity of Probe 1.

A 2 x 2 designated Unit A represents the extent of the data recovery excavations in the Northern Locus. The previously excavated Test Unit 1 was incorporated into Unit A as Quad C, thus only Quads A, B, and D were removed during data recovery. Excavations in these three quads continued into the seventh level (30-35 cm), with only Quad A dug deeper thereafter, due to declining quantities of cultural materials in the other quadrants. The upper 25 cm of deposits consisted of light gray-brown silts that contained an abundance of small angular gravel and red cinder derived from the nearby highway. The red cinder was probably used to "sand" the highway during icy winter conditions, and fine grains of the material cast a pinkish hue throughout the first 15 cm of deposits. Historic debris occurred only in the first 15 cm at the North Locus. Rounded, water-borne gravels increased after 25 cm, and the light gray-brown fill took on a darker, more uniformly brown coloration. The fill became more compact, and the presence of subangular gravels, sand, and obsidian nodules became more pronounced with increased depth. The coloration of the fill lightened, changing from pale brown to tan at approximately 55 to 60 cm below the surface as the excavators approached the basal hardpan. Test Unit 1 was the only unit in the Northern Locus that cut into the hardpan. The hardpan itself was an extremely compact, cemented layer of calcium carbonates, gravels, and cobbles primarily of volcanic origin. The matrix was very dense and resisted all but the most concerted efforts to break it up with pickaxes. The calcium carbonate-bound fill continued past one meter in depth, at which point the test unit was terminated. No artifacts were found in the hardpan.

Cultural materials recovered from Unit A included 46 pieces of bone and 221 pieces of lithic debitage, of which 97.3% was obsidian, 1.4% was CCS, and 1.4% was basalt. No tools were collected from Unit A, and no cultural features were encountered. Only a trace of charcoal was noted, which occurred in Level 5, 20-25 cm below the surface. The Rose Spring projectile point found in Probe 1, just east of the unit, may be an isolate, though an obsidian core was also recovered from Probe 0, ten meters to the north. Debitage was first encountered in Level 3 (10-15 cms) and peaked in Level 7 at 28 flakes. Debitage counts declined after Level 7, but a few flakes were recovered in every level through Level 12, when the unit was discontinued upon encountering the hardpan layer. Debitage recovered from the hardpan boundary had to be carefully examined for percussion platforms or patination because the pickaxe used on the hardened earth frequently shattered obsidian nodules imbedded in the matrix, creating new flakes.

The Central Locus

The Central Locus yielded the highest concentrations of artifacts at the site during the testing phase and again during data recovery. Two excavation blocks were established to explore the issue of possible multiple components at this locus. The North Block was situated at a location believed to contain a single cultural component at approximately 99.80 to 99.60 elevation 15-35 cm below the surface (Table 5.1). The South Block (Table 5.2) appeared to contain a cultural component approximately 15-30 cm below the surface (elev. 99.40 to 99.10), as well as a lower component 40-60 cm below the surface (elev. 99.10 to 98.85).

Connolly (see Appendix) conducted a statistical analysis of obsidian hydration rinds on artifacts from the North and South Blocks. He found that artifacts from the North Block had on average thinner hydration bands (approximately 2.7 μ) than those from the deeper deposits of the South Block (over 5.0 μ), indicating that an earlier occupation had taken place in the area of the

South Block. The North Block (Fig. 5.3) was the most intensively used portion of the site and both the projectile point types and the hydration readings support the 1060 BP radiocarbon date from Feature 1. The South Block (Fig. 5.4) contained a thin overlay of late Holocene artifacts including Rose Spring points (the Late Component). Beneath this lay a considerably deeper deposit of debitage, bifacial tools, and utilized flakes (the Early Component) that may be attributable to a period of activity between 2000-4000 BP (Appendix). The benefit of employing obsidian hydration readings as a regular aspect of the archaeological analysis is clear in this example. The absence of dateable organic materials in the Early Component,

Table 5.1. Artifact distributions in the North Block.

Variety		Unit B	C	D	E	F	G	H	I	Total
Chipped Stone:										
Projectile Points										
Rose Spring		2	4	1	3	4	1	1	2	18
Eastgate		-	-	-	1	2	-	-	-	3
Elko Eared	-	-	1	-	-	-	-	-	1	
Proj. Point Fragments										
Tips		-	3	1	1	1	1	1	-	8
Midsections		-	-	1	-	-	-	1	-	2
Tangs/Stems		-	1	-	1	1	-	-	-	3
Other Tools										
Drills		-	-	-	-	1	-	1	1	3
Awls		-	1	-	-	-	-	-	-	1
Bifaces		3	4	3	2	5	2	4	5	28
Cores		-	-	-	-	4	1	-	1	6
Util. Flakes		7	6	22	14	26	22	29	21	147
Debitage										
Obsidian		1282	1337	1300	1003	2607	1171	1846	1051	11,597
Basalt		56	30	9	16	65	28	29	60	293
CCS		36	9	17	10	5	45	10	181	313
Groundstone:										
Metates		-	-	1	1	1	-	2	5	1
Manos		-	-	1	-	-	-	-	-	1
Mano Frags		1	-	-	-	-	-	-	-	1
Fragments	4	-	4	2	1	-	-	-	11	
Abraders		-	-	-	-	1	-	-	-	1
Bone:										
Tools		-	-	-	1	-	-	-	-	1
Fragments	200	217	190	47	594	47	107	33	1435	
Total		1591	1612	1551	1102	3362	1278	2066	1189	13,751

Figure 5.3. The North Block of the Hines site, shown facing north.

coupled with its lack of temporally diagnostic artifacts, would have relegated the discussion of this component to the realm of conjecture, prior to the advent of obsidian hydration studies. In the Harney Basin, where radiocarbon dates prior to 2000 BP are uncommon, hydration readings should prove to be an important tool for understanding the cultural stratigraphy of sites.

The North Block of the Central Locus was composed of six 2x2 and two 1x2 meter units (Fig. 5.5). The highest concentrations of cultural deposits in the North Block began within 10-15 cm of the surface and were present in the following 15-20 cm of fill, rapidly declining in quantity as excavators approached the hardpan. The upper 10-15 cm of deposits were the most disturbed portion of the stratigraphy, in part due to the heavy equipment leveling and shrub removal previously mentioned. The deposits were loose sandy silts that were a dark grayish-brown in color with an abundance of road gravel, cinders, and recent historic debris. A medium brown layer of fine, moderately compacted silts was noted beneath the disturbed fill, extending to a depth of approximately 20 cm. This contained the majority of the cultural remains and the charcoal from which the radiocarbon date was derived. A third stratum of very compact brown sandy silt containing increased amounts of subangular gravels and obsidian nodules is situated beneath the second layer of fill, between 20-45 cm below the surface, followed by a 10 cm band of silty clay just above the hardpan. Excavations in the North Block varied in depth from 30 to 60 cm depending either on time constraints or the abundance of cultural remains.

The excavations initially focused around Unit H, which contained the test pit where a small temporary hearth feature dating to 1060 BP was located. The abundance of cultural remains encountered in Unit H encouraged the further exposure of deposits to the north and east. Although 28 square meters of deposits were exposed, no additional cultural features were identified. However, there appears to be at least one and possibly two associated concentrations of artifacts at this location. These concentrations center around areas of charcoal-flecked soil that may represent the ephemeral remains of temporary fire hearths. Items recovered here include Rose Spring and Eastgate projectile points, one Elko Eared point, drills, a CCS awl, bifaces and biface fragments, utilized flakes, mano fragments, a metate and metate fragments, and fire-cracked rocks. A total of 12,071 pieces of debitage was recovered from the North Block, including obsidian (96.1%), basalt (2.4%), and CCS (1.5%). Analysis of the animal remains from the North Block showed high concentrations of rodent, bird and fish bones (the only fish bones present at the entire site).

The South Block of the Central Locus consisted of five 2 x 2 meter units that were conjoined to form a linear trench running north to south. The impetus for excavation at this location was provided by the recovery of 322 pieces of debitage in Level 6 of Test Pit 2, 50-60 cm below the surface. The flakes indicated the presence of relatively deep, potentially rich deposits. Unit L was positioned over the location of Test Pit 2, with the test pit occupying the location of Quad C. Units were established to the north and south of Unit L in anticipation of following whatever features might be present there. The surface elevations at South Block sloped gently to the south, losing 20 cm of elevation over the course of eight meters. The initial 10 to 20 cm of deposits at the South Block were affected by recent human activity, and bioturbation due to rodent and possibly badger activity was more extensive here than at any other portion of the site.

The surface deposit at the South Block consisted of a thin (5 cm), and very disturbed band of brownish-gray sandy silts composed of as much as 30% angular road gravels and cinder. This deposit covered a second layer (20-25 cm thick) that was a light gray-brown and similar to the overlying fill, but composed of more compacted silts mixed with subangular gravels which increased in concentration with depth. Historic debris was present to an depth of 45 cm in most units, reaching 60 cm in Unit J and 65 cm in Unit L. A transition occurred at approximately 30

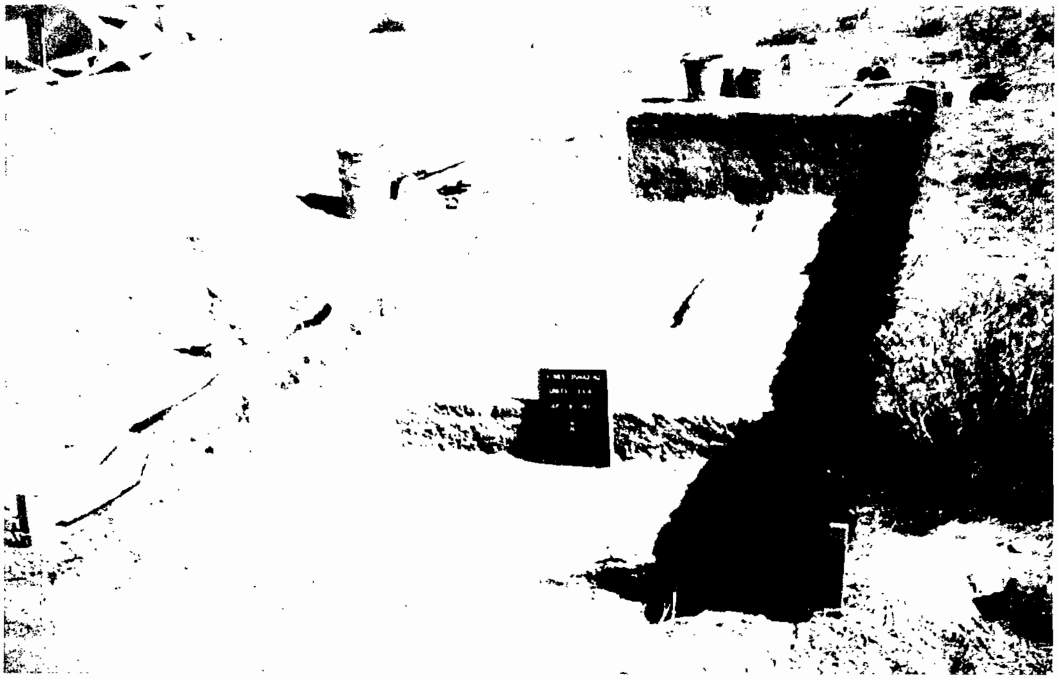


Figure 5.4. The South Block, shown facing north.

cm. The underlying light gray fill developed a very dense structure due to a high clay content, 30-35% subangular gravels, and binding of the matrix caused by an increased level of calcium carbonates. The early component occurred primarily in the lower 10 cm of these deposits, just above the hardpan. The light tan calcium carbonate-laden hardpan deposits became evident at approximately 50 cm beneath the surface. Excavations averaged 60 cm in depth (elev. 98.85 m), ceasing as the deposits graded into the undulating surface of the hardpan. Trenching and excavation of the earlier test pits had revealed that no cultural deposits were to be anticipated below the hardpan.

Lithic debitage was found in relatively high quantities throughout the deposits of the South Block, with 7034 pieces (76%) recovered from the Early Component and 2267 (24%) from the Late Component. Chronologically diagnostic artifacts consisted of one Rose Spring and one Eastgate projectile point, both of which were found in the late upper deposits. Bifaces, utilized flakes, cores, and ground stone account for the remaining artifacts (Table 5.2). The Late Component yielded the only ground stone fragment at the South Locus, and seven of the eight

Table 5.2. Artifact distributions in the South Block.

	Unit											
	J		K		L		M		N		Total	
Variety	Early	Late	Early	Late	Early	Late	Early	Late	Early	Late	Early	Late
Debitage	212	621	305	458	3825	367	1678	562	1014	259	7034	2267
Bone	28	61	4	140	2	37	4	30	8	22	46	290
Utilized Fl.	2	5	2	5	8	5	2	3	3	2	17	20
Bifaces	-	2	-	2	1	-	-	3	-	-	1	7
Cores	-	1	-	1	2	-	1	-	-	-	2	3
Ground Stone	-	-	-	-	-	-	-	-	-	1	-	1
Projectile Pts	-	-	-	RS	-	-	-	-	-	RS	-	2
Total	242	690	311	607	3838	409	1685	598	1025	285	7100	2591

Key: RS= Rose Spring

biface fragments found there. Animal remains consisted primarily of low quantities of lagomorph and other rodent bones, for a total of 290 fragments. Only 46 fragments were collected from the early component, accounting for 13% of the total. While it seems apparent that lithic reduction was a key activity during the early occupation, the Late Component may be representative of a more generalized use of the site, with lithic reduction occurring alongside the procurement of plant and animal resources. It is also possible that the Late Component at the South Block is a portion of the more intensive occupation that appears to have been centered at the North Block, just ten meters away.

The Southern Locus

The Southern Locus produced two of the four peak concentrations of cultural materials during the testing phase. Unit O, measuring 2 x 2 meters, was excavated over the location of the second highest peak, approximately 20 meters south of the South Block of the Central Locus.

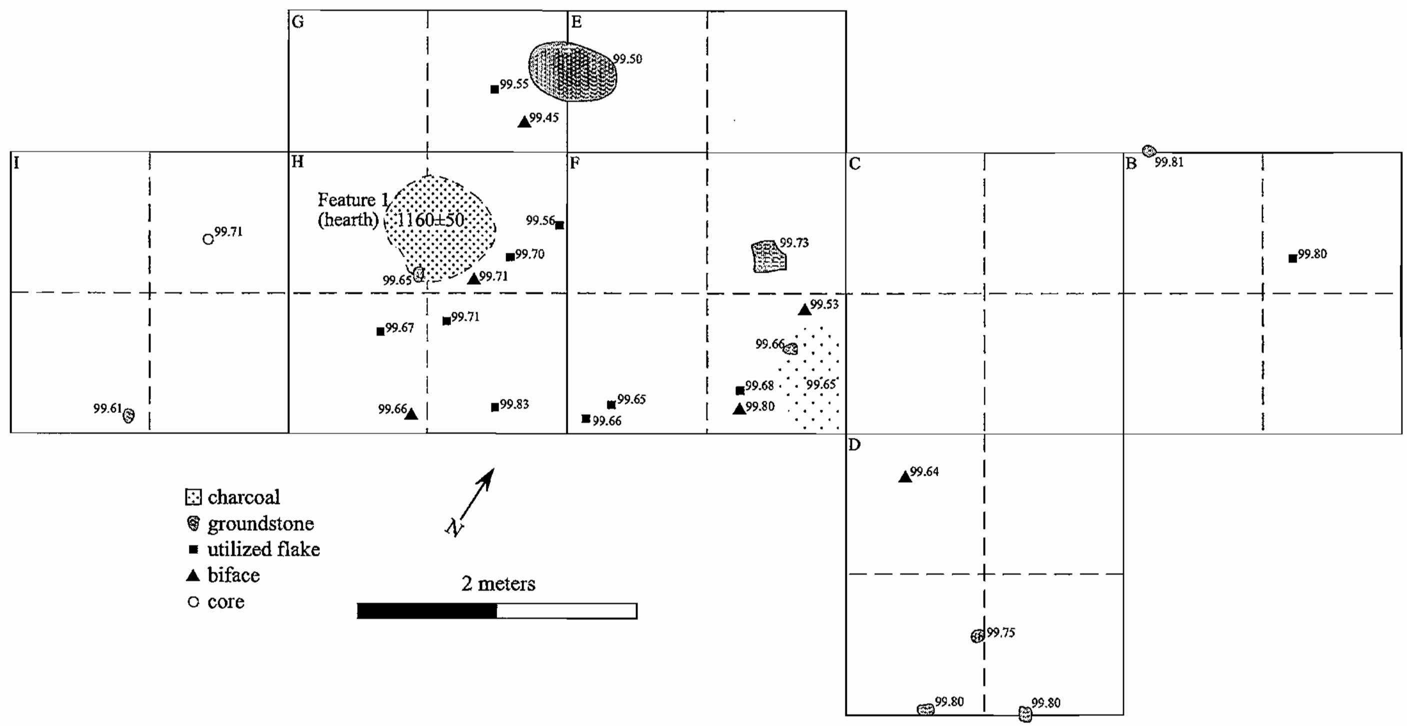


Figure 5.5. The North Block of the Central Locus, showing the location of Feature 1 and other artifacts.

Unit P, a 1 x 1 located 35 meters south of Unit O, was placed just west of the probe that yielded the fourth highest concentration. Neither of the units contained features, tools, or datable cultural debris. The sparse quantities of cultural materials at this location did not warrant an expansion of excavations beyond the two units. At both units, the fill graded from a gray-brown sandy silt in the upper levels to more compact light brown silts lower in the deposits. Disturbance was evident from earlier leveling of the site and road gravels were found intruded down into the fourth level (20-25 cm). The quantity and size variation in the natural gravels and cobbles initially increased with depth, but dropped off rapidly as excavators reached the hardpan. It is noteworthy that gravels and cobbles increased nearer the hardpan at the Northern and Central Loci, but not in the South Locus.

A total of two bone fragments and 764 pieces of lithic debitage was removed from Unit O including 45 flakes recovered from Probe 13 (in Quad C). Obsidian represented 94.2% of the debitage, followed by basalt (5.4%) and CCS (0.4%). The debitage count peaked in Level 5 (elev. 98.95-98.90) at 117 flakes, but counts were almost as high between levels 4 through 8 (elev. 98.95-98.75). Historic debris was noted from the surface through Level 8. Excavation was ended at Level 10 (elev. 98.70-98.65) as cultural materials declined in number. Unit P produced three bone fragments and 55 pieces of debitage, almost half (23) of which were recovered from Level 6 (elev. 98.40-98.35). Obsidian accounted for 89.1%, basalt 9.1%, and CCS 1.8% of the lithic debris. Rodent activity was noted through Level 7 (30-35 cms), and historic artifacts were collected in all levels. The unit was terminated at Level 9 (elev. 98.25-98.20) as the excavators approached the hardpan.

Features

A single radiocarbon date was derived from Feature 1, a hearth in the North Block of the Central Locus (Figure 5.5). The composite charcoal sample used for radiocarbon dating was extracted from soil collected in the hearth, which was the only cultural feature identified at the Hines site. It was located in Quads A and C of Unit H, occupying a shallow basin that had been scooped from surface deposits. The hearth was faintly defined by a slight darkening of the soil. The hearth was roughly oval in shape; approximately 80 cm in length (north-south) by 50 cm in width. It was first encountered about 20 cm below the surface at an elevation of 99.70 m. In profile, the charcoal stain was basin-shaped, attaining a depth of 10-15 cm. There were a number of artifacts recovered within a two meter radius of the hearth, including 10 projectile points, 10 bifaces or biface fragments, 76 utilized flakes, six cores, two pieces of ground stone, and one drill. The hearth feature contained little animal bone, which suggests that it was used for only a short time.

The charcoal flecking present in the hearth was visible during testing in May, when the fill was still moist from winter and spring precipitation. The soil sample was collected at that time from the third level (20-30 cm) of Test Pit 3. In September, when data recovery occurred, the soil was considerably drier and the feature was barely discernable as a faint gray coloration against the prevailing medium brown fill. After an initial treatment of alkalai and acid washes at Beta Analytic Inc., the charcoal sample was shipped to Lawrence Livermore National Laboratory where it underwent accelerator mass spectrometry, producing the date of 1060 BP reported above. Figure 7.5 shows the location of the feature amidst a concentration of artifacts, which lend further weight to the argument that the dated feature was indeed a hearth.

Artifact Assemblage

A total of 22,595 pieces of debitage was collected during the Phase III excavations. Obsidian was the primary tool stone employed at the site, comprising 97% (21,919 pieces) of the total assemblage. Basalt accounted for 2% (458 pieces), and CCS 1% (218 pieces) of the chipping waste. In all, 298 lithic tools and one bone tool were recovered from the Hines site. Utilized flakes were the largest tool category represented at the site, comprising 63.3% (n=189) of the total. Other tool categories included bifaces in varying stages of manufacture at 12% (n=36), diagnostic projectile points at 7.4% (n=23) and projectile point fragments at 5.7% (n=17), cores of obsidian and basalt at 3.3% (n=10), drills at 1.3% (n=4), ground stone at 6.4% (n=19), an abrader (0.3%) and a bone tool (0.3%).

Projectile Points

A total of 28 chronologically diagnostic projectile points and non-diagnostic projectile point fragments was recovered from the excavations at the Hines Site (Fig. 5.6, Table 5.3). The projectile points have been typologically classified according to a system established by Thomas (1981) for Monitor Valley in central Nevada.

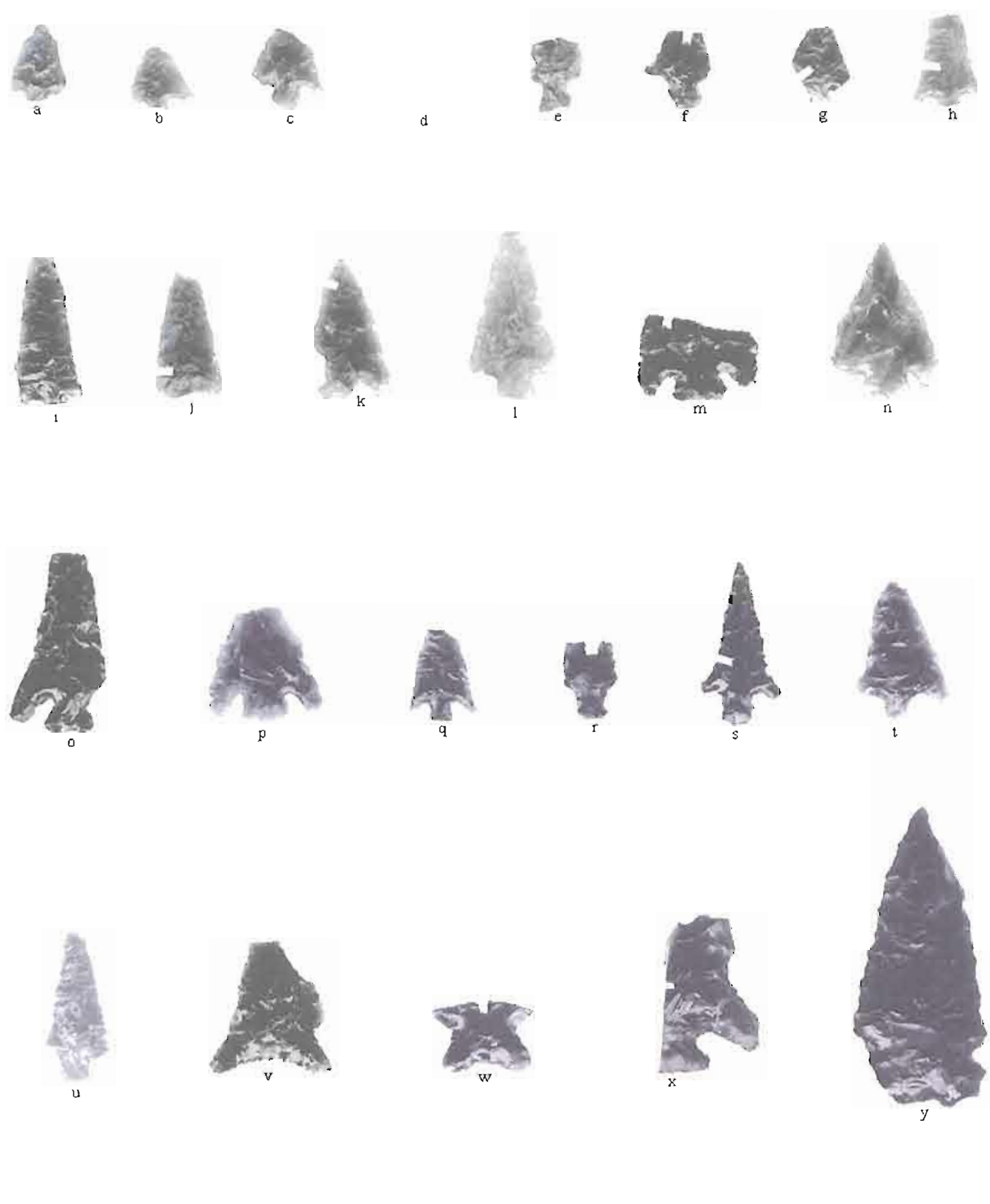
Obsidian was the primary material used at the Hines site. One diagnostic point (3.6%) was made of chert and no points were made from basalt. A total of 19 points were Rosegate Series (67.8%), five were Small Stemmed points (17.9%), three were Elko Series points (10.7%) and one was Northern Side-notched (3.6%). Only one of the Elko Series points was recovered from the excavation deposits; the remaining two Elko points and the Northern Side-notched point were surface collected in the general site location.

Small Stemmed Points. Five small corner-notched points lack the expanding stems characteristic of Rosegate Series points. Dumond and Minor (1983:170) characterize a "pinstem" point for the Columbia Plateau, which they describe as being straight stemmed and "...virtually round in cross section". Thomas (1981) does not include a category of this kind for the Great Basin. Four of the five points have straight stems and also have a neck width of <5mm; another hallmark of pinstemmed points under the classification scheme of Dumond and Minor (Table 5.3). However, the stems of these four points vary considerably in the degree of roundness that they exhibit. The remaining point has a slightly contracting stem. Although Dumond and Minor (1983) also describe a series of small contracting stem points in their Plateau typology, the presence of only one point matching this description prompts the placement of the two relatively similar point types into a single category of small stemmed points, rather than splitting them into distinct categories.

The Small Stemmed points co-occur with Rose Spring points in the upper levels of the North Block. Small Stemmed points were found in levels 2 through 6, while Rose Spring points were recovered from levels 1 through 7. Small Stemmed points were absent from deposits elsewhere at the Hines site, but three Rose Spring points were recovered north and south of the North Block. The limited spatial occurrence of Small Stemmed points within the larger site

Figure 5.6. Selected projectile points from the Hines site, shown actual size: Rose Spring, a-l; Eastgate, m-p; Small Stemmed q-u; Elko Series, v-x; Northern Side-notched, y.

a. 1070-92-C-c-3-1	b. 1070-92-C-b-3-2	c. 1070-92-B-b-4-1	d. 1070-92-I-d-5-1
e. 1070-92-F-a-5-1	f. 1070-92-C-a-5-3	g. 1070-92-E-b-7-2	h. 1027-P1-2-2
i. 1070-92-E-b-6-1	j. 1070-92-H-d-4-1	k. 1070-92-F-b-1-1	l. 1070-92-E-d-2-1
m. 1027-TP3-1-1	n. 1070-92-N-b-5-1	o. 1070-92-F-b-9-1	p. 1070-92-E-b-7-1
q. 1070-92-F-b-6-1	r. 1070-92-I-b-2-1	s. 1070-92-D-c-5-1	t. 1070-92-B-b-5-1
u. 1070-92-C-c-5-1	v. 1070-92-D-a-4-1	w. 1070-92-M-c-3-1	x. 1027-SF-1
y. 1070-92-SF-1			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boundaries suggests that these points may have been limited to a particular episode during the site's occupational history.

The obsidian sources for the Small Stemmed points are either adjacent to or west of the Hines site. The contracting stem point is from the Chickahominy source, which is located approximately 40 kilometers west of the site. One of the pinstem points is from the Riley source, some 30 kilometers to the west. The remaining three points came from sources very near the site; two from Burns Butte and one from Rimrock Springs, slightly to the northwest of Burns Butte.

Rose Spring and Eastgate Points A total of 18 projectile points can be classified as Rosegate, characterized by their small size (weight <1.5 grams), expanding stems, and a basal width less than 10 mm (Table 5.3). Thomas (1981:19) lumped the Rose Spring (Lanning 1963) and Eastgate (Heizer and Baumhoff 1961; Lanning 1963) point types together under one classification, but the two types are clearly dissimilar in both form and distribution, and in this report, Rose Spring and Eastgate are analyzed separately.

A total of four Eastgate points were recovered from the Hines site. Of these, three occurred in the North Block between 0-45 cm in depth; and one at a depth of 20-25 cm in the South Block. The Eastgate points were interspersed among both Rose Spring and Small Stemmed varieties in the cultural deposits, which suggests that the three projectile point styles were used concurrently. Two of the Eastgate point's obsidian tool stone (Specimens 1070-92-E-B-7-1 and 1070-92-N-B-5-1) originated from the Buck Springs source, associated with the Rattlesnake Tuff Formation. Rattlesnake Tuffs are widespread ash flows that originated from vents south of Harney Lake and continue north as far as the Blue Mountains (Skinner et. al 1998). One of the Eastgate

Table 5.3. Metric attributes for projectile points from the Hines Site.

Type	Catalog no. (1070-92)	Length (mm)	Width (mm)	Thickness (mm)	Wt. (Gr.)	Base Width	Neck Width	Source
				North Locus				
RS	1027-P1-2-2	14.6	10.3	1.7	0.3	-	3.3	B
				Central Locus				
				North Block				
PS	B-B-5-1	23.5	15.1	3.0	0.8	3.2	3.8	CH
RS	B-D-4-1	13.9	11.8	2.5	0.3	4.2	3.9	RRS
RS	C-A-5-3	12.2	9.9	2.8	0.4	5.3	4.4	B
RS	C-B-3-2	10.4	10.3	2.2	0.2	-	2.5	WWR
RS	C-C-3-1	12.9	8.3	2.0	0.2	-	3.1	RRS
LS	C-C-7-1	32.3	21.3	7.5	6.4	-	-	B
PS	C-C-5-1(C)	24.9	9.9	2.4	0.4	4.3	3.5	RRS
EE	D-A-4-1	19.7	14.2	3.8	1.2	18.3	12.7	OO
PS	D-C-5-1(C)	26.9	11.6	2.2	0.4	3.8	4.1	B
RS	E-B-6-1	24.5	10.0	2.7	0.6	-	3.4	RRS
EG	E-B-7-1	19.6	17.3	3.5	1.0	6.7	6.0	BS
RS	E-B-7-2	12.9	8.9	1.9	0.2	4.1	2.7	B
RS	E-D-2-1	28.2	14.2	3.5	1.0	6.4	5.4	BS
RS	F-A-5-1	11.3	7.2	2.3	0.2	5.4	3.5	B
RS	F-B-1-1	23.0	10.8	2.3	0.6	5.1	4.1	B
EG	F-B-9-1	29.6	12.4	3.4	1.2	4.6	7.1	R
RS	F-D-5-1	13.4	12.9	2.3	0.3	-	4.3	U2
PS	F-B-6-1	14.9	10.3	2.0	0.3	3.	2.4	R
RS	G-B-7-1	16.5	11.3	2.8	0.4	-	3.9	CH
EG	TP3-1-1	13.5	17.8	3.0	0.7	7.5	5.9	B
RS	H-D-4-1	21.2	10.2	2.9	0.6	-	4.2	B
PS	I-B-2-1	12.5	7.6	2.4	0.6	4.1	3.6	B
RS	I-D-5-1	10.5	8.4	2.3	0.3	4.2	6.2	-
				South Block				
RS	K-B-6-1	15.7	15.9	4.1	1.0	11.0	10.3	WWR
EE	M-C-3-1	10.3	15.8	3.7	0.7	13.6	10.0	B
EG	N-B-5-1(C)	26.3	16.5	3.1	1.0	7.7	6.2	BS
				Surface				
EE	1027-SF-1	26.1	15.9	5.7	1.8	-	-	B
NSN	1070-92-SF-1(C)	49.3	20.8	6.1	6.2	17.0	16.5	OO

Key:

PS= PINSTEM	B= BURNS
(C)=COMPLETE	BS= BUCK SPRINGS
RS= ROSE SPRING	CH= CHICKAHOMINY
EG= EASTGATE	OO= DOUBLE O
EE= ELKO EARED	R= RILEY
NSN= NORTHERN SIDE-NOTCHED	RRS= RIMROCK SPRING
LS= LEAF-SHAPED	WWR= WHITEWATER RIDGE
	U2= UNKNOWN 2

points is obsidian from the Riley source (1070-92-F-B-9-1), to the west, and one (1027-TP3-1-1) is from the Burns source, adjacent to the Hines site. This seems to indicate that Eastgate points, like the Small Stemmed points, were either being manufactured at the site or transported to the site from the west.

The remaining 15 diagnostic points can all be clearly assigned to the Rose Spring type. All but one of the Rose Spring points were recovered from the North Block, with the remaining point collected in Unit A, between 5-10 cm in depth, at the Northern Locus (Tables 5.3 and 5.4). Rose Spring points were found between 0-35 cm in depth at the North Block. Only one diagnostic point was found lower in the deposits; an Eastgate in Level 9 (40-45 cmbs) of Unit F.

There are three basic variations among the Rose Spring points that were recovered. The three variations all fit the morphological characteristics of either the Rosegate typology for the Great Basin (Thomas 1981) or the ES-1 category for the Columbia Plateau (Dumond and Minor 1983). The variations are not of a nature to suggest functional or technological enhancements in projectile point production, but perhaps may say more about the type of flake chosen for manufacturing a point, or the flaking technique of the flintknapper.

One Rose Spring variation (RS-1) includes small, corner-notched points with expanding stems that extend well below shoulders that either taper toward the stem of the point or terminate even with the beginning of the stem. In cross section, they are fat-bodied relative to their width and range from lenticular to oval in shape. There are five Rose Spring points that match this description. Four of the points are made of obsidian (Specimens 1070-92-C-A-5-3, 1070-92-C-C-3-1, 1070-92-E-D-2-1, and 1070-92-F-A-5-1) and one is CCS (1070-92-I-D-5-1).

Table 5.4. Diagnostic artifacts by unit and level.

Level	1	2	3	4	5	6	7	8	9	10
					North Locus					
Unit										
A	-	RS	-	-	-	-	-	-	-	-
					Central Locus: North Block					
B	-	-	-	RS	SS	-	-	-	-	-
C	-	-	RS(2)	-	SS,RS	-	-	-	-	-
D	-	-	-	EE	SS	-	-	-	-	-
E	-	RS	-	-	-	RS	RS,EG	-	-	-
F	RS	-	-	-	RS(2)	SS	-	-	EG	-
- -	-	-	-	RS	-	-	-			
H	EG	-	-	RS	-	-	-	-	-	-
I	-	SS	-	-	RS	-	-	-	-	-
					Central Locus: South Block					
J	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	EE	-	-	-	-
L	-	-	-	-	-	-	-	-	-	-
M	-	-	EE	-	-	-	-	-	-	-
N	-	-	-	-	EG	-	-	-	-	-

SS= Small Stemmed, RS=Rose Spring, EG=Eastgate, EE=Elko Eared, ECN=Elko Corner Notched, NSN= Northern Side-notched

The second Rose Spring variety (RS-2) consists of small, short corner-notched points. These seven artifacts (Specimens 1070-92-B-D-4-1, 1070-92-C-B-3-2, 1070-92-E-B-7-2, 1070-92-F-B-1-1, 1070-92-F-D-5-1, 1070-92-G-B-7-1, 1070-92-K-B-6-1) were constructed from triangular blanks that impart a squat, triangular appearance to the finished tool. The expanding bases are bracketed by barbs that extend past the neck, sometimes to a length that is even with the base. The points are generally quite thin in relation to their width and finely flaked.

The third (RS-3) Rose Spring variety (1027-P1-2-2, 1070-92-E-B-6-1, 1070-92-H-D-4-1) are similar to RS-2 points, but more elongated. The points tend to be at least twice as long as they are wide, and show fine, delicate workmanship. None of the three points in this category have intact bases, but it appears that the barbs are quite shallow, and would not extend as far back as the base.

X-ray Fluorescence analysis was used to determine the origin of the obsidian used to make 14 of the 15 recovered Rose Spring projectile points (all of the obsidian artifacts). The single CCS point could not be sourced. Of those geochemically characterized, six (43%) were manufactured from nearby Burns Butte obsidian. The second most common source was Rimrock Spring, adjacent to the Burns source, of which three (21.5%) of the points were produced. Two Rose Spring points (14.2%) were of Whitewater Ridge obsidian. The Chickahominy and Buck Springs sources each accounted for one point (7.1%), as did a source called Unknown 2 (Skinner et. al 1998). With the exception of the source which has yet to be identified, the obsidian sources for the Rose Spring points are all north and west of the Hines site. The most distant of them is Whitewater Ridge, approximately 65 km to the northeast. Since nine (64.5%) of the Rose Spring points were derived from sources very close to the site, it is not unreasonable to suggest that the site was occupied at least in part to manufacture and refurbish tools used in nearby hunting forays with the obsidian readily available from Burns Butte and nearby Rimrock Springs. In addition, the people who were using Rose Spring points appear to have traveled to the location from the north or west, the points presumably have been made at or near the obsidian sources there.

Leaf-shaped Points. A single leaf-shaped point base (1070-92-C-C-7-1) was collected in the North Block. This large, finely flaked artifact is broken approximately at the midsection and is also missing a small portion of the base. One side of the artifact exhibits a diagonal flaking pattern, with flake scars meeting at the midsection. The opposite side is more randomly flaked, with flake scars extending across the tool at times.

Elko Series. Only three of the 28 projectile points recovered from the Hines site were identified as Elko Series points. All three can be categorized as Elko Eared points, based on the classification system adopted by Thomas (1981), or Side Notched 5 under the system developed by Dumond and Minor (1983:171). Elko Eared points are large, corner-notched dart points with a deeply indented base that, in conjunction with the corner-notching, form "ears" for hafting the projectile on to a dart shaft. The widest portion of the projectile point is just above the base. All of the Elko Series points collected at the Hines site are fragmentary, consisting of bases broken off at the top of the neck.

The Elko points were distributed across the Central Locus, with one collected in Unit D of the North Block (15-20 cm), one from Unit M in the South Block (10-15 cm), and the third point surface-collected to the east. Although the tools were recovered near Rosegate Series artifacts, obsidian hydration analysis has shown that Elko points have thicker hydration rinds, except for one Roasgate with a hydration rind comparable in thickness to the Elko points. Although the sample size is limited, this shows that most of the Elko artifacts are not coeval with the Rosegate points. It is likely that both types were dropped on a stable, non-accreting surface at widely separated times.

The three Elko points have been analyzed to determine the origin of the obsidian from which they were manufactured. One of the points has been traced to the Burns source, and two originated from the Double O source, which is located approximately 40 km south of the Hines site. The Eastgate, Rose Spring, and Elko projectile point types all include specimens from the Burns source, as would be expected with the obsidian available in such close proximity. However, the Elko Series points are the first from the Hines site to include obsidian sources originating to the south.

Northern Side-notched Points. A single Northern Side-notched (NSN) point was surface-collected from the Hines site. It was found 16 meters east of the Central Locus. Northern Side-notched points were designed for use with an atlatl, and are characterized by their elongated triangular shape, straight to slightly convex sides, and a base that is generally flat or concave, but can be convex as well. They are heavy-bodied points with notches that angle either upward or straight in to the sides of the tool, and the maximum width of the point is at the base. Under the Plateau classification system of Dumond and Minor (1983:171), the Hines site NSN point would also fit the Side Notched 1 category.

The NSN point is obsidian that has been identified as originating at the Double O source, approximately 40 kilometers to the south. The Northern Side-notched point is comparable in size and age to the Elko points, and it is interesting that three of the four dart points found at Hines (two Elko Eared and one NSN) can be traced to southern obsidian sources. Not one of the late Holocene arrow points can be directly linked to a southern source of obsidian. The Buck Spring source has its origin near Harney Lake, but the flow extends to the north as far as the Ochocos and obsidian could have been collected at many points in between. The geographical distribution may suggest that Buck Spring obsidian was collected at a more northerly location, in keeping with the other Rosegate sources.

Point Fragments

Projectile point fragments consist of finely worked bifacial tool fragments that are not recognizeable as diagnostic tools, yet are clearly portions of finished projectile points. A total of 17 projectile point fragments were recovered from the Hines site consisting of eight tips, three midsections, two bases, and four tangs (Table 5.5). All but one of the 17 fragments were collected from the North Block of the Central Locus, with a single tang, or barb, originating from the South Block. Only one point fragment was manufactured from CCS (a tip), the others being made of obsidian.

Table 5.5. Metric attributes of projectile point fragments, in millimeters.

Type	Catalog No.	Material	Length	Width	Thickness	Weight
			North Block			
Tip	1070-92-C-A-5-1	Obs	11.1	5.3	1.8	0.1 g
Tip	1070-92-C-C-7-6	Obs	6.2	4.4	1.2	<0.1 g
Tip	1070-92-D-C-3-1	Obs	11.1	5.1	1.4	0.1 g
Tip	1070-92-E-D-7-1	Obs	8.9	4.0	1.0	<0.1 g
Tip	1070-92-F-B-6-2	Obs	6.5	4.1	1.3	<0.1 g
Tip	1070-92-G-B-9-1	Obs	12.7	5.4	1.9	0.1 g
Tip	1070-92-H-D-5-1	Obs	10.8	6.3	1.6	0.1 g
Tip	1027-TP3-2-1CCS		20.9	9.5	2.5	0.4 g
Mid	1070-92-F-C-7-3	Obs	15.3	9.1	3.1	0.3 g
Mid	1070-92-F-D-6-1	Obs	9.7	7.0	2.5	0.2 g
Mid	1070-92-H-A-4-1	Obs	19.2	12.4	3.9	1.1 g
Tang	1070-92-C-C-7-7	Obs	7.0	6.9	2.0	0.1 g
Tang	1070-92-E-B-1-1	Obs	5.0	4.5	1.1	<0.1 g
Tang	1070-92-H-C-1-1	Obs	6.0	6.7	1.5	0.1 g
Base	1070-92-C-B-7-1	Obs	5.0	4.4	2.6	0.1 g
Base	!070-92-F-B-6-3	Obs	5.3	6.2	2.0	0.1 g
	South Bloc					
Tang	1070-92-M-D-4-1	Obs	8.4	7.5	1.8	0.1 g

All eight of the point tips from the Hines site are long, thin, narrow, and sharply pointed, giving the impression that they were broken from arrow points rather than from dart tips. All are finely pressure flaked and most exhibit patterned flaking techniques that are reminiscent of Rose Spring points. The only CCS point tip in the assemblage (1070-92-TP3-2-1) is larger and shows less patterning in the flaking technique than the obsidian tips, perhaps reflecting the flaking properties of the material rather than stylistic differences.

The four tangs could be mistaken for tips, but they are thicker, broader, more randomly flaked, and the angle of flake removal is generally not equivalent on each side. All are made of obsidian. The single fragment recovered from the South Block (1070-92-M-D-4-1) is somewhat larger than the other tangs, recovered from the North Block, and may possibly be from a dart point. The two stem and base fragments (Specimens 1070-92-C-B-7-1 and 1070-92-F-B-6-3) are made from obsidian. Both are clearly broken from arrow points, judging by their small size. One of the bases has an expanding stem and the other is a straight, or pinstemmed base. One of the three midsections recovered during excavation is clearly non-diagnostic (1070-92-H-A-4-1). Although the fragment is quite thin and narrow like an arrow point, it is missing the tip and the entire base. The tool was made of obsidian from the Burns source. Another midsection (1070-92-F-D-6-1) is missing its tip, base, and one tang, but retains the other tang, a distinct scar where the base snapped free from the body of the point, and an overall shape suggests it was either a Rosegate or Small Stemmed point. It is manufactured from Rimrock Spring obsidian. The third midsection (1070-92-F-C-7-3) also appears to derive from an arrow point. It originates from Burns source obsidian.

Shaped Bifaces

Most of the biface tools are fragmentary but bear enough characteristics to enable determinations of both general appearance and the lithic reduction methods employed in their manufacture. Shapes vary from rounded to polygonal, and flaking methods can range from the rough percussion flaking of quarry blanks to fine pressure flaking associated with the manufacture of knives and projectile points (Figure 5.7). The stage classification developed by Jenkins and Connolly (1990) is used in this analysis.

Stage 1. Four obsidian artifacts fit the Stage 1 classification, three of which are bases and the fourth complete. The complete biface (1070-92-C-C-4-1) is a crude, triangular-shaped tool with one slightly concave side that has been employed as a scraper. The scraping edge has been straightened and strengthened by additional flake removal, but the other sides are very sinuous. The entire tool shows evidence of use-wear. The three biface bases (Specimens 1070-92-B-A-3-1, 1070-92-I-D-3-2, and 1070-92-L-D-5-1) are rounded. The first two are manufactured from Burns obsidian, the latter artifact has not been identified to source. The biface is derived from the Dog Hill source, near Burns Butte.

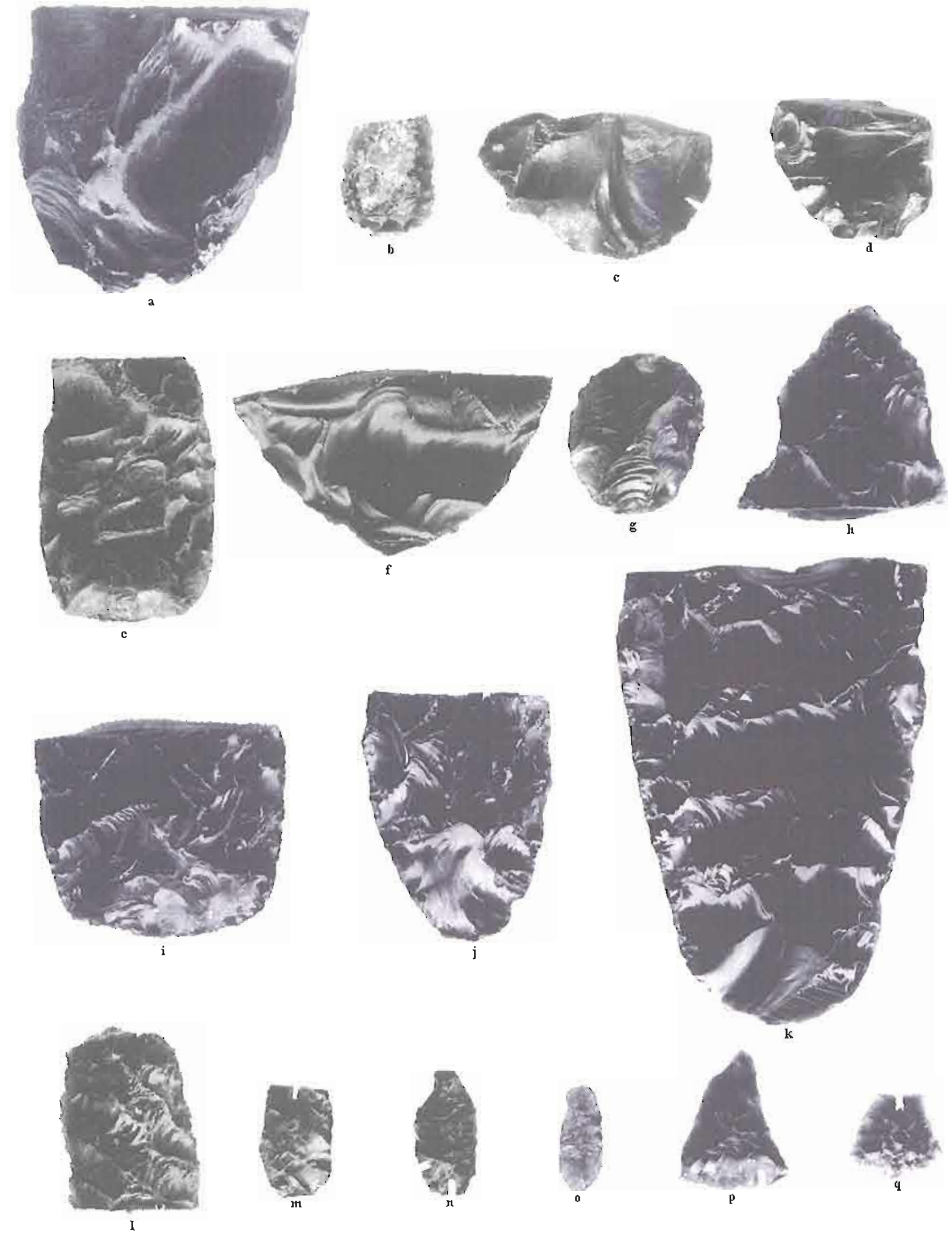

Figure 5.7. Bifaces, shown actual size; Stage 1, a-d; Stage 2, e-h; Stage 3, i-k; Stage 4, l-q.

a. 1070-92-L-d-5-1 b. 1070-92-C-d-6-1 c. 1070-92-I-d-5-1 d. 1070-92-B-a-3-1
e. 1070-92-L-d-11-1 f. 1070-92-I-d-4-1 g. 1027-TP3-3-1 h. 1070-92-I-b-4-1
i. 1070-92-G-b-9-2 j. 1070-92-J-b-3-1 k. 1070-92-F-b-4-1 l. 1070-92-C-a-7-1
m. 1070-92-H-a-4-1 n. 1070-92-H-a-3-1 o. 1070-92-D-c-2-1 p. 1070-92-E-b-4-1
q. 1070-92-I-b-5-1

Stage 2. A total of nine obsidian bifaces fit into the Stage 2 classification, including four bases, four tips, and a complete discoidal biface. Three of the bases are rounded (Specimens 1070-92-A-B-2-1, 1070-92-C-D-6-1, and 1070-92-J-B-3-1) and one is squared (1070-92-L-D-11-1). All are well-thinned, but one (1070-92-C-D-6-1) retains cortex. The three tips vary considerably in size and degree of thinning. The discoid (1070-92-TP3-3-1) is oval with broad, deep percussion flaking scars across both sides and no evidence of pressure flaking. The edges are well worn from use. All of the Stage 2 bifaces were analyzed for obsidian sources. Seven originated at the Burns source (including the disc), one at Dog Hill, and one at Rimrock Spring. All of these sources are in close proximity to each other and to the Hines site.

Stage 3. All nine of the Stage 3 biface fragments were manufactured from obsidian. These included three tips, three bases, and three midsections, including two edge fragments. The three tips are primarily percussion flaked, with pressure flaking working in from the edges towards the center of the artifact. The bases include one very large rounded base that was found in Unit F in association with a metate fragment (1070-92-F-B-4-1), one small rounded base (1070-92-H-C-5-1), and one squared base (1070-92-G-B-9-2). All are well-thinned, have relatively straight edges, and show fine flaking and crushing of the edges associated with use wear. Prior to breakage, any of these tools could have been utilized without further treatment. The midsection fragments are derived from large bifaces with thick cross-sections. Four of the Stage 3 bifaces are from the Burns source, two are from Dog Hill, and one is from Buck Springs, approximately 55 kilometers to the west. An additional artifact was not identified to source.

Stage 4. There were two categories of Stage 4 bifaces at Hines. The first category includes fragments derived from triangular to oval shaped preforms which may have been intended for use as projectile points. The six specimens of this group included two bases, one midsection, and three tips. Most of the artifacts were manufactured of obsidian from the Burns or Rimrock Springs sources, along with one tool that was not identified to source. An examination of the biface fragments revealed that a tip (1070-92-F-A-4-1) and a base (1070-92-C-D-4-1) were the conjoinable fragments of a complete, small point preform with a total length of 28.3 mm, width of 13.7 mm, thickness of 2.7 mm, and weight of 1.2 g. Both tool fragments were found in Level 4 of adjoining Units C and F, approximately one meter apart. The biface has a squared base, convex sides, and a somewhat rounded tip. The other base fragment was rounded, tapering toward the distal end. The other two tips have the broad dimensions of large projectile points or preforms. The midsection is entirely pressure flaked, with diagonal flake scars meeting at the center. It has a slight taper, and its overall dimensions suggest a complete, or nearly complete dart point.

The second category of Stage 4 bifaces includes four small, well-thinned and finely pressure-flaked obsidian bifaces. Each will be described separately. Specimen 1070-92-D-C-2-1 is a narrow but a relatively thick tabular biface with rounded ends, of which one is broader than the other. The broad end exhibits strong evidence of use wear, while the smaller end exhibits very limited use. Its small size and use wear patterns suggest that the tool was gripped between thumb and forefinger and used either for incising or perhaps boring out holes that were started by the use of a drill or awl. The degree of pressure flaking and overall shaping of this small biface indicate that the tool was not of an expedient nature. The obsidian was derived from an unknown source. The remaining three artifacts were derived from the Burns obsidian source. Specimen 1070-92-E-B-4-1 is a triangular biface with a plano-convex cross-section. The convex side was shaped by a series of pressure flakes driven from the perimeter towards the interior of the artifact. The flat surface on the other side has minimal pressure flaking around the edges. The artifact exhibits evidence of very light use that may be attributed to edge preparation, and the tool may be an unfinished preform. Specimen 1070-92-H-A-3-1 is a tabular artifact with a shaped stem extending from one end. The tip is broken from the stem and its intended use is unclear, but it is possible that the tool may have served as a graver or perforator, held between thumb and forefinger. The edges of the artifact have been strengthened by the removal of small pressure flakes, and the artifact may have had a secondary use as a small scraper. Specimen 1070-92-I-B-5-1 appears to have been a small, triangular preform that was broken toward the distal end, then retouched for use as a small scraper similar to one reported by Musil (1995:134). However, there is little evidence of use wear. The proximal end has a small spur which may have been the beginning of a base or stem prior to breakage.

Drills

Five artifacts collected from the North Block were apparently drills or awls (Fig. 5.8). Either hafted or held between thumb and forefinger, the tools were twisted back and forth to bore holes in leather, wood or possibly other materials. Three of the drills are made from obsidian, one is of basalt, and one is of CCS.

The only complete drill (Figure 5.8e)is fashioned from CCS (Specimen 1070-92-C-C-8-2). It is a bifacial tool, with lightly serrated edges that taper to a point at the distal end, and a slightly flattened base at the proximal end. In cross section, the tool has a thick, lenticular shape with a maximum width of 10.3 mm, a maximum thickness of 6.2 mm, and a total length of 45.1 mm. A somewhat cylindrical obsidian midsection (1070-92-E-D-3-1) appears to be a portion of a drill fragment (Figure 5.8d). The fragment is broadly lenticular in cross section, with weak shoulders that tapered to a narrower point prior to breakage. A portion of the base is missing, but it did not appear to expand beyond the width of the fragment. The specimen was was 16.8 mm long, 16.4 mm wide, and 8.2 mm in thickness.

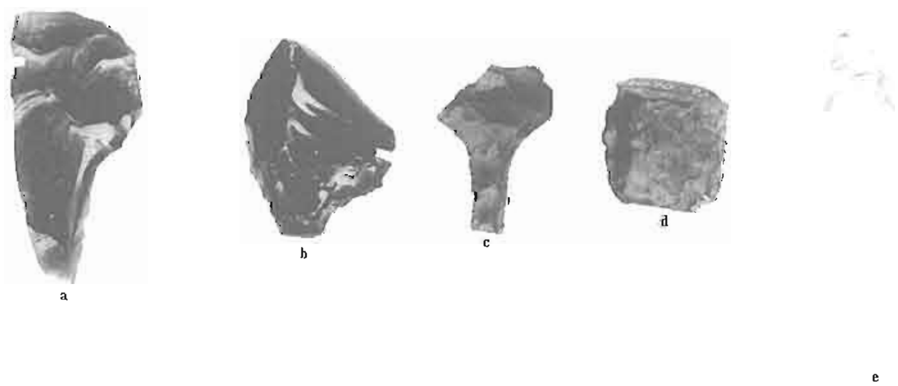

Figure 5.8. Drills, shown actual size: a. 1070-92-H-a-5-2; b.. 1070-92-F-b-3-1; c. 1070-92-I-d-3-1; d. 1070-92-E-d-3-1; e. 1070-92-C-c-5-2

Three drills with expanding bases were recovered. One obsidian drill (1070-92-H-A-5-2) is missing the tip and appears to be broken lengthwise, but was actually manufactured from an expedient flake that has a naturally formed taper from stem to base. A minimal number of flakes were struck from each side of the flared base to taper the edges, and the remaining stem has limited evidence of usewear. The tool was manufactured from Burns obsidian. The second obsidian drill (1070-92-F-B-3-1) was crafted from a large obsidian flake, of which one portion was reduced to create a cylindrical stem. The drill stem was broken almost even with the expanding base. The total length of the broken tool is 26.5mm, the base width is 20.0 mm, the stem width is 6.8 mm and the stem thickness is 5.2 mm. The tool was manufactured from Burns obsidian. A third expanding base drill (1070-92-I-D-3-1) is made of very fine-grained basalt that has a somewhat shiny appearance as though the material borders on vitrophyre. This small artifact is missing its tip and a portion of the base. The stem flares to create a t-shaped base that would have provided a suitable purchase for either hafting or holding. In cross-section, the drill stem appears almost round. The total length of the broken tool is 22.2 mm, the maximum width of the base is 15.8 mm, the width of the stem is 5 mm, and the maximum stem thickness is 4.2 mm.

Table 5.6. Metric attributes of Hines biface fragments, in millimeters.

Type	Catalog No.	Material	Length	W.	Th.	Weight	Source
			North Block				
Stage 1:							
base	1070-92-B-A-3-1	obs	24.7	28.8	9.0	5.9g	B
biface	1070-92-C-C-4-1	obs	43.2	32.5	10.7	13.5g	DH
base	1070-92-I-D-5-2	obs	24.8	41.3	11.4	10.8g	B
Stage 2:							
biface	1027-TP3-3-1	obs	28.6	23.2	6.3	3.9g	B
base	1070-92-A-B-2-1	obs	24.3	29.8	9.0	7.3g	B
base	1070-92-C-D-6-1	obs	20.2	15.9	4.0	1.5g	RRS
tip	1070-92-G-B-2-2	obs	16.2	23.0	4.4	1.6g	B
tip	1070-92-I-B-4-1	obs	36.9	36.5	6.9	8.6g	DH
tip	1070-92-I-D-4-1	obs	31.8	55.1	9.0	14.3g	B
Stage 3:							
tip	1070-92-B-D-5-1	obs	24.5	21.8	6.8	3.0g	B
mid	1070-92-C-A-8-1	obs	37.6	43.8	9.4	15.4g	DH
tip	1070-92-C-C-4-2	obs	17.6	23.6	6.8	2.5g	BS
edge	1070-92-F-B-2-1	obs	24.5	26.9	9.2	4.9g	B
base	1070-92-F-B-4-1	obs	81.4	52.7	9.7	46.7g	DH
base	1070-92-G-B-9-2	obs	36.6	43.4	8.7	16.0g	B
edge	1070-92-H-A-5-1	obs	17.8	34.5	6.7	4.6g	B
base	1070-92-H-C-5-1	obs	17.3	14.7	4.2	1.2g	B
Stage 4:							
mid	1070-92-C-C-7-1	obs	32.1	22.2	7.8	6.4g	B
base	1070-92-C-D-4-1	obs	19.4	13.7	2.7	0.7g	RRS
biface	1070-92-D-C-2-1	obs	18.8	7.3	3.1	0.5g	UNK1
biface	1070-92-E-B-4-1	obs	24.6	18.5	3.2	1.3g	B
tip	1070-92-F-A-4-1	obs	19.9	11.1	2.5	0.5g	RRS
tip	1070-92-F-B-5-1	obs	17.1	14.4	13.5	0.6g	B
base	1070-92-H-A-3-1	obs	22.0	10.2	3.1	0.9g	B
base	1070-92-H-A-4-1	obs	19.6	12.6	4.0	1.0g	B
biface	1070-92-I-B-5-1	obs	14.5	15.8	3.1	0.6g	B
tip	1070-92-I-C-6-3	obs	7.2	8.2	2.4	0.1g	-
			South Block				
			Late Component				
Stage 1:							
base	1070-92-L-D-5-1	obs	49.6	48.6	14.7	44.6g	-
Stage 2:							
base	1070-92-J-B-3-1	obs	42.9	31.4	8.2	13.0g	B
tip	1070-92-K-A-1-1	obs	11.8	22.4	6.1	1.3g	B
Stage 3:							
tip	1070-92-M-B-7-1	obs	19.3	27.5	5.3	2.8g	-
			Early Component				
Stage 2:							
base	1070-92-L-D-11-1	obs	45.7	31.8	6.6	11.8g	B

Unshaped Bifaces

Two artifacts are classifiable as unshaped bifaces. Specimen 1070-92-B-B-5-3b is a crescentic-shaped biface exhibiting deep, unpatterned percussion flake scars on both sides, with an area of cortex on one side. Both ends have areas of crushing associated with use wear, and additional, but limited, flaking possibly due to scraping activities. The artifact has a maximum length of 51.8 mm, a width of 32.7 mm, a thickness of 14.9 mm, and weight of 23.3 grams. It is made from Rimrock Springs obsidian. Specimen 1070-92-I-A-5-6a is a plano-convex, oval to rectangular-shaped artifact with unpatterned percussion flaking on both sides. It has the appearance of a small core which has been utilized as a scraper along one of the thicker curved edges. The used edge shows bifacial flaking and crushing associated with heavy use. The tool is 41 mm in length and 38.5 mm in width, with a thickness of 13.8 mm, and a weight of 18.3 grams.

Edge-modified Flakes

Although utilized flakes constituted the largest artifact category at all three of the Hines, Morgan, and Hoyt sites, there was a much greater variety and quantity of this tool type at the Hines site. Utilized obsidian, basalt or CCS flakes have at least one edge that shows patterned flaking from cutting or scraping activities. Contiguous unidirectional flake removal results from scraping an object in a single direction (either toward or away from the user), while holding the flake transverse to the object. Noncontiguous bifacial flake removal results from using a flake in a sawing motion perpendicular to the worked material (Kiigemagi 1989).

At the Hines site, most utilized flakes seem to have been used for scraping activities, based on a unidirectional pattern of flake removal. A total of 189 flake tools was recovered from the cultural deposits at the site. Of these, 154 (81%) displayed evidence of unifacial edge modification. An additional 15 (9%) flakes were bifacially flaked and 10 were transversely flaked (5%). Nine other flakes were identified as spokeshaves, and one as an expedient drill, or perforating tool. On average, 17 % of the edge modified tools from the Hines site exhibited cortex, indicating that the tools were probably removed from obsidian nodules present at the site location. A total of 20% of the spokeshaves and bifacially flaked tools showed cortex, as did 17% of the unifacial tools and 9% of the transverse bifacial tools.

Of the 154 unifacially modified flakes, 119 were recovered from the North Block and 31 from the South Block of the Central Locus. Four additional artifacts were collected from Unit O, located in the South Locus. All tools but one (CCS) were manufactured from obsidian. Of the artifacts collected from the North Block, the majority (84%) were found in levels 2-8 of Units D-I. Unit H, the location of Feature 1, contained 21 uniface tools, Units D and F yielded 18 unifaces, Unit G produced 19, and Unit I produced 20. Utilized flakes in the South Block were more dispersed. Unit L contained 13 unifacially modified flakes (eight Early Component, five Late Component), Units J and K each contained five (both with two Early and three Late), and Units M and N both had four (M two Early, two Late; N three Early, one Late).

A total of 15 flakes showing bifacial edge modification was collected at the Hines site. Of these, 13 were made from obsidian, one from CCS, and one from basalt. Bifacially modified flakes at the Hines site were characterized as having one side with substantial, contiguous flaking, and the reverse side non-contiguously flaked, with a more limited degree of flake removal. It appears that these flakes were used initially for unidirectional scraping activities followed by either bidirectional scraping or sawing. Eleven of the bifacial flake tools were collected from the North Block of the Central Locus; five from Unit H alone. The four recovered from the Late Component at the South Block included two obsidian tools, one CCS tool, and one of basalt. All bifacial flakes occurred between 10-55 cm in depth, with over 70% recovered between 10-25 cm.

There were 10 tools which displayed transverse bifacial flaking, having flakes removed from opposite sides at two distinct locations. Of these, five were flaked on non-opposing sides of the tool, while the other five were flaked on opposite sides of a contiguous edge. All tools of this type were recovered from the North Block of the Central Locus and were vertically distributed throughout the deposits.

Spokeshaves are tools which have a crescentic or concave edge used for scraping curved or round surfaces, and may show evidence of unifacial or bifacial flake removal. Only one of the nine Hines spokeshaves exhibited bifacial modification (Specimen 1070-92-E-D-4-4). Aperture sizes ranged from 5.9 - 17.2 mm in width. Of the nine spokeshaves recovered at the Hines site, eight were collected in the North Block of the Central Locus. Units D, E and F each produced two and Units G and H one apiece. These units contain some of the highest concentrations of artifacts at the site and includes Feature 1 (in Unit H). All of the spokeshaves from the North Block were collected from levels 4-7 (15 to 35 cm). The South Block of the Central Locus produced one spokeshave from the Late Component. Specimen 1070-92-K-B-2-1 is a unifacially flaked tool manufactured from a small obsidian nodule. The artifact was recovered from Level 2, and may be associated with the Late Component at that location.

There is a strong pattern in the distribution of utilized flakes at the Hines site. Almost all of the tools were recovered from the Central Locus, with the majority coming from Units C - I of the North Block (12.1/m^3). At the North Block, artifacts were concentrated in levels 3-8. Those of the South Block were more dispersed, with just over half (19, or 2.6/m^3) occurring in the Late Component and 17 (3.7/m^3) in the Early Component. The North Block is distinguished by the presence of both a hearth and a metate and other groundstone fragments that may represent activity areas in association with the hearth. The abundance of utilized flakes also found in this location seems to indicate that they were used in food preparation, perhaps for processing plant resources in conjunction with the ground stone metate.

Cores

There were 12 obsidian cores collected at the Hines site (Table 5.7). One was recovered from the North Locus, five from the North Block and six from the South Block of the Central Locus. None were collected from the South Locus. Specimen 1027-P0-2-1 was collected at the North Locus during the testing phase. It is a nodule fragment with cortex on one side and unpatterned flake removal on the other portions. The five cores from the North Block include one large tabular core with unpatterned flake removal (Specimen 1070-92-I-A-3-1), and four smaller, blocky specimens, of which three (Specimens 1070-92-E-B-5-2, 1070-92-F-C-6-1, and 1070-92-F-C-7-2) show evidence of edge modification through usage. The six cores from the South Block include three that are tabular with unpatterned flaking, and three that are plano-convex. These latter cores have flakes struck from along the edges of the flat portion of the artifact which taper downward and inward, creating a convex appearance.

Table 5.7. Metric attributes of Hines cores, in millimeters.

Catalog No.	Material	Length	Width	Thickness	Weight
		North Locus			
1027-P0-2-1	obs	68.1	35.4	53.2	142.7g
		Central Locus:			
North Block:					
1070-92-E-B-5-2	obs	35.7	35.0	15.8	17.7g
1070-92-F-C-6-1	obs	51.6	41.5	17.3	29.3g
1070-92-F-C-7-2	obs	40.0	36.6	13.3	17.0g
1070-92-F-D-4-1	obs	55.0	27.8	22.8	28.8g
1070-92-I-A-3-1	obs	89.3	76.3	24.2	155.2g
South Block:					
		Late Component			
1070-92-J-B-5-1	obs	40.5	38.3	12.0	16.1g
1070-92-J-D-5-1	obs	83.5	43.6	24.1	79.4g
1070-92-K-C-6-1	obs	72.8	36.5	27.9	49.2g
		Early Component			
1070-92-L-D-7-1	obs	86.9	70.6	46.9	258.7g
1070-92-L-D-8-1	obs	94.0	68.4	25.7	123.5g
1070-92-M-D-10-1	obs	66.8	42.9	16.5	56.4g

Debitage

Debitage associated with the Early and Late Components of the Hines site was also separated and analyzed for comparative purposes (Table 5.8). The comparison was accomplished by analyzing the characteristics of the debitage most closely associated with peaks in cultural deposition for each component; usually involving the material collected from 15 to 20 cm of fill surrounding that which contained peak numbers of flakes. As with the other sites, the debitage was processed through a series of nested screens with dimensions of 1", 1/2:" ¼", and 1/8". The flakes from each size grade were counted, weighed, and examined for the presence of cortex.

Table 5.8. Mass analysis of Hines site obsidian debitage.

Unit	G1 (1")			G2 (1/2")			G3 (1/4")			G4 (1/8")			Totals		
	Ct.	Wt. (g)	Ctx	Ct.	Wt. (g)	Ctx	Ct.	Wt. (g)	Ctx.	Ct.	Wt. (g)	Ctx.	Ct.	Wt. (g)	Ctx.
A	3	75.9	3	1	3.9	1	17	8.3	7	81	6.9	23	102	95.0	34
B	3	62.0	3	44	141.7	8	378	102.3	27	941	51.7	37	1366	357.7	75
C	6	95.9	4	120	414.4	29	443	193.8	33	1040	65.3	26	1609	769.4	92
D	3	63.8	1	44	157.2	10	304	116.6	8	912	43.7	13	1263	381.3	32
E	3	33.9	2	62	189.7	15	213	95.6	24	496	29.1	19	774	348.3	60
F	7	187.7	3	139	407.1	26	529	200.9	16	1547	78.4	29	2222	874.1	74
G	1	15.7	1	44	128.9	8	268	102.1	15	709	40.8	26	1022	287.5	50
H	4	88.3	2	54	176.0	11	322	110.9	23	1223	63.6	37	1603	438.8	73
I	2	58.7	0	47	139.2	10	271	92.5	13	714	43.7	21	1034	334.1	44
J	1	28.7	1	26	66.0	2	198	85.1	15	521	32.2	22	746	212.0	40
K	1	39.0	1	19	96.5	5	212	79.2	19	418	26.9	23	650	241.6	48
L	2	47.2	1	67	126.9	4	433	152.4	23	3097	148.0	80	3599	474.5	108
M	6	130.9	2	57	159.4	7	381	153.2	27	1494	86.7	97	1938	530.2	133
N	3	82.9	2	33	104.8	6	233	88.5	21	796	48.8	62	1065	325.0	91
O	2	23.0	1	47	153.2	10	228	96.4	15	372	27.1	17	649	299.7	43
P	1	29.9	0	4	18.7	0	15	4.8	0	23	1.5	0	43	54.9	0
Totals	48	1063.5	27	808	2483.6	152	4445	1682.6	286	14,384	794.4	532	19,685	6024.1	997
Weight/flake		22.16			3.07			0.38			0.06				
Percent	0.2	17.7	0.1	4.1	41.2	0.7	22.6	27.9	1.5	73.1	13.2	2.7			

The debitage size distributions were very similar to those at the Hoyt and Morgan sites, with small percentages of G1 and G2 material, higher quantities of G3 flakes, and the majority of the debitage occurring in the G4 class. A few large G1 and G2 flakes account for 58.9% of the total debitage weight at the site, but less than 5% of the total number of flakes. This is comparable to the distribution at the Morgan site but different from the Hoyt site, where more than 50% of the debitage weight came from the G3 and G4 classes. Cortex flakes were found in small quantities at all three sites. The Hines site produced almost double the amount of cortex flakes yielded by the other two Harney Basin sites (5%, as opposed to 2.6% at Morgan and 2.84% at Hoyt). The abundance of cortex flakes from the G4 class is the most striking difference between the Hines site and the other two sites. Over half of the cortex flakes (532, or 2.7%) were from the G4 class, perhaps suggesting that small cobbles were being utilized on site for the production of formed tools.

The identification of Early and Late Components in the South Block at the Hines site is demonstrated by both obsidian hydration measurements and bimodal distributions in debitage counts. Mass analysis indicates differences between the components that include both size grade and weight distributions. Some of these differences are due in part to an abundance of G4 debitage in the Early Component deposits of Unit L. There, several thousand flakes were concentrated in the lower 20 cm of deposits. The Early Component debitage considered here included 4335 flakes, of which 181 showed the presence of cortex. The total debitage weight was 423.0 g. The Late Component consisted of 1838 flakes, including 146 cortex flakes, for a total weight of 677.5 grams.

The G4 class yielded the highest quantities of debitage in both Early and Late Components, but the G1-G3 classes provided a much higher percentage of the Late Component material. Only 1% of the Early Component material came from G1 and G2 size grades, while 10 % was G3 and 89% was G4-sized. The G4 class comprised 64% of the Late Component material 31% was G3, and 4.8% was from the G1 or G2 classes. Debitage weight was concentrated in the G3 and G4 categories of the Early Component, at 76% of the total. The Late Component was divided almost evenly with 52% in G1 and G2, and 48% in G3 and G4. Cortex flakes (Table 7.7)were almost absent from the G1 and G2 categories of the Early Component, but accounted for over 86% of the G4 material. Cortex flakes were present in all 4 size grades from the Late Component, becoming more concentrated in the G3 and G4 categories. The frequencies of cortex parallel the quantities of debitage for each size grade in each component, perhaps suggesting that lithic reduction activities followed similar paths in both components with limited (or no) initial lithic reduction occurring on site.

Ground Stone Tools

Ground stone tools exhibit shaping or wear that is usually associated with the processing of botanical resources, particularly roots, bulbs, and seeds. Ground stone tools at the Hines site include manos, metates and abrading stones (Table 5.9). Most of the tools are quite fragmentary and often appear to have been used for a limited duration judging by the minimal amount of polish on the worked surfaces.

All of the ground stone artifacts were recovered from the North Block of the Central Locus. The artifacts consisted of seven metate fragments, one complete metate, six mano fragments and one abrader (Table 5.8).

Metates

Six small fragments appear to be portions of small, unshaped, unifacially worked slab metates. Three were recovered in Unit B, and one each in Units D, G, and I. Specimens 1070-92-B-B-4-2, 1070-92-D-D-5-1, and 1070-92-I-D-5-3 each have a single rounded edge on the faceted side. Specimens 1070-92-B-B-4-1, 1070-92-B-C-5-1, and 1070-92-G-D-3-1 are medial fragments. Specimen 1070-92-B-C-5-1 has a deeply dished surface, perhaps indicating intensive use.

Two large block metates were recovered at the Hines site. Specimen 1070-92-F-A-4-2 is a fragment of a large metate that was located less than a meter from the fire hearth in the southeast

Table 5.9. Metric attributes of Hines ground stone fragments, in millimeters and grams.

Catalog No.	Type	Material	L	W	Th.	Wt.
		North Block				
1070-92-B-B-4-1	metate frag.	basalt	76.0	43.9	19.4	58.8g
1070-92-B-B-4-2	metate frag.	basalt	59.7	32.6	20.1	45.8g
1070-92-B-C-4-1	mano frag.	basalt	48.6	46.3	20.2	29.7g
1070-92-B-C-5-1	metate frag.	basalt	39.4	39.8	14.2	22.0g
1070-92-D-B-2-1	bifacial mano frag.	basalt	73.4	45.1	36.0	124.0g
1070-92-D-D-2-1	mano frag.	basalt	36.1	31.5	34.5	43.7g
1070-92-D-D-3-1	mano edge frag.	basalt	50.2	12.9	26.7	15.7g
1070-92-D-D-5-1	metate frag.	basalt	76.5	44.9	22.5	77.1g
1070-92-D-D-5-2	mano frag.	basalt	37.8	44.5	35.6	28.8g
1070-92-G-D-3-1	metate frag.	basalt	76.6	65.0	18.1	134.2g
1070-92-F-A-5-2	mano frag.	basalt	67.5	64.0	29.0	108.1g
1070-92-F-B-6-5	abrader	ccs	78.4	58.0	22.7	172.3g
1070-92-I-D-5-3	metate frag.	basalt	104.7	73.7	24.9	255.2g
1070-92-E-A-9-(1-3)* metate		basalt	213.0	135.0	106.0	5.50 kg
1070-92-F-A-4-2	metate	basalt	135.0	77.0	213.0	2.15kg
		South Block (Late Component)				
1070-92-N-D-4-1	mano	basalt	49.5	52.1	31.0	33.2g

*=complete tool

corner of the unit. The worn portion of the metate surface has a pinkish cast apparently caused by the exposure of mineral inclusions within the stone itself. The surface is flat but not heavily worn by use, and the stone was probably initially selected because it was well suited for the work at hand. Specimen 1070-92-E-D-9-(1-3) is a large metate found approximately one meter northeast of Feature 1. The metate was broken into two large fragments, with an additional fragment broken from the under side of the largest piece. The metate is slightly dished, but shows relatively little wear.

Manos

Six of the seven tools are highly fragmentary (1070-92-B-C-4-1, 1070-92-D-D-2-1, 1070-92-D-D-3-1, 1070-92-D-D-5-2, and 1070-92-F-A-5-2), with only small portions of grinding surfaces or edges revealing their original shape. Specimen 1070-92-D-B-2-1 is a fragment of a bifacially faceted tabular mano which has been shaped by pecking and abrasion. It and three other mano fragments were recovered from Unit D. None of the fragments were determined to be from the same artifact, although possibly some are. Another blocky, unshaped unifacial metate fragment was collected in the Late Component of the South Block (1070-92-N-D-4-1)

Abrader

A single artifact from the Hines site has been identified as an abrader. Specimen 1070-92-F-B-6-5 is a tabular stone 79.2 mm long, 58.7 mm wide and 23.7mm thick. The material is basalt, covered with a reddish-brown coating of an unknown composition. The flat side is covered with innumerable incised lines and scratches running in all directions across the surface. The opposite side shows no such use wear. The actual use of the artifact is unknown, but it has the appearance of a sharpening stone used for shaping and maintaining a point or edge on materials of a softer composition, such as bone or wood.

Miscellaneous Artifacts

Stone Bead

A fragment of a stone bead (Specimen 1070-92-H-A-5-4a) was collected in Unit H, Quad A, adjacent to Feature 1. The artifact was recovered in Level 5, which also contained two biface fragments, two utilized flakes, and the peak debitage count for the unit, at 445 pieces. The fragment fractured both laterally and longitudinally, appears to have been a tubular bead. It is made of steatite, with at least one beveled end and a barrel-shaped cross section. The bead fragment is 6.6 mm in length, has a maximum width of 5.1 mm, and a thickness of 1.2 mm.

Bone Tool

A single bone tool fragment (1070-92-E-B-5-1) was recovered from Unit E, Quad B, Level 5 in the North Block of the Central Locus (Fig. 5.9). The artifact is a small bone fragment from a

Figure 5.9. Bone tool 1070-92-E-b-5-2, actual size.

medium to large sized mammal with a concave underside and a convex upper surface. The tool has a maximum width of 10.1 mm (where the break occurred), a length of 16.0 mm, and a thickness of 2.3 mm. It tapers to 6.5 mm at a distance of 11.8 mm from the widest point, and a lobed tip reaching a maximum width of 7.9 mm composes the remaining portion. The dark brown artifact is highly polished, with a deep longitudinal striations on the convex surface. The concave surface has fewer striations which are not as symmetrical, and it seems that less attention was given to the appearance of this side. The function of the tool is not evident, but the high degree of polish and minimal signs of wear seem to indicate that it was not a utilitarian item.

Fire-Cracked Rock

Fire-cracked rock (FCR) was noted in seven of the sixteen units excavated at the Hines site. FCR was reported in Units B, C, D, F, H, and I of the North Block; generally occurring in levels 2 - 7. One piece was also reported in Level 4 of Unit M. Overall, the quantities of FCR at the site were quite low, and only two pieces were associated with the single identified hearth (Feature 1) at the site.

Historic Artifacts

Being adjacent to a busy highway corridor, the Hines site had the usual array of modern historic debris, including objects manufactured from cellophane, plastic, metal, and glass. These materials were collected and catalogued along with the prehistoric artifacts as a component of the overall site assemblage.

One historic artifact deserves a more specific description. A cylindrical brass rifle cartridge was surface-collected at the Hines site during the data recovery phase. It is a center-fire cartridge (primer cap located in the center of the cartridge head). The cartridge has been fired; the primer has been indented by the impact of a rifle firing-pin, the bullet is absent, and the neck of the cartridge has been crimped almost completely closed by compression from either vehicle or foot traffic. This cartridge was identified by Robin Kesler, a local small-arms expert, as .50 Government caliber (also known as 50/70 Government) through casing and head diameter measurements. The cartridge was used by the U.S. military from 1863 to 1873, and is among calibers manufactured for use with early repeating rifles such as the 1866 Henry. The cartridge is not head-stamped with information regarding either caliber or manufacturer, indicating that it is government-issued ammunition. However, rifles were chambered for the .50 Government caliber until 1940, and it is unclear how long government ammunition was available after the round was discontinued from military use. The cartridge is 46.3 mm in total length. The casing is 14.7 mm in diameter and 0.2 mm in thickness, while the head has a diameter of 16.5 mm and a thickness of 1 mm.

Faunal Remains

The faunal assemblage from the Hines site consisted of 39 bones collected during the testing phase and 1780 specimens from the data recovery phase, for a total of 1819 complete bones and fragments. Most of the faunal remains were highly fragmented and often very light in color, unlike the darkly stained bones associated with sites that have been intensively occupied. Heavily occupied sites often develop rich, dark anthropic soils that alter the appearance of bones through prolonged contact. The overall preservation of bone was good, with many small and delicate fish, rodent, and bird bones recovered during the excavations (Table 5.10). Burned bone was uncommon.

Of the 1819 bones recovered during the Hines excavations, 303 were identifiable to a series of size classes which ranged from Class 1 (mice, shrews, voles) to Class 6 (elk, bison, horse). Some of the 303 bones were further classifiable to order, family, or genus/species based on the completeness of whole elements or distinguishing characteristics of bone fragments. For instance, the tibia and fibula configuration of various rodent families is much more distinctive than are vertebral elements, especially when a complete set of comparative specimens is lacking. The variety of species recovered from the site was quite diverse, considering the relatively small size of the faunal assemblage. The good preservation qualities of the site provided a number of easily identifiable specimens.

Because much of the bone was lightly colored, it was sometimes difficult to determine which bones were culturally deposited, and which were the result of natural deposition, particularly in the case of rodent remains. Several species of rodents were noted at the site over the course of the excavations there, and evidence of rodent burrowing was common throughout the excavated units. The identification of cultural versus non-culturally deposited remains was based on the determination that non-cultural bones would most often (but not exclusively) be the remains of rodents, were often lighter in color than the culturally deposited material, contained more complete elements in a concentrated area (as would occur in a burrow death), or otherwise did not seem to fit with the general characteristics of other bones being recovered from the same context in terms of preservation, appearance, and types of species. The location of the site adjacent to a busy highway where animals are frequently struck by vehicles may have contributed to the variety and quantity of fragmented animal remains. The possibility that the first 10-20 cm of deposits may have been altered by the removal of vegetation and leveling by heavy equipment may also have altered the faunal composition to a degree. Despite these potential problems, several trends were apparent in the faunal assemblage, which will be described below.

Table 5.10. Faunal remains recovered from the Hines site.

Taxon	Common Name	North Locus N. Block	North Locus S. Block	Central Locus	South Locus	Total
Insectivora						
Sorex sp.	Shrews	-	1	-	-	1
Lagomorpha						
Lepus sp.	Hares	-	8	-	-	8
Syvilagus sp.	Rabbits	-	1	1	-	2
Leporids	Hares and rabbits	-	35	2	1	38
Total						48
Rodentia						
Castor canadensis	Beaver	-	1	-	-	1
Ondatra zibethicus	Muskrat	-	2	-	-	2
Dipodomys ordii	Ord's Kangaroo Rat	-	-	1	-	1
Spermophilus sp.	Ground Squirrels	-	1	-	-	1
Thomomys sp.	Pocket Gophers	-	7	-	-	7
Dipodomys sp.	Kangaroo Rats	-	1	-	-	1
Neotoma sp.	Woodrats	1	3	1	-	4
Microtus sp.	Voles	1	-	-	-	1
Sciuridae	Squirrels	-	2	-	-	2
Rodentia	Rodents	4	51	3	-	58
Total						78
Carnivora						
Taxidea taxus	Badger	-	1	-	-	1
Procyon lotor	Raccoon	-	-	1	-	1
Canis sp.	Coyotes, Dogs	-	3	2	-	5
Total						7
Artiodactyla						
Odocoileus hemionus	Mule Deer	-	6	-	-	6
Cervus elaphus	Elk	-	-	-	1	1
Bos taurus	Domestic Cattle	-	1	-	-	1
Artiodactyla		-	6	-	-	6
Total						14
Aves						
Gallus gallus	Domestic Chicken	-	2	-	-	2
Anas sp. (Large)	Mallard-sized	-	5	-	-	7
Anas sp. (Medium)	Pintail-sized	-	3	1	-	4
Anas sp. (Small)	Teal-sized	-	2	-	-	2
Unidentified Bird		-	7	-	-	7
Total						22
Pisces						
Gila bicolor	Tui Chub	-	26	-	-	26
Unidentified fish		-	7	-	-	7
Total						33
Amphibia						
Spea intermontana	Spadefoot Toad	-	6	1	-	7
Reptilia						
Serpentes	Unidentified snakes	-	2	-	-	2
Class 1	mice, shrews	-	23	-	-	23
Class 2	squirrels, gophers	5	52	3	-	60
Class 3	rabbits, hares	1	55	3	-	59
Class 4	coyote, bobcat	1	5	-	-	6
Class 5	deer, antelope	1	9	-	-	10
Class 6	elk, bison	-	1	-	1	2
Class x	unidentifiable	37	1170	240	2	1449
Totals		51	1505	258	5	1819

The mammalian faunal assemblage accounted for the highest number of animal remains at the Hines site, and included species from the Orders Insectivora, Lagomorpha, Rodentia, Carnivora, and Artiodactyla. Rodents (21%) and lagomorphs (13%) were the most commonly identified mammal species, with artiodactyls (4%), carnivores (2%), and insectivores (<1%) less common in the deposits. Identified species include Ord's Kangaroo Rat, Beaver, Muskrat, Badger, Raccoon, Mule Deer, and Elk. Hares may have included either Black-tailed or White-tailed Jackrabbits, but the White-tailed species is less common, and occupies more scattered habitats (Verts and Carraway 1998). The canid remains may include both coyotes and domestic dogs. The highly fragmented material did not permit clear identifications. One small second molar may have been that of a fox.

Other animal remains included fish (9%), of which the majority were Tui Chub; birds (6%), including a variety of waterfowl; and reptiles and amphibians (2%), of which the amphibian remains were exclusively Great Basin Spadefoot Toad. The insectivore and the reptiles and amphibians are not related to the cultural deposits, but are included because they provide examples of the range of species that are present at the site.

The largest concentration of faunal remains occurred in Units C and F of the North Block, with the total bone count at Unit F accounting for 29% of the site total (529 specimens). Bone counts at units surrounding C and F decreased rapidly (Figure _), possibly indicating that a processing or butchering activity area was located where the two units were established, or a favored discard area. The North Block alone produced 80% of the bone recovered at the Hines site, and almost all of the artiodactyl, bird, and fish bones came from this location. The only exceptions were an unidentified artiodactyl bone fragment recovered from Unit A at the North Locus, and a medium-sized duck humerus found in Unit L at the South Block. Diversity was high at the North Block, with a total of 20 species, families, orders, or classes of animals represented in the deposits. The South Block contained nine taxa, the North Locus had four, and the South Locus had three.

Unfortunately, the limited quantities of animal bone recovered at the South Block did not permit an analysis of the potential differences between the earlier and later components at the Hines site. The bone from the South Block was highly fragmented and decreased rapidly in quantity as depth increased.

Botanical Remains

Pollen and macrofloral analyses were conducted by Linda Scott Cummings, Kathryn Puseman, Thomas E Montoux and Laura L. Ruggiero of Paleo Research Laboratories (Cummings et al. 1998). One offsite sample, four column samples, and eleven additional soil samples were submitted for study. Of these, one modern surface sample (1070-92-Offsite) was submitted for both pollen and macrobotanical analysis. A column sample (TR3-1 through TR3-3) that was taken from Trench 3 between 1.0 - 1.75 meters in depth, was submitted for pollen analysis alone. The remaining samples underwent macrofloral analysis only. A summary of the results is presented here, along with tables listing the materials that were recovered (Tables 5.11, 5.12).

Pollen Analysis

The surface pollen sample contained an abundance of Artemesia pollen produced by the sagebrush surrounding the site on the valley floor and hillsides, and smaller amounts of juniper and pine pollen from higher elevations to the northwest. Quercus (oak) and Salix (willow) pollen were transported from nearby sources. Small amounts of Cheno-am (amaranth or pigweed), Sarcobatus (Greasewood), Poaceae (grasses), Leptodactylon-type, and indeterminate types of pollen were also noted from the modern surface sample.

The surface sample was collected away from the excavation, at a location that was free of debitage and other obvious evidence of cultural materials. Approximately 1000 cm^3 of fill was collected after several centimeters of surface material containing twigs, and rootlets were removed. The sample was apparently taken from an area containing unseen subsurface cultural deposits, which included a burned camas bulb, sagebrush and serviceberrry charcoal, and a number of debitage flakes in addition to the above-mentioned pollen. Some or all of the charred plant materials may have been the result of natural fires, but the presence of debitage suggests that they may also be cultural in origin. As a result, the sample can not be considered truly representative of non-cultural deposits in the vicinity of the Hines site.

Table 5.11. Pollen recorded at the Hines site.

Pollen	1070-92-Offsite	TR3-1	Sample # TR3-3	TR3-2
Algal Spores	-	L	L	L
Alnus	-	L	L	L
Apiaceae	-	H	-	-
Artemesia	H	-	L	L
Asteraceae	M	L	L	L
Brassicaceae	-	L	-	-
Ceanothus/Vitus	-	-	L	L
Celtis	-	-	L	L
Centaurea	-	L	L	L
Chen-am	L	H	L	L
Cyperaceae	-	L	-	-
Elaeagnus	-	-	-	L
Eriogonum	-	-	-	L
Juniperus	L	L	L	L
Leptodactylon	L	-	-	-
Phlox	-	-	-	L
Picea	-	L	-	-
Pinus	L	L	H	H
Poaceae	L	-	-	L
Polygonaceae	-	L	-	-
Quercus	L	L	-	-
Rosaceae	-	L	L	L
Salix	L	-	-	-
Sarcobatus	L	H	L	L
Indeterminate	L	-	-	-

L=Low M= Medium H=High

Additional pollen analysis was conducted on three samples derived from Trench 3, located between Unit N (at the South Block) and Unit O, further to the south. The samples were collected from deposits believed to be associated with the Late Pleistocene/Early Holocene lakeshore. The trench was excavated to depths averaging 1.5 meters and stratigraphic layers were evident that included dark, organically rich deposits believed to be associated with old marsh deposition, underlain by fine silts and a greenish clay from the lake bottom. The wall of the trench was "shaved" to eliminate backhoe smear, and the samples, averaging 10 cubic cm in size, were collected at locations specified by the on-site geomorphologist. Sample TR3-1 was collected at a depth of 95-108 cm below the surface, and contained pinkish banding and dark gray layers of a brittle ashy-silt. The sample contained less *Pinus* pollen than the samples taken lower in the deposits.This is attributed to the retreat of pines to higher elevations, possibly as a result of dryer, warmer conditions at the time the material was deposited (Cummings et al. 1998). Small quantities of juniper and oak pollen suggest that both of these species were found locally, and the presence of spruce pollen indicates that such trees occurred at higher elevations in the area (Cummings et al. 1998). Algal spores occurred in all three samples, indicating the presence of water. Increased Cheno-am and *Sarcobatus* pollen suggests increasing salinity along the lake edge as the result of drying of the lake.

Sample TR3-3 (the lower sample numbers were transposed) was collected between 118-128 cm below the surface, and contained a fine, moist silty-clay that was tannish-gray in color and interspersed with small red and gray pebbles. Sample TR3-2 came from a depth of 153-163 cm below the surface and consisted of a damp sandy clay, gray in color, with obsidian pebbles, orange staining from iron oxides, and rounded volcanic gravels. Both of the samples have reduced *Artemesia* pollen frequencies (although sagebrush was still the principal ground cover) and high quantities of *Pinus*, indicating that pines were growing closer to the site at the time the sampled sediments were accumulating. Alder and juniper were also present, along with sunflowers, buckbrush/grape, hackberry, cheno-ams, rose, silverberry, wild buckwheat and others (Table 7.12).

Overall, the Trench 3 samples seem to indicate that the vegetation present during the late Pleistocene/early Holocene transition was considerably different than it is today. Sagebrush was common as now, but pines and alders were much nearer to the site, and spruces occurred in the higher elevations. At a later time, the lake (indicated by algal spores) began to retreat, salinity-tolerant plants increased, and plants which were adapted to moister conditions declined in numbers.

Table 5.12. Macrofloral remains from the Hines site (Cummings et al. 1998).

	Sample #					
Col. Sample 4D (Unit L)	4-D-CS-1	4-D-CS-2	4-D-CS3	4-D-CS4	4-D-CS5	4-D-CS6
Amaranthus	f	f	-	-	-	-
Artemesia	f,c	f,c	-	c	c	-
Brasscaceae	f	f	f	f	-	-
Cupressaceae	f	-	-	-	-	-
Chenopodium	f	-	f	-	-	-
Descuraniaf	-	-	-	-	-	
Dicot	-	-	f	-	-	-
Juniperus	-	f	-	-	-	-
Linaria	f	f	f	-	-	-
Lupinus	f	-	-	-	-	-
Malvaceae	-	f	-	-	-	-
PET Starchy	-	f	-	-	-	-
Plantago	f	-	f	-	f	-
Poaceae	f	f	f	f	-	f
Polyganum	f	-	-	-	-	-
Rosaceae	-	-	c	-	-	-
Unidentified	f	f	f	-	-	-

Col. Sample 10B (Unit F)	10-B-CS1	10-B-CS2	10-B-CS3	10-B-CS4
Artemesia	f	c	c	c
Asteraceae	f	-	-	f
Brasscaceae	f	-	f	-
Cheno-am	f	-	f	f
Chenopodium	f	f	f	-
Descuraniaf	-	-	-	
Juniperus	c	c	c	c
Lactuca	f	-	-	-
PET Starchy	f	-	f	f
Pinus	c	-	-	-
Plantago	-	-	-	-
Poaceae	f	f	f	-
Sarcobatus	-	-	f	-
Unidentified	f	f	f	-

Table 5.12 (cont.). Macrofloral remains from the Hines site (Cummings et al. 1998).

Col. Sample 13A (Unit G)	13-A-CS1	13-A-CS2	13-A-CS3	13-A-CS4
Artemesia	-	c	c	c
Brasscaceae	f	f	-	f
Cupressaceae	f	-	-	-
Cheno-am	f	-	-	f
Chenopodium	-	f	f,c	-
Cyperus	f	-	-	-
Distichlis	f	f	-	-
Descurania	f	-	-	-
Juniperus	c	c	c	c
Lactuca	f	-	-	-
Monocot	f	-	-	-
PET Starchy	-	-	-	f
Portulaca	f	f	-	-
Poaceae	f	f	f	f
Rosaceae	-	-	c	-
Salsola	f	-	-	-
Scirpus	f	-	-	-
Solanum	-	f	-	f
Unidentified	f	-	-	-

Additional Samples	Offsite Sample	6-A-7	7-A-6	10-B-4	10-B-5	10-B-6
Amalanchier	c	c	c	c	-	-
Artemesia	c	c	c	c	c	c
Brasscacea	-	-	-	f	f	-
Camassia	f	-	-	-	f	-
Cheno-am	-	f	-	f	-	-
Chenopodium	f	f	f	f	f	f
Chrysothamnus	-	-	-	-	c	-
Descurania	-	f	-	f	-	-
Juniperus	-	-	-	c	c	-
PET Starchy	-	-	f	-	-	f
Poaceae	-	-	f	f	f	-
Rosaceae	-	c	-	-	-	-
Solanum	-	f	-	-	-	-
Unidentified	-	f	-	f	f	f

Additional Samples	10-B-7	10-A-8	13-B-8	14-B-4/5	15-D-4	16-B-5	
Amaranthus	-	-	-	-	f	-	
Amalanchier	-	c	c	-	-	c	
Artemesia	c	c	c	c	c	c	
Atriplex	f	-	-	-	-	-	
Brasscaceae	-	f	-	-	-	f	
Cheno-am		f	f	f	-	-	-
Chenopodium	f	-	c	c	f	f	
Juniperus	f,c	c	c	c	-	c	
Lactuca	-	-	-	-	-	f	
Poaceae	f	-	-	-	f	f	
Purshia	-	-	-	c	-	-	
	Rosaceae	-	-	-	c	-	-
Solanum	-	-	-	-	-	f	

f= floral remains c= charcoal

Macrofloral Analysis

Three column samples were submitted for macrofloral analysis, along with 11 soil samples from various parts of the excavations (Table 5.13). The column samples were taken in Unit L (1070-92-4-D-CS1 through 1070-92-4-D-CS6), Unit F (1070-92-10-B-CS1 through 1070-92-10-B-CS4), and Unit G (1070-92-13-A-CS1 through 1070-92-13-A-CS4).

The Unit L column was taken in an area where both Late and Early Component deposits were identified. The upper sample from Unit L contained charred specimens from the mustard family, plantain, and grasses. These may be attributable to either human or natural fires. Sample 2 (10-20 cm) originated in the Late Component fill and botanical remains included charred grass seeds, PET starchy tissue that may be from a bulb, and sagebrush charcoal. Column Sample (CS) 3 (20-30 cm), also from Late Component fill, contained both *Chenopodium* and grass seeds that were charred and charcoal from small *Rosacaea* (rose family) twigs. Plant remains identified from the Early Component included charred grass seeds and sagebrush charcoal (Table 7.12).

The Unit F column was chosen because the highest concentration of cultural materials occurred there and debitage and charred bone were present in the first 30 cm of fill. Charred grass seeds were present to a depth of 30 cm. Charred PET starchy tissue fragments were recovered from CS 1 (0-10 cm), CS 3 (20-30 cm), and CS 4 (30-40 cm); and *Chenopodium* or Cheno-ams were present in CS 3 and 4. Charcoal remains included both juniper and pine in CS 1, and sagebrush and juniper in CS 2, 3, and 4. Unidentified fruit and seed fragments, and Sarcobatus (greasewood) were collected in CS3.

The Unit G column came from an area where a large metate was recovered, and the possibility was high that plant materials might be associated with it. Modern plant remains were common in the first sample along with Russian thistle, an introduced species. Column Sample 1 also produced charred grass seeds and juniper charcoal. Charred Chenopods and Cheno-ams, and grass seeds were identified in CS 2 and CS 3 as were sagebrush and juniper charcoal. Charred bone fragments and lithic debitage were noted in all samples. No increases in either the amount or diversity of plant remains were noted despite the fact that plant processing equipment was recovered nearby.

Additional soil samples were taken at various locations during the course of excavations to serve as "spot checks" for botanical remains in areas where charcoal stains were evident, cultural remains were dense, or clusters of ground stone were present (Table 5.13). The soil samples included one from Unit B (1070-92-14-B-4/5), one from Unit D (1070-92-15-D-4), one from Unit E (1070-92-16-B-5), five from Unit F (1070-92-10-B-4 through 1070-92-10-B-7, and 1070-92-10-A-8), one from Unit G (1070-92-13-B-8), one from Unit H (1070-92-7-A-6), and one from Unit N (1070-92-6-A-7). The analysis revealed that the number and variety of charred edible plant remains closely resembled the materials recovered from the column samples. No apparent concentrations of edible species were identified at any one location, including the sample collected from Feature 1 hearth deposits.

The quantity and diversity of botanical remains at the Hines site do not provide clear evidence that particular families or species of plants were being targeted for collection and processing at the location. Charred remains of edible plant species are present along with the ground stone tools needed to process them, making it likely that some of these species were being used by the inhabitants of the site. However, Cummings (et al. 1998) caution that: "Plant remains might have been charred through processing, through people burning vegetation to encourage production of certain plants, or even through natural burning".

Table 5.13. Soil samples and associated materials.

Sample #	Association
1070-92-offsite	For comparative purposes, 28 paces east and 40 paces south of Unit P
1070-92-14-B-4/5 (Unit B)	Location of 4 ground stone fragments and other tools
1070-92-15-D-4 (Unit D)	From area where projectile point and three flake tools were collected
1070-92-16-B-5 (Unit E)	Location near bone tool flake tool, and elevated bone and debitage counts
1070-92-10-B-4 (Unit F)	Location where ground stone and a large biface were recovered
1070-92-10-B-5 (Unit F)	Location where tools, FCR and elevated quantities of debitage were noted
1070-92-10-B-6 (Unit F)	Charcoal flecking and possible bisque
1070-92-10-B-7 (Unit F)	Increased debitage and bone
1070-92-10-A-8 (Unit F)	Stratigraphic transition zone
1070-92-13-B-8 (Unit G)	Charcoal flecking and increased debitage
1070-92-7-A-6 (Unit H)	Feature 1 fill
1070-92-6-A-7 (Unit N)	Charcoal flecking

Summary

The Hines site is located on an alluvial fan adjacent to the shoreline of Pleistocene Lake Malheur, within the present-day city of Hines, Oregon. The alluvial fan originates on the slopes of nearby Burns Butte, which is a prominent source of good quality obsidian. The deposits of the site are rich with obsidian nodules of varying sizes, many of which would have been adequate for the manufacture of a variety of tools and small projectile points and may in part have been an attraction to the site occupants. Most of the data recovery efforts centered around the Central Locus, which was divided into a North Block and a South Block based on peaks in artifact concentrations identified during testing. The recovered tool assemblage included 63% utilized flakes, 26% formed tools, 6% ground stone, 3% cores, 1% drills, and less than 1% for both abraders and bone tools. The only cultural feature identified at the Hines site was located in the North Block and consisted of a small hearth radiocarbon dated to 1160 BP. Concentrations of bifaces, utilized flakes, cores, and drills, as well as an awl and an abrader, were encountered near this hearth. In addition, 22 projectile points were recovered from the area surrounding the hearth, of which 58% were Rose Spring, 14% were Eastgate, 23% were straight stemmed or "pin stemmed" points more common to Columbia Plateau assemblages, and 5% were Elko Eared. A single Northern Side-notched point was also found. All of the types named, except for Elko Eared and Northern Side-notched, are consistent with the 1160 BP radiocarbon date.

Two small concentrations of ground stone were found at the site. The first was located about one meter northeast of the hearth, the other approximately 2.5 meters to the east. Two Rosegate and one Elko Eared point were recovered from the South Block. A Rose Spring, an Elko Eared, and a Northern Side-notched point were collected from the surface of the site. The Rosegate Series and Pinstem artifacts were of obsidian either derived from the Burns Butte source, or from obsidian sources located to the north and west of the Hines site. Elko and Northern Side-notched points originated either at the Burns obsidian source or at the Double O source to the south.

In all, 119 obsidian artifacts from the Hines site were measured for hydration rims. The resulting frequency distribution of rim values suggests that there were two major periods of occupation at this site. Although the hydration rims span a range of 1.4 to 9.5 microns, most of the values range between 2 and 8 microns, with peaks at approximately 3 and 6 microns. A clearer pattern emerges when hydration rims from the North Block are compared with those from the South Block. The majority of rims in the North Block range between 1.5 and 4 microns, while most rims from the South Block are between 5 and 7.5 microns in width. This clearly suggests that occupations in the South Block are generally older than those in the North Block. The Early Component lies directly over a hardpan layer associated with a Pleistocene lakebed. Because the Early Component is probably mid-Holocene in origin, this indicates that one or more erosional episodes are likely to have been responsible for the removal of deposits dating between the early to middle Holocene, and that the Early Component materials are laying on a depositional unconformity. The presence of a nearby stream channel and gravel deposits associated with fluvial activities in some portions of the site are in keeping with this idea. Unfortunately dateable materials were not available in the South Block and diagnostic artifacts were found only in the upper deposits, so hydration rims and the single radiocarbon date offer our only clues about the full occupational chronology of the site.

The zooarchaeological assemblage from the site suggests that faunal resources were derived from a marshland and grassland setting. A total of 1819 faunal remains was identified from the site, of which 370 were identified at least to the taxonomic level of class. Of the identified remains, rodents were the most abundantly identified taxon at the Hines site, accounting for 21% of the assemblage, followed by lagomorphs at 13%. Some of the rodent bones may have been the result of burrow deaths, rather than human activity. Fish remains, particularly those of tui chubs accounted for the third largest category of identified bones at 9% of the total and birds, especially waterfowl, comprised the fourth largest category, at 6%. Only 4% of the remains from the site were identified as large mammals, such as artiodactyls. The presence of eggshell and the unfused bones of immature animals indicates that the site was used, at least in part, during the spring and summer months.

Macrofloral analysis of three column samples taken in different portions of the site reveal the presence of sagebrush, juniper, and possibly rose and serviceberry as potential fuel woods. All columns contained PET starchy fragments and grass seeds (Poaceae), and Mustard family seeds were generally found in the upper levels. Less frequent were Cheno-ams, goose foot, plantain, and serviceberry, among others. A bulb fragment that may be camas was recovered from the only portion of the site where fire-cracked rock was found.

The Hines site appears to have been a location well suited for the procurement of both obsidian toolstone and marshland food resources. Site occupation is best documented for a period around 1000 BP, but obsidian hydration data and Elko and Northern Side-notched points also indicate an earlier occupation in mid-Holocene times, perhaps around 4000 – 5000 BP.

CHAPTER VI
KNOLL SITE (35HA2530)

The Knoll site is located approximately 20 miles north of the Harney Basin, in the Silvies Valley, in Section 6 of Township 19 South, Range 32 East; and Section 31 of Township 18 South, Range 32 East. The Silvies River flows southward through Devine Canyon and empties into Malheur Lake, tying the Silvies Valley to the Harney Valley hydrologic system and creating a natural corridor through which the Native inhabitants of Harney Valley passed en route to hunting and berry picking camps near John Day and Seneca (Whiting 1950). The Knoll Site is named for two small knolls nearby. A Forest Service road that begins at U.S. Highway 395 passes eastward between the knolls and into the Blue Mountain foothills east of the site. The site is located between the two knolls and continues around the east side of the south knoll between the knoll and a stream channel that leads to a small swale (Figure 6.1). The locality supports sparse vegetation that includes sagebrush, wild onion, needle and thread grass, Indian rice grass and sedges in the stream channel. The channel has been modified upslope to create a reservoir for cattle, but enough moisture moves through the channel and into the swale to support wetland vegetation distinctly different from the dominant sagebrush steppe. Vegetation is sparse due to the presence of range cattle. The Newell Creek valley to the north is closed to cattle grazing and the stream channel and steppe land supports a lush growth of riparian species, grasses, sagebrush and other shrubs.

Site reconnaissance occurred in May of 2000 in the company of Burns District BLM Archaeologist Scott Thomas. Test excavations at the Knoll site occurred from June 26 to July 13, 2000. The excavation was undertaken to address damage that had occurred on BLM land as a result of illegal fill removal, and because of the site's placement in a resource procurement area previously identified by Whiting (1950). Site testing included the excavation of 11 square meters in the form of 16 probes 50x50 cm square, one meter square unit, and three 1x2 meter test pits, resulting in the removal of 4.8 cubic meters of fill.

Figure 6.1. The South Locus of the Knoll site (35HA2530), facing southwest

Two loci roughly 80 meters apart were investigated at the site (Figure 6.2). The North Locus includes Units 1, 3, and 4; and probes 13-16. It is the location where the illegal fill removal occurred. The South Locus includes Unit 2 and probes 1-12. Site damage at the South Locus was limited to a single looter's pit, located in the area of highest artifact concentrations.

Excavation Strategies

Testing

Archaeological testing at the Knoll site was undertaken on June 26, 2000. The site was initially recorded in 1986 as an eight acre lithic scatter that included a corner-notched point, biface fragments, and some ground stone (Werner and Flaherty 1986). The looter's pit was also recorded during the initial visit. A BLM testing project occurred in May of 2000 following the discovery that between 10 and 30 cm of fill had been illegally removed by grading from a roughly 20x30 meter area within the portion of the site that would become the North Locus. The destruction exposed cultural remains that included formed tool fragments, debitage, an apparent hearth that was subsequently designated as Feature 1, and charcoal. Although three distinct charcoal concentrations were identified, only one had sufficient integrity to warrant excavation. The 50x100 cm BLM test pit dug there reached a depth of 40 cm, revealing a cluster of fire-blackened tuffaceous stones surrounded by pale brown sandy clay infused with sagebrush charcoal.

The University of Oregon testing effort began with the pinflagging of all cultural materials visible on the surface of the site, most of which were situated in the South Locus between the southernmost knoll and the stream channel (identified in Figure 6.2). Probes 1 – 8 were established to explore this concentration. The probes ran east to west, beginning on the floor of the stream channel, crossing a bench where most of the cultural materials were deposited, and continuing well upslope on the south knoll. All of the probes produced debitage, but Probe 5 was exceptional, yielding 3372 flakes from nine excavation levels. Unit 2, a 1x2, was established over Probe 5 to explore the debitage concentration further. The results of that work are described in detail below. Probes 9 – 12 were excavated north of the Probe 5/Unit 2 excavation through an area of concentrated debitage.

At the same time the work was occurring in the South Locus, Unit 1 was established at the North Locus just north of the previously mentioned 50x100 cm test unit excavated by BLM personnel. Unit 1 was established to explore the Feature 1 hearth earlier discovered. Unit 3, also a 1x2, was an expansion of the Feature 1 study. Aside from the Feature 1 hearth explorations, a series of four 50x50 cm probes, designated 13 -16 (from east to west), were also excavated. A pestle uncovered in the southeast corner of Probe 16 led to the excavation of Unit 4, a 1x1 meter unit that also produced an obsidian core and a large, pointed basalt tool, along with 456 pieces of debitage.

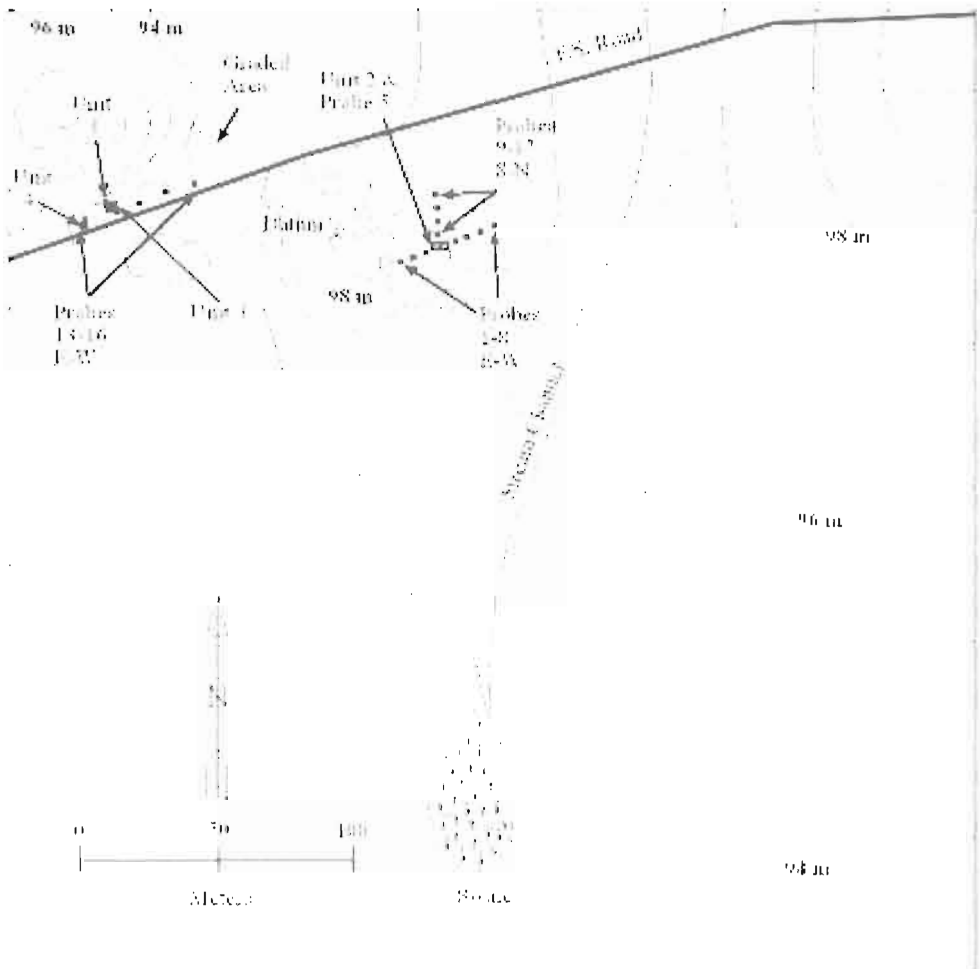

Figure 6.2. The Knoll Site (35HA2530) showing excavation units and pertinent landmarks.

Excavation Units

Prior to excavation, an arbitrary datum was established at the summit of the southern knoll for mapping the site. Using a Topcon GTS-203 transit, coordinates for the datum were set at 500 N/500 E, with an arbitrary elevation of 100 meters. The individual excavation units were tied into the grid system but they are reported only by their numeric designations for this report. Individual elevation datums were shot in for the excavation units and vertical control was maintained by level lines attached to datum stakes.

The basic unit of excavation was a 2x2 meter square, divided into 1x1 meter quadrants oriented towards magnetic north. Quad A was always to the northwest, Quad B to the northeast, Quad C to the southwest and Quad D to the southeast. The paperwork for each excavation level included drawings, artifact counts, the location of *in situ* artifacts and various physical features on a plan view map, and written descriptions of sediment types. The excavators worked with great care to insure that chronologically diagnostic artifacts and other formed tools, features, utilized flakes, and noteworthy bone fragments were recorded *in situ* when possible. Drawings were made of selected stratigraphic profiles and photographs were taken of representative walls in some excavation units. In situ artifacts and potential features were photographed. Fill was removed in ten centimeter levels and passed through 1/8 inch mesh hardware cloth. Debitage, bone, and other artifacts not discovered *in situ* were retrieved during the screening process, counted, and added to the level record.

Analytical Components

As previously noted, the Knoll site was divided into a North Locus and a South Locus based on two concentrations of cultural materials roughly 80 meters apart. Both areas had perceptibly higher quantities of debitage and other cultural materials visible on the sparsely vegetated surface than did the site at large. The looter's pit had specifically targeted an artifact concentration or cultural feature that has now been lost to history, but the illegal fill removal in the North Locus appears to have been situated for the convenient use of a front-end loader, and only coincidentally struck the heavy concentration of artifacts there.

As indicated by artifact counts and radiocarbon dates, Unit 2 at the South Locus had two concentrations of cultural material, with the first 10 – 40 cm below the surface and the second between 60 and 90 cm (Tables 6.1 and 6.2). Charcoal from levels 3 and 8 produced AMS radiocarbon dates of 1000±40 BP and 1780±40 BP respectively.

Table 6.1. Summary of artifacts from the Knoll site excavation units.

Probe	Debitage	Bone	Projectile Points	Point Frags	Bifaces/ Frags	Drills/ Awls	Flake Tools	Utilized Flakes	Cores	GS	Ochre	Charcoal	Botanicals
P-1	20	-	-	-	-	-	-	-	-	-	-	-	-
P-2	203	-	-	1	1	-	-	1	-	-	-	-	-
P-3	210	3	-	-	-	-	-	-	-	-	-	X	-
P-4	817	4	-	-	-	-	-	1	-	-	-	X	-
P-5	3372	175	-	-	2	1	-	-	-	-	-	-	-
P-6	183	18	-	-	-	-	-	-	-	-	-	-	-
P-7	14	-	-	-	-	-	-	-	-	-	-	X	-
P-9	251	11	-	-	-	-	-	-	-	-	-	X	-
P-10	244	2	-	-	-	-	-	-	1	-	-	X	-
P-11	295	6	-	-	-	-	-	-	-	-	-	X	-
P-12	285	-	-	-	-	-	-	-	-	-	-	X	-
P-13	18	-	-	-	-	-	-	-	-	-	-	-	-
P-14	44	-	-	-	-	-	-	1	-	-	-	-	-
P-15	233	-	-	-	1	-	-	-	-	pestle	-	-	-
P-16	226	3	-	-	-	-	-	1	-	-	-	-	-
Isolates	-	-	1	-	3	-	2	-	3	3	-	-	-
Totals	6415	-	1	1	7	1	2	4	4	4	-	-	-
						North Locus							
Unit 1	Quads A&C												
1	534	3	NSN	1	-	-	-	-	-	-	-	-	-
2	358	-	-	-	-	-	-	-	-	-	-	X	-
3	463	17	NSN	3	4	-	-	2	-	-	-	X	-
4	103	5	-	1	-	-	-	1	-	-	-	X	-
5	13	-	-	-	-	-	-	-	-	-	-	-	-
Unit 3Quad D of Unit 1													
1	470	2	-	-	-	-	-	-	-	-	-	-	-
2	242	-	-	-	-	-	-	1	-	-	-	-	X
3	261	4	-	-	-	-	-	-	-	-	-	-	-

Table 6.1 (continued). Summary of artifacts from the Knoll site excavation units.

Probe	Debitage	Bone	Projectile Points	Point Frags	Bifaces/ Frags	Drills/ Awls	Flake Tools	Utilized Flakes	Cores	GS	Ochre	Charcoal	Botanicals
						North Locus (continued)							
Unit 4	Quad A												
1	456	-	-	-	-	-	1	-	-	pestle	-	-	X
						South Locus							
Unit 2	Quads A&B												
1	264	1	-	-	-	-	-	-	-	-	-	-	-
2	1994	16	-	-	3	-	-	-	-	abrader	-	X	-
3	4065	89	EE	-	2	-	-	1	1	1	-	X	X
4	2195	44	-	1	-	-	-	-	-	-	-	X	-
5	914	30	-	-	1	-	-	-	-	-	-	X	-
6	467	61	-	-	1	-	-	2	-	-	-	X	-
7	591	97	-	-	-	-	-	-	1	-	-	X	-
8	716	109	-	-	-	-	-	-	-	-	-	X	-
9	786	138	-	-	-	-	-	-	-	-	-	X	-
10	42	5	-	-	-	-	-	-	-	-	-	-	-
Totals	14,934	622	3	6	11	-	1	7	2	3	-	-	-

Totals from probes and excavation units combined

debitage	21,349
bone	
projectile points	4
point fragments	7
bifaces/fragments	18
drills/awls	1
flake tools	3
utilized flakes	11
cores	6
ground stone	7

Table 6.2. Knoll Site: All faunal remains by unit and level.

	Unit												
Level	TP1a	TP1c	TP2a	TP2b	TP3d	P3	P4	P5	P6	P9	P10	P11	P16
Total													
1	3	-	-	1	2	2	-	5	1	-	1	1	2
2	-	-	7	9	-	1	1	3	1	2	-	3	1
3	14	3	6	83	3	-	-	19	5	4	-	1	-
4	3	2	8	36	-	-	-	6	8	3	1	1	-
5	-	-	5	25	-	-	2	25	3	2	-	-	-
6	-	-	8	53	-	-	-	14	-	-	-	-	-
7	-	-	44	53	-	-	-	23	-	-	-	-	-
8	-	-	43	66	-	-	-	80	-	-	-	-	-
9	-	-	75	63	-	-	-	-	-	-	-	-	-
10		-	-	5	-	-	-	-	-	-	-	-	-
backdirt		-	-	-	-	-	-	1	-	-	-	-	-
Total	20	5	201	389	6	3	4	175	18	11	2	6	3
Percentage	2.4	0.6	23.8	46.1	0.7	0.4	0.5	20.8	2.1	1.3	0.2	0.7	0.4

The presence of Northern Side-notched points indicates that some occupation occurred during the middle Holocene as well. Feature 1, in the North Locus, yielded a conventional radiocarbon date of 450±60 BP.

The North Locus

Four probes and three test units were excavated at the North Locus. The identification of Feature 1 as a possible hearth during BLM testing prompted the excavation of Unit 1 shortly upon arrival at the site. Feature 1 (Figures 6.3 and 6.4) consisted of a pit containing a cluster of large angular, fire-blackened tuffaceous stones five to 30 cm in size. It may have served as an oven or hearth , but was probably the latter since the feature lacked charred floral or faunal remains that might indicate food processing, and contained only sagebrush charcoal. The pit was approximately 80 cm long (west to east) by 50 cm wide (north to south), tapering downward to a 40 x 35 cm oval basin that reached a depth of 40 cm. The pit held rocks and charcoal, and a thin band of charcoal staining had leached into the surrounding sediments. Feature 1 intruded into the older, deeper deposits at the North Locus, but the site inhabitants apparently ceased their work upon encountering hard sandy clay deposits.

Probes 13 - 16 were excavated just south of Unit 1 to assess the integrity of deposits both inside and outside of the area damaged by grading. Probes 13 and 14 were located in the damaged area where the majority of fill was displaced, exposing hard silica-bound sediments underlying the cultural deposits. The silica-bound deposits were cemented so hard that two probes were terminated in the first level. Probe 15 also penetrated the damaged area, but 30 – 40 cm of artifact laden deposits were found there, including one biface, debitage, and faunal remains. The artifacts suggest an activity area at the location.

Unit 1, a 1x2 meter unit, was excavated to a depth of between 35 – 40 cm at the North Locus immediately north of Feature 1. Artifacts included three Northern Side-notched points (one in Level 1 and two in Level 3), four point fragments, seven biface fragments

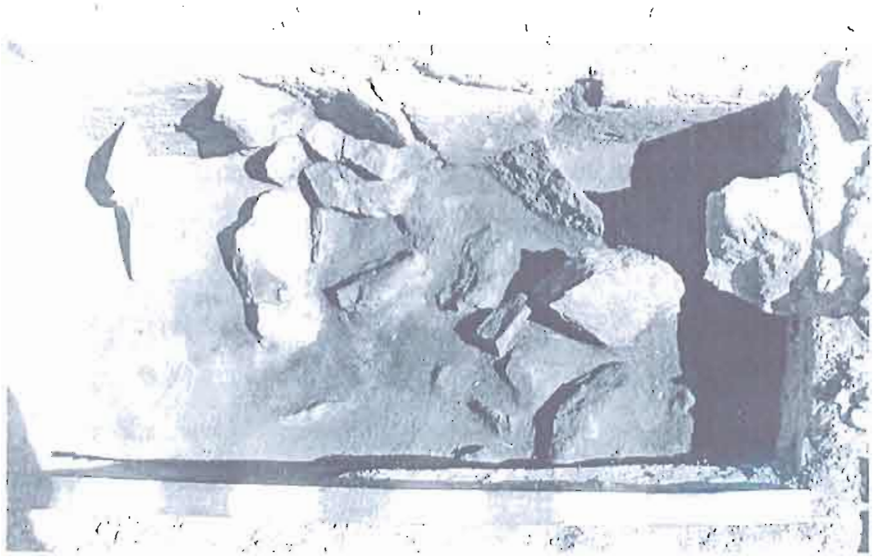

Figure 6.3. Feature 1, Level 3 (20-30 cm) facing north. Photograph courtesy of Scott Thomas, Burns District BLM.

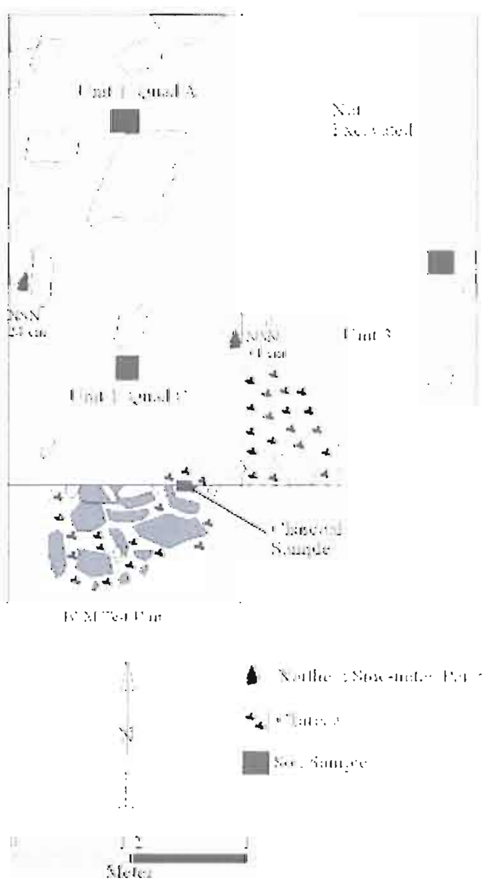

Figure 6.4. Units 1 and 3 at the North Locus. Feature 1 is the rock and charcoal concentration located in the BLM test unit.

and three utilized flakes. The two Northern Side-notched points collected during the BLM testing brings the total to five collected at the North Locus. Unit 1, placed north of the Feature 1 hearth to assist in identifying its northern boundary and other characteristics, showed that the majority of Feature 1 was removed during the BLM test excavations, save for a narrow band of charcoal staining on the southern edge of Unit 1. Sagebrush charcoal from the feature produced a conventional radiocarbon date of 450±60 BP

(Beta-146122), but the Northern Side-notched points suggest a far greater antiquity for the artifacts found in the excavation unit. Apparently, the Feature 1 hearth had been excavated into a considerably earlier cultural deposit. Debitage counts were high in Level 1 of Unit 1, declined somewhat in Level 2, and peaked once more in Level 3 before tapering off sharply in levels 4 and 5. The three Northern Side-notched points were recovered in levels 1 and 3; point fragments, biface fragments, faunal remains, and utilized flakes were found in the highest numbers in Level 3. It is apparent that Level 3 has the most evidence of cultural activity within the deposits examined at the North Locus, but Level 1 did contain 176 more pieces of debitage than Level 2 and it may be representative of a more recent cultural component.

Unit 3 (Figure 6.4)is actually Quad D of Unit 1, but is identified separately because it was excavated at a later time by other crew members. The unit was opened to aid in the identification of the eastern boundary of Feature 1. It was discovered that charcoal staining from the feature barely extended into Unit 3. An edge-modified flake and some charred botanical remains were recovered from Unit 3 along with 973 pieces of debitage and 21 bone fragments.

Unit 4 (Figure 6.5), a 1x1 meter excavation, was located just south of Probe 16 to further reveal a pestle located in the southeastern corner of the probe. The Unit was excavated to a depth of 17 cm, producing 456 pieces of debitage, an obsidian core, and a crudely manufactured pointed basalt tool.

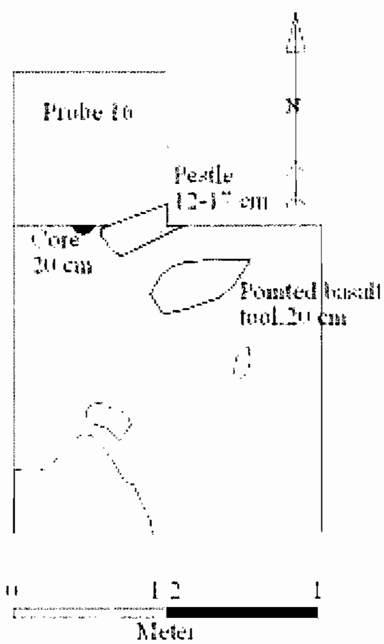

Figure 6.5. Unit 4 at the North Locus, showing the location of *in situ* artifacts and Probe 16.

The South Locus

The South Locus of the Knoll site was identified by systematic subsurface testing of a low bench adjacent to the stream channel. Prior surface reconnaissance and pin-flagging of visible cultural materials indicated high concentrations of formed tools at the locus. A total of 12 probes was excavated there. Probes 1 – 8 extended from east to west, beginning at the level of the stream channel, crossing the bench above the channel, and continuing well upslope on the south knoll. Probes 9 – 12 extended from south to north, roughly forming a "T" with the east to west probes, with Probe 5 at the juncture. It was determined during this effort that deep deposits containing an abundance of cultural materials were present between probes 4 and 6 (10 meters east to west) and probes 5 and 12 (20 meters north to south), defining an area of approximately 200 square meters.

Figure 6.6. Feature 2, in the northern portion of Unit 2, Quad A, with Probe 5 at the top of the photo.The metate is buried under the debitage and cobbles shown. The trowel points north.

Probe 5, a 50x50 cm unit, contained the highest quantities of artifacts; Level 3 alone produced almost 1,500 pieces of debitage. The concentrations noted in Probe 5 prompted the excavation of Unit 2 (Figures 6.6 and 6.7), which was 1x2 meters in size, oriented as quads A and B. Unit 2 enveloped the probe and extended northward, with Probe 5 in the southeast corner of Quad A. An Elko Eared point, two point fragments, six biface fragments, two cores, and three utilized flakes

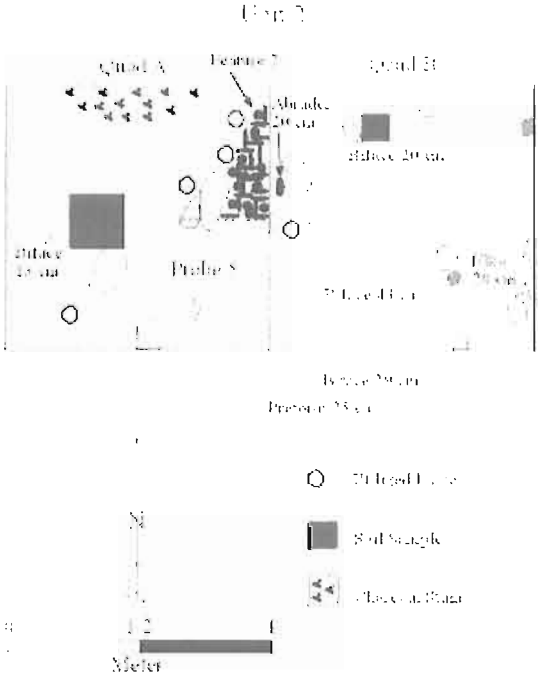

Figure 6.7. Unit 2 at the Knoll site, indicating the location of Feature 2, Probe 5, and various artifacts. The metate is buried under the debitage and cobbles identified as Feature 2.

were recovered from the unit. Feature 2, a metate, and associated cobbles and debitage, was identified on the northern edge of the excavation at a depth of 10 – 50 cm. The large, well-formed metate fragment, roughly estimated to be ¼ of the original artifact, had pecked edges. It was covered by several natural cobbles, a tapered abrader with three distinct grooves, and almost 1300 pieces of debitage that were mounded over the metate and a scattering of other natural cobbles. The cobbles may have been used as hammer stones in edge and platform preparation during the lithic reduction activity apparent from the debitage pile, though they lack obvious signs of that process, such as surface striations or other evidence of wear. The points, point fragments and other tools mentioned previously are probably associated with Feature 2 as well, but the clumped debitage and abrader that covered the metate stand out from the less coherent distribution of the other artifacts.

Paleobotanical remains recovered from Unit 2 included bitterbrush, juniper, currant or gooseberry, rabbitbrush, greasewood and sagebrush. Two of the specimens were submitted for AMS radiocarbon dating, described below.

Radiocarbon Dates

In the South Locus, the samples drawn for radiocarbon dating were correlated to peak concentrations in debitage and bone in levels 3 and 8 of Unit 2, and clearly indicate two distinct periods of occupation (Table 6.3). A greasewood twig, recovered from the Feature 2 concentration in Level 3 of Quad B, produced a date of 1000±40 BP (Beta-158860). Rabbitbrush charcoal, collected from Level 8 of Quad A within the deepest concentration of artifacts, yielded a date of 1780±40 BP (Table 6.3.). The late component, dating to ca. 1,000 BP and associated with Feature 2, included a single Elko Series point and a variety of other tools that are not temporally diagnostic. The early component, dating to ca. 1,700 BP, consisted only of increased debitage and bone counts in Level 8 and below. Diagnostic projectile points and other tools were absent from the early component deposits in Unit 2.

Sagebrush charcoal from the Feature 1 hearth in the North Locus produced a conventional radiocarbon date of 450±60 BP (Beta-146122). The Northern Side-notched points recovered from the deposits into which the Feature 1 hearth pit was intruded are not consistent with those from other late Holocene occupations, but the obsidian hydration data indicate at least some use of the site during the late Holocene (see below). Five Northern Side-notched projectile points indicate that most use of the site occurred approximately 3,500 years before Feature 1 was created.

Table 6.3. Radiocarbon dates from the Knoll site.

Sample no.	Beta ID	Provenience	Radiocarbon age	Cal. at intercept	Method
2530-BLM-1-4-9	Beta-146122	Unit 1, L4	450±60 BP	510 BP	Radiometric
119625302B35	Beta-158860	Unit 2, Q B, L 3	1000±40 BP	940 BP	AMS
119625302B83	Beta-158861	Unit 2, Q B, L8	1780±40 BP	1710 BP	AMS

Artifact Assemblage

Chipped Stone Tools

Projectile Points

Eight projectile points were recovered at the Knoll site, seven of which were of temporally diagnostic types (Table 6.4, Figure 6.8). All are manufactured from obsidian. They have been classified according to the system established by Thomas (1981) for the Monitor Valley in central Nevada and Heizer and Hester (1978) for the Great Basin at large. They include one Elko Eared point (12.5%), one Humboldt point (12.5%), and five Northern Side-notched points (62.5%). One fragmented point base is not typologically assignable. Temporal associations between the Northern Side-notched points and radiocarbon-dated features at other sites in the northern Great Basin suggest that the Knoll site was inhabited at least 4,000 years ago and perhaps earlier, although radiocarbon dates at the site itself fall well short of that assessment. Northern Side-notched and Elko points were designed for use with the atlatl, although Fowler and Matley (1979:151) provide evidence that Elko Series points were occasionally mounted on arrow shafts during the protohistoric period. The presence of Northern Side-notched and Humboldt points at the North Locus and Elko Series Points at the South Locus also seems indicative of a temporal difference between the two loci.

Table 6.4. Metric attributes of Knoll site projectile points, in millimeters.

Artifact	Type	L	W	Th	Neck W	Wt	Source	Hydration
2530-BLM-1	NSN	24.5	19.3	4.8	12.3	2.43	Tule Sp.	4.4
2530-BLM-5	NSN	13.3*	18.9*	4.2*	16.4	1.24	Wolf Cr.	5.0
2530-1-A-1-2	NSN	10.3*	14.9*	3.9*	10.7	0.59	Whitewater	4.8
2530-1-C-3-1	NSN	17.8*	15.9	4.1	10.4	1.04	Whitewater	-
2530-1-C-3-2	NSN	7.9*	17.7*	3.9*	11.4	0.54	Wolf Cr.	4.8
2530-1-C-3-4	pt base	6.9*	9.7*	3.2	-	0.17	Whitewater	4.1
2530-2-B-3-1	ECN	31.8	16.8	4.2	10.2	1.67	Whitewater	3.1
2530-4-B-5-2	Hum	32.4*	12.4	4.1	-	1.97	-	-

* indicates breakage, incomplete artifact

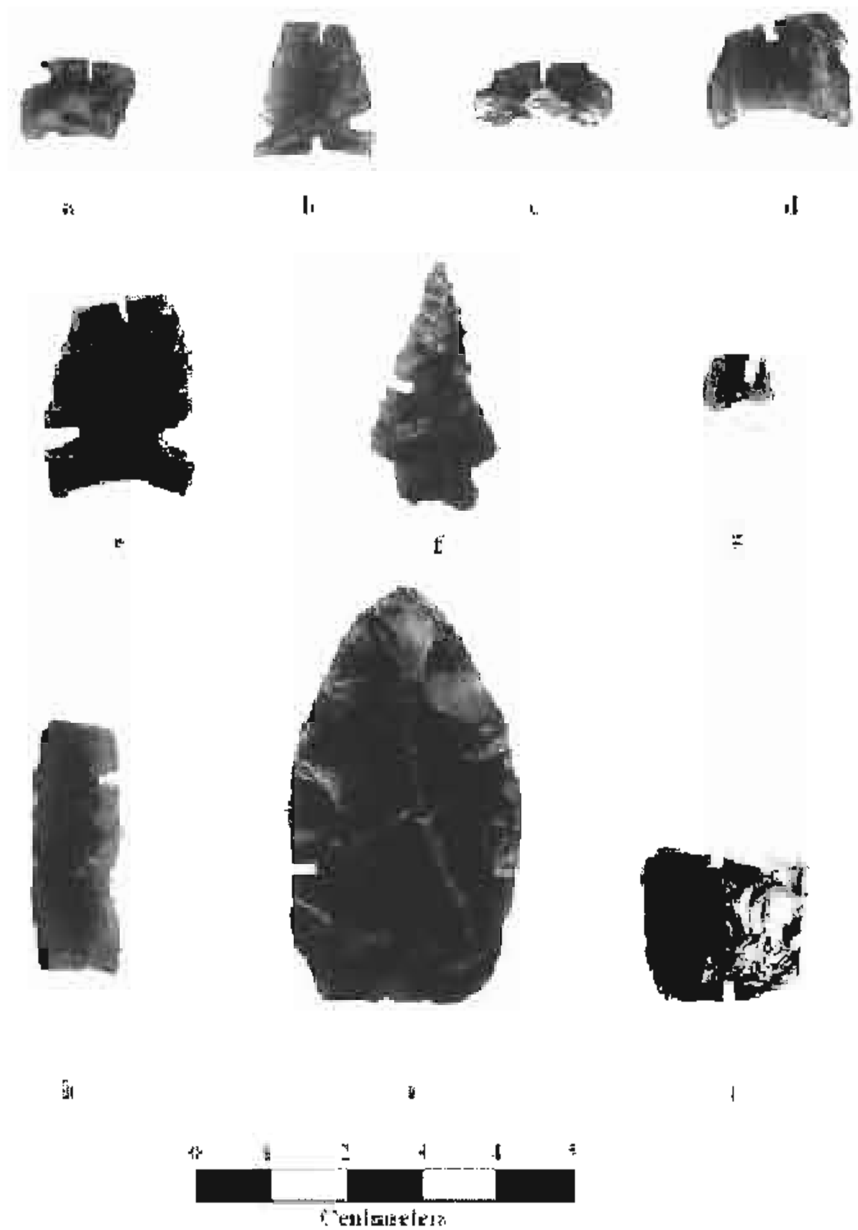

Figure 6.8. Projectile points and selected bifaces from the Knoll site.

a. 2530-1-A-1-2　b. 2530-1-C-3-1　c. 2530-1-C-3-2
d. 2530-BLM-5　e. 2530-BLM-1　f. 2530-2-B-3-1
g. 2530-1-C-3-4　h. 2530-4-B-5-2　i. 2530-2-D-surf-2
j. 2530-IF-7

Elko Series Points. A single, complete Elko Eared point (Fig. 4,f) was collected from Unit 2, Quad B, Level 3 of the South Locus. Elko Eared points are large, corner-notched points with a deeply indented base that, in conjunction with the corner-notching, form "ears" for hafting purposes. Elko Corner-notched points are morphologically similar to Elko Eared points, but lack the deep basal indentation that produces the eared appearance. The widest portion of either point is just forward of the base. Specimen 2530-2-B-3-1 is manufactured from Whitewater obsidian and has a hydration thickness of 3.1±0.1 micron. The point was recovered at a depth of 20 cm near the east edge of Quad B, in a scatter of bifaces and cobbles that may be associated with the Feature 2 metate. The radiocarbon date of 1000±40 BP for Feature 2 is in keeping with the later period of use for Elko Series points (Oetting 1994:45).

Large Side-notched. Large side-notched projectile points have been identified by various regional appellations or morphological attributes in the northern Great Basin and southern Columbia Plateau. The side-notched points recovered from the Knoll site fit well in the Northern Side-notched category established by Heizer and Hester (1978) for the Great Basin, having straight to concave bases and notches that are deep and either perpendicular to the long axis or angled upward toward the distal end of the point (Fig. 4, b, d, e). Oetting (1994) places Northern Side-notched points between 7,000 and 4,000 years in age in the northern Great Basin. The five points, all manufactured from obsidian, were recovered from the Northern Locus of the Knoll site. Two were collected during the BLM testing and three during the University of Oregon excavations. All were in association with the Feature 1 hearth, either found in the BLM test unit or in Unit 1, adjoining to the north. Two each originate from the Wolf Creek and Whitewater Ridge obsidian sources to the north, and one is from the Tule Springs source, which is located in the Stinkingwater Mountains southeast of the Silvies Valley. The obsidian hydration readings range between 4.4 and 5.0 microns, much wider than the 3.1 micron reading from the Elko point and well suited to their greater antiquity.

Humboldt Series. These points are described as "...unnotched, lanceolate, concave-base projectile points of variable size...", by Thomas (1981:17). The single Humboldt Series point fragment was collected from Unit 4 and was not found *in situ*. The point base (Fig. 4, c) was recovered from the debitage during analysis, and was not submitted for obsidian sourcing and hydration analysis.

Unknown. One point fragment, collected from Unit 1, Quad C, Level 3, is a projectile point base (Fig. 4, a). The artifact appears to be a portion of an Elko Corner-notched base that is slightly concave. The obsidian from which it is made originated at Whitewater Ridge to the north, and the hydration reading is 4.1 microns, placing it between the hydration readings for the known Elko Series and Northern Side-notched points at the Knoll site.

Shaped Bifaces

This category is based on the multi-stage biface classification system employed by Jenkins and Connolly (1990) at the nearby Indian Grade Spring site. Stage 1-5 bifaces are discussed here (Table 6.5). Stage 5 bifaces are generally classified as projectile points, and all diagnostic point fragments have been treated separately in a previous portion of the text. Most of the artifacts are fragmentary. They are considered in terms of a generalized leaf-shaped biface morphology because many share similar characteristics. Tips are pointed and are thought to be the distal ends of the artifacts. Bases usually have rounded or slightly convex squared ends and are thought to be the proximal portions of the artifacts. Midsections are frequently tapered to some degree, but can be straight-sided. Certainly not all bifaces have rounded bases, pointed tips, and show clear signs of tapering, but it seems most utilitarian for descriptive purposes to emphasize the shape of a common artifact form when only fragments exist. Bifaces often served multiple purposes, ranging from cutting implements to cores for the manufacture of projectile points and other tools.

Stage 1 bifaces. These bifaces have thick cross-sections and large, unpatterned flake scars. They exhibit only the most rudimentary development, with rounded or thick lenticular shapes and cross-sections. The flaking pattern reflects use of the hard hammer percussion technique, and the edges of these tools can be very sinuous. None of the bifaces recovered from the Knoll excavations reflected Stage 1 reduction, though a number of specimens seen on the surface but not collected fit this level of categorization. Most such bifaces were present at the South Locus in areas where quarrying of stream borne obsidian and basalt cobbles was evident.

Stage 2 bifaces. Bifacial thinning is continued on these artifacts through the removal of contiguous hard hammer percussion flakes. The removal of the flakes results in the development of an artifact, which, although still crudely shaped, has a more pronounced form than stage 1

Table 6.5. Metric attributes of Knoll Site biface and nondiagnostic projectile point fragments.

Artifact	Type	L	W	Th	Wt	Notes
2530-BLM-4	St. 3	51.3	33.2	9.7	15.10	yellow banded CCS edge frag
2530-IS-3	St. 3	27.0	26.5	8.7	4.56	pointed base, red CCS
2530-IF-7	St. 3	20.9	21.9	7.4	3.87	square base, obs
2530-IF-9	St. 5	31.0	24.7	6.1	5.59	obs. pt or drill midsection
2530-IF-13	St. 4	33.3	30.7	7.1	6.24	midsection, obs
2530-P2-1-1	St. 3	7.1	7.7	2.7	0.11	tip, obs
2530-P2-1-2	St. 3	27.3	25.1	7.8	5.58	midsection, obs
2530-P5-5-1	St. 3	18.8	36.8	8.7	5.86	rounded base frag,obs
2530-P5-8-1	St. 3	24.1	36.0	12.2	11.08	rounded brown CCS base frag
2530-P15-2-1	St. 3	33.9	79.5	11.0	27.57	lg rounded base frag, obs
2530-1-A-1-1	St. 4	6.4	9.8	3.1	0.17	small edge fragment, obs
2530-1-C-2-?	St. 2	26.2	34.9	6.8	6.35	square crude base frag, obs,
2530-1-C-3-?	St. 4	8.1	7.5	3.5	0.28	obs. small edge fragment
2530-1-C-3-3	St. 4	11.5	15.2	4.4	0.55	small edge fragment, obs
2530-1-C-3-5	St. 3	31.5	31.9	5.1	5.03	midsection, obs
2530-1-C-3-6	St. 5	11.9	12.8	4.1	0.61	proj point midsection, obs
2530-1-C-3-7	St. 5	8.9	13.4	3.7	0.38	proj pt midsection, obs
2530-1-C-3-8	St. 3	34.3	31.7	7.5	7.20	square base, obs
2530-1-C-4-1	St. 5	14.1	9.5	2.2	0.21	proj pt tip, obs
2530-2-A-2-1	St. 4	51.7	35.5	8.0	10.89	knife tip, obs
2530-2-A-2-2	St. 2	26.5	41.9	11.5	12.74	tapered base w/ cortex knob, obs
2530-2-A-3-1	St. 3	13.7	26.3	6.9	2.67	edge fragment, obs
2530-2-A-4-1	St. 5	28.4	21.7	3.8	1.80	finely wrought point tip, dart, obs
2530-2-B-2-1	St. 3	40.1	36.5	10.9	13.92	pointed base frag, obs
2530-2-D-surf-2	St. 3	55.4	31.2	6.8	11.84	complete, rounded base, obs
2530-2-B-3-2	St. 3	46.2	33.9	12.0	13.7	edge fragment, obs
2530-2-B-3-salv-1	St. 3	21.2	35.9	4.4	2.91	pointed base, obs
2530-2-B-5-1	St. 3	31.1	39.2	8.1	8.47	rounded base, obs
2530-2-B-9-?	St. 5	7.0	7.8	1.9	0.06	proj. pt. tip, obs
2530-2-D-surf-1	St. 3	39.8	51.0	10.0	18.97	rounded base, obs
2530-3-D-2-1	St. 4/5	37.0	15.7	6.4	2.19	lt brown edge frag, CCS

artifacts. Stage 2 bifaces are considered to be quarry blanks. Two artifacts fit this classification. The Stage 2 biface from the North Locus (2530-1-C-2-?) is a square base fragment. The biface from the South Locus (2530-2-A-2-2) is somewhat rounded but a bulb of intact cortex situated at the proximal end appears to have been left in place intentionally.

Stage 3 bifaces. The most common reduction stage at the Knoll site, these bifaces exhibit little to no evidence of pressure flaking and have the slightly sinuous edges characteristic of large percussion flake scars created by the initial stages of bifacial reduction. The entire artifact surface has been modified through the removal of flakes the scars of which can reach the middle of the artifact. It is at Stage 3 that major thinning of a biface occurs, often leading to breakage. A total of 17 biface fragments fit this classification, 14 of which are of obsidian and three of CCS. Most of the artifacts exhibited fine pressure flaking along some edges, with varying degrees of percussion flaking along other edges and across the body of the artifact. Four of the biface fragments were collected at the North Locus and 13 were from the South Locus.

One fragment is a tip (2530-P2-1-1), two are midsections (2530-1-C-3-5 and 2530-P2-1-2), three are edge fragments (2530-BLM-4, 2530-2-A-3-1, and 2530-2-B-3-2) and 11 are fragments of bases. The bases can be categorized into round, square, and pointed varieties. The square-based bifaces included 2530-IF7 and2530-1-C-3-8, both of which were made from obsidian. Pointed bases lend the biface a willow leaf shape, though the base is more broadly convex than the distal end, or point tip. Three bases, including 2530-IS-3, 2530-2-B-2-1, and 2530-2-B-3-salv-1 fit this description. Specimen 2530-IS-3 is manufactured from red CCS. The six round-based bifaces would have originally been teardrop-shaped and exhibit considerable variety in size. They include 2530-P5-5-1, 2530-P5-8-1 (made of brown CCS), 2530-P15-2-1, 2530-2-D-surf-1, 2530-2-D-surf-2 (the only complete biface recovered from the site), and 2530-2-B-5-1

Stage 4 bifaces. The continuation of percussion and pressure flaking techniques after Stage 3 results in bifaces with a more "finished" appearance than Stage 3 tools. Pressure flake scars can reach the midline of the artifact or beyond, and frequently eliminate the large percussion flake scars from earlier reduction. Edges are strengthened by the removal of pressure flakes, which increases the edge angle. Six Stage 4 artifacts were collected from the Knoll site, including one tip (2530-2-A-2-1), one midsection (2530-!F-13), and four edge fragments (2530-1-A-1-1, 2530- 1-C-3-?, 2530-1-C-3-3, and 2530-3-D-2-1). All but one edge fragment are of obsidian. The CCS fragment (2530-3-D-2-1) is manufactured from brown semi-translucent material. All but one (2530-2-A-2-1) of the Stage 4 bifaces were recovered at the North Locus.

Point Fragments. Most of the six point fragments recovered from the Knoll site could reasonably be attributed to dart points, with the possible exception of 2530-2-B-3-? which is so small and fine that it may be the tip of an arrow point. Three fragments are midsections and three are tips. Two midsections and one tip were recovered from Unit 1, two point tips were collected in Unit 2, and one straight-sided midsection fragment reminiscent of a drill or awl was collected as an isolate (2530-IF-9) in the South Locus.

Large Core and Flake Tools

Large core and flake tools are unshaped to roughly shaped artfacts exhibiting unpatterned flaking and edge damage associated with the performance of tasks such as cutting, scraping, and chopping. The used edges may exhibit additional modification to improve cutting ability, but often the edges are altered only by wear associated with use. Some of these tools are not made on flakes *per se*, but on large broken chunks of stone. Such tools can be either unifacial or bifacial. As a group, large core and flake tools differ from either utilized flakes or Stage 1 bifaces in two ways. First, their overall size and mass suit them best for work that would damage thinner, more refined tools, suggesting that they were designed for hard use in tasks such as shaping wood, scraping hides, or butchering large game animals. Second, they are frequently made of very dense lithic materials including CCS and basalt, which are capable of holding an edge under heavy use conditions. There are characteristics which large core and flake tools share with other tool categories such as edge-modified flakes, but, as a whole, they belong to a distinct class of tools designed for specific activities.

Several basalt tools collected at the Knoll site were distinctive because of their robust proportions and edge preparation, indicative of specialized heavy-duty cutting or chopping activities (Table 6.6). Specimens 2530-IS-4 and 2530-IF-11 are large, single-edged tools that appear to have been utilized as hand-held choppers. The two artifacts were collected as surface

Table 6.6. Metric attributes of Knoll site flake tools.

Artifact	Type	L	W	Th	Wt	Notes
2530-IS-4	basalt	105.0	71.3	19.7	152.11	oval cobble flake with one cortex side, uniform flaking around edge on cortex side
2530-IF-11	basalt	107.1	54.1	42.7	161.2	single edge cobble frag
2530-P5-3-1	basalt	84.8	70.9	29.5	140.9	lg flake with light use of curved/ptd end

isolates at the South Locus. Specimen 2530-P5-3-1 may have been used as either a chopping or cutting tool, but, based on the limited amount of edge flaking, not as extensively as the other two artifacts. Chip removal along the used portion of the flake may have developed during use and not as a result of intentional edge preparation. The three tools may be representative of butchering or woodworking, whereas other artifacts from the site suggest tool stone quarrying and plant processing.

Edge-modified Flakes

. These artifacts include both expedient flake tools and spoke shaves (Table 6.7). The expedient flake tools commonly have unifacial chipping on one side of the artifact which is the result of unintentional modification through use, with flakes being removed from the far side of the tool as it is held perpendicular to the worked object and drawn towards the user (Kiigemagi 1989:148). In some cases, bifacial chipping is exhibited due to the use of both sides of the flake for such tasks. This type of edge modification can occur along the same edge or at numerous locations on an artifact. Artifacts with prepared edges include scrapers with at least one edge strengthened by steep pressure-flaking for long term use. Spoke shaves generally have a narrow crescentic notch ideal for scraping curved or rounded surfaces.

A total of 17 artifacts (16 obsidian and one CCS) exhibit wear characteristic of edge-modified flakes. Of these, 11 are unifaces, one is bifacially worked, one was used as a graver, and four can be classified as spoke shaves. Seven edge-modified flakes, including four single-edged flakes and three spoke shaves, were collected at the North Locus. Two of the spoke shaves were

Table 6.7. Metric attributes of Knoll site edge-modified flakes.

Artifact	Type	L	W	Th	Wt	Notes
2530-P5-1-1	ccs	49.9	19.8	11.5	10.96	triangular in cross section, expedient graving spur at tapered end
2530-P14-1-1	obs	34.9	21.0	4.2	3.02	curved rectangular flake, crescentic scraping edge inset near end of one long side
2530-P16-2-1	obs	17.9	14.7	4.0	1.07	single edge, 9.8 scraping edge, thumb-finger use
2530-1-A-1-?	obs	52.0	16.2	5.9	3.16	single edge on one long side
2530-1-A-2-?	obs	23.3	17.2	2.6	0.93	single crescentic edge on broad end
2530-1-A-2-?	obs	20.8	9.4	2.9	0.64	single well won edge on one long side
2530-1-C-3-10	obs	60.3	29.1	8.5	14.73	long curved flake with edges on both long axes of convex side
2530-2-A-3-2	obs	66.2	35.0	4.4	8.62	teardrop shaped, one edge on convex side of curved flake
2530-2-A-6-2	obs	52.4	39.0	7.2	13.02	curved ovoid flake w/edges only on concave side all sides, possible preparation for biface manufacture
2530-2-B-2-?	obs	50.4	31.7	10.0	15.48	ovoid, thick flake w/single slightly inset edge
2530-2-B-3-?	obs	18.2	12.9	2.0	0.44	single edged on one long side
2530-2-B-4-?	obs	33.5	14.8	2.6	1.11	single edge on one side of long axis
2530-2-B-6-4	obs	53.2	41.6	8.0	19.04	rectangular flake w/lt flaking on one straight long edge, one side
2530-2-B-6-?	obs	20.2	16.4	4.4	1.64	cortex flake w/single edge on one long side
2530-2-B-8-?	obs	41.7	20.2	5.6	5.06	cortex flake w/crescentic edge on one end, both sides of flake
2530-2-B-9-?	obs	14.6	11.1	2.2	2.6	single edge on long side

collected in Unit 1 and one in Probe 14. Ten edge-modified flakes were recovered at the South Locus, including seven single-edged, one bifacially-edged, one spoke shave, and one graver. All have the kind of minimal edge development that would be expected from expedient use. There were no steep-sided scrapers or spoke shaves with the careful edge-preparation that might be utilized for repeated use in specific activities. The CCS tool (2530-P5-1-1) was used as a graver. It has a triangular cross section with one tapering end on which a small, well-worn spur had been created.

Cores

Eight cores were collected, all from the South Locus (Table 6.8). Three were isolates found on the surface, one was found in Level 2 of Probe 10, and four were recovered from Unit 2 (two in the early component and two in the late component). All but two of the cores were

Table 6.8. Metric attributes of Knoll site cores.

Artifact	Type	L	W	Th	Wt	Notes
2530-IS-5	bas	66.9	50.1	47.5	200+	tabular basalt cobble frag w/flakes struck from three planes
2530-IF-6	obs	61.4	55.7	41.4	137.9	obsidian cobble frag with flakes struck on five planes
2530-IF-8	bas	71.7	54.5	38.9	187.86	cobble frag, flakes struck on two opposite sides
2530-P10-2-	1obs	32.8	26.3	24.0	23.75	small cobble with flakes struck from 5 planes (half of the round)
2530-2-A-3-3	obs	34.2	31.1	14.1	10.7	spent core, flakes struck on at least 7 planes, polygonal
2530-2-A-6-1	obs	47.8	47.7	15.7	30.25	round cobble frag, flakes struck from 3 planes on one side, other curved cortex
2530-2-A-7-1	obs	41.6	41.3	18.2	32.71	small cobble cracked as test
2530-2-B-3-salv-1	obs	53.0	48.2	20.8	33.64	polygonal core with flakes struck on at least 7 planes

cobbles of obsidian or basalt readily available from the nearby stream bed, and had two or more flakes stuck from them. Two cores were more carefully prepared for flake removal, having been fashioned into tabular or polyhedral forms, from which multiple flakes of relatively uniform size could be struck for manufacture into projectile points or other artifacts.

In addition to the cores, a variety of broken cobbles "tested for their flaking qualities by the removal of a few flakes littered the stream bed and the bench at the South Locus. Concentrations of medium to large stream rounded cobbles suitable for testing were present on the stream bed and as lenses in cutbanks. It is apparent that the location served as a convenient source for both obsidian and basalt tool stone, and it is likely that other stream channels in the vicinity, including Newell Creek and the Silvies River, provided easy access to those resources. The debitage recovered from the Feature 1 and 2 excavations was dominated by the Whitewater Ridge source, undoubtedly also the origin of the stream-borne cobbles present at the site.

Ground Stone

Ground stone tools are those which exhibit shaping or wear by abrasion that is usually associated with the processing of botanical resources, particularly roots, bulbs, and seeds, but can also result from the preparation of faunal resources. Ground stone tools include manos, metates and abrading stones. The ground stone artifacts were collected at the Knoll site as surface isolates and from excavation at the North and South loci. The ground stone artifacts consisted of three metate fragments, one mano, and one abrader (Table 6.9).

Metates

Three fragments are portions of metates. One fragment recovered from the BLM testing at Feature 1 (2530-BLM-2) has wear on both sides and appears to be from a relatively thin, well formed grinding slab of basalt. Specimen 2530-IF-2, collected as a surface artifact at the South Locus, is also from a thin basalt grinding slab, which has a uniformly pecked edge indicating some care went in to the crafting of the artifact. A third basalt metate fragment (2530-2/P5-3) was collected from Unit 2 in association with Feature 2. This metate fragment was roughly one quarter of a large, non-portable specimen with grinding facets on both sides and a rim that was pecked to soften sharp edges. The metate has a symmetrical appearance,

Table 6.9. Metric attributes of Knoll site ground stone.

Artifact Type	L	W	Th		Notes
2530-BLM-2	metate	77.4	60.2	40.7	fine grained basalt, two sided interior fragment
2530-IF-2	metate	89.2	58.8	44.8	basalt edge fragment, two-sided, with well-formed pecked edge.
2530-IF-10	mano	68.5	64.0	40.8	two sided basalt roughly pecked to oval shape, end fragment, lichen growth
2530-2/P5-3 both	metate	195.0	143.6	100.6	large edge fragment with pecked edges, faceted on sides
2530-4-A-1-1	pestle	164.2	70.7	51.0	used for grinding, pounding, and as a hammerstone
2530-2-B-2-2	abrader	83.4	32.6	18.9	roughly triangular, two grooves lengthwise, one transverse notch, series of diagonal striations on non-grooved side

with smooth flat grinding surfaces and uniform edges that show considerable effort went into preparing it for continued service over time. The artifact was not photographed *in situ* because trampling by cattle, which occurred following our crew's departure from the site one evening, dislodged a number of the Feature 2 elements, including the metate.

Mano

A single mano fragment was collected as a surface artifact at the South Locus. Specimen 2530-IF-10 is approximately two-thirds of a oval cobble that had underwent some rough shaping of the edge, with heavy pecking indentations all the way around. The mano had two grinding facets on opposite sides that were used only to a moderate degree. The crudely manufactured mano fragment seems out of place with the metates, which display a fair degree of craftsmanship.

Pestle

One pestle was recovered in Probe 16/Unit 4 at the North Locus. Specimen 2530-4-A-1-1, while clearly a pestle, also appears to have served as a mano and a hammer stone. Specimen 2530-4-A-1-1 is 164.2 mm in length, 70.7 mm wide, and 51.0 mm thick (Figure 6.9). It has a somewhat rounded, but rectangular shape in cross section and both ends have been flattened by processing activities. All sides show evidence of grinding and shaping, but the two broadest sides are faceted as though by use as a mano. One of the broad sides has a distinct rounded indentation near its midpoint that probably resulted from secondary use as a hammer stone. The pestle was carefully manufactured, consistent with the carefully crafted metates seen at the Knoll site and perhaps indicating that floral processing was an important aspect of human use of the Silvies Valley.

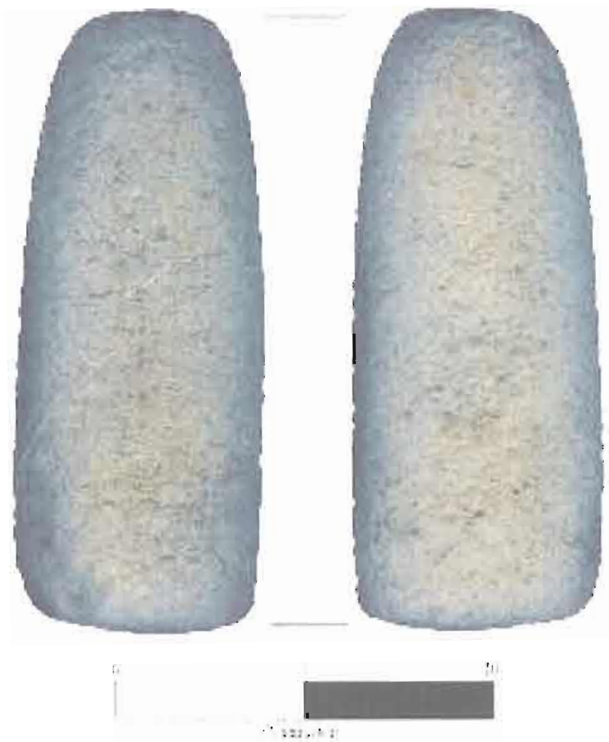

Figure 6.9. Specimen 2530-4-A-1-1, a pestle, shown at 50% of actual size.
Note indentation on obverse view (to the right).

Abrader

A single abrader was collected at the South Locus in association with the Feature 2 metate and other items. Specimen 2530-2-B-2-2 is a triangular stone that is 83.4 mm long, 32.6 mm wide and 18.9 mm thick (Figure 6.10). The material is welded tuff. Two of the three sides are grooved. The narrowest side has a deep uniform groove running the entire length that appears to be a shaft abrader. A deep, uniform notch cuts transversely across the shaft abrader and appears to have served a similar purpose. One broad side has a less well-developed groove that is shallow and undulating, possibly used in edge preparation of tool stone during lithic reduction activities. The opposite broad side has a series of diagonal scars across the widest end that also appear to be from lithic processing activities.

Figure 6.10. Specimen 2530-2-B-2-2, an abrader of apparently multiple uses, shown actual size. Groovesare located at the front and right side of the left photo, running lengthwise. Photo at right shows diagonal scars. Transverse groove visible near midpoint in both views.

Faunal Remains

The recovery of faunal remains at 35HA2530 was tied closely to those areas which produced abundances of other cultural material, suggesting that activity areas at the Knoll site were small and concentrated, and that subsistence activities were occurring in association with the quarrying and lithic reduction activities that are also well attested (Table 6.10).

Table 6.10. Faunal remains from the Knoll site.

Taxa	1	2/P5	3	Other Probes	Total
Cervus elaphus	-	1	-	-	1
Lepus sp.	-	6	-	1	7
Syvilagus sp.	-	7	-	-	7
Spermophilus sp.	-	2	-	-	2
Anura	-	2	-	-	2
Pisces	-	1	-	-	1
Size Class					
1	-	9	-	-	9
2	8	285	2	3	298
2/3	-	121	-	1	121
3	1	153	1	19	174
4	-	31	-	7	38
5	2	11	-	5	18
X	14	135	3	13	165
Total	25	763	6	49	843

Size Classes: After Schmitt (1988) and Thomas (1969)

1	<100g	shrews, mice
2	100-700g	squirrels, gophers
3	700g-5kg	hares, muskrats
4	5kg-25 kg	coyote, bobcat
5	25-150kg	deer, antelope, mt. sheep
6	>150 kg	elk, bison
X		unidentifiable

North Locus Fauna

A total of 34 pieces of bone were recovered from this portion of the Knoll site. Of these, 31 were calcined (91%). One burned fragment and two unaltered fragments were also recovered. Unit 1 produced 25 bone fragments, Unit 3 contained six, and Probe 16 yielded three. All of the specimens were identifiable only to general size classes, of which Class 2 composed the largest category (n=10 or 29%) following Class X, or unidentifiable remains (53%).

South Locus Fauna

The South Locus produced 808 animal bone fragments, of which 66.5% were unaltered, 16.8% were darkened, or stained for reasons that are unclear, 11.1% were calcined, and 5.6% were burned. Unit 2 and Probe 5 yielded 87% of the faunal remains, the rest were recovered from Probe 6 and from Probes 9 – 11. Animal bone counts peaked in conjunction with debitage and artifact counts in Unit 2, indicating that subsistence and lithic reduction activities were occurring at the same time, and that the stratigraphic integrity of the site is fairly good. Calcined bone counts also peaked in both early and late period components at the Knoll site, with 28% of the calcined bone recovered from levels 2 and 3, and 17% from levels 8 and 9, associated with the early component (n=90). The burned bone was more dispersed, with 8% found in both early and late components (n=45).

Most faunal remains were too fragmented or deteriorated to identify to species. Only one bone specimen, of Lepus, was altered from human use. This radius fragment, found in Level 7 of Unit 2, was blackened and polished, probably from cooking. Other bones identifiable to order, family, genus, or species level included an elk (*Cervus elaphus*) tooth enamel fragment, and various fragmentary bones of cottontail rabbit (Syvilagus sp.), jackrabbit (Lepus sp.), ground squirrel (Spermophilus sp.), frog (Anura), and fish (Pisces). None showed clear evidence of having been altered through cooking or consumption by the Knoll site occupants, though their presence at the site suggests they were deposited as a result of such activities. All of the animals found in the Knoll site are known to have been utilized by Great Basin cultural groups (see Fowler 1986). One Class 5 (large mammal) fragment associated with Feature 2 did have cut marks from the butchering process.

Botanical Remains

Paleobotanical identifications were carried out by Dr. Marge Helzer of the University of Oregon (Helzer 2001)and Paleo-Research Labs of Golden, Colorado (Puseman and Cummings 2001 [Table 6.11]). With the exception of the abundant sagebrush charcoal at Feature 1, intact carbon samples were uncommon. Samples selected from Units 1 and 2 for AMS dating were sent to Dr. Helzer for identification to species. Additional samples were drawn during follow-up examinations of charcoal and soil samples and submitted to Paleo-Research Labs for identification. In all, seven species were identified in 11samples. Included are sagebrush, juniper, an unknown conifer (not juniper), bitterbrush, greasewood, rabbitbrush and currant or gooseberry. The results indicate that there has been little change in vegetation at the site, as all of the plants identified are available within a short distance of the site today. All are known to have been used medicinally or for food, fiber, and structural elements in house construction (Fowler 1986, 1989; Couture 1978).

Table 6.11. Botanical remains from the Knoll site.

Sample no.	Provenience	Species	Common name	Use
2530-1-C-13-1	Unit 1, Q C, L 3	*Artemesia*	Sagebrush	fiber, fuel, medicine
2530-2-A-7-4	Unit 2, Q A, L 7	*Purshia*	Bitterbrush	dyemaking, medicine
2530-2-A-8-3	Unit 2, Q A, L 8	-	Unknown Conifer	-
2530-2-A-8-5	Unit 2, Q A, L 8	*Juniperus*	Western Juniper	food, fuel, medicine,
2530-2-B-3-4	Unit 2, Q B, L 3	*Ribes*	Currant, Gooseberry	food, medicine
2530-2-B-3-5	Unit 2, Q B, L 3	*Chrysothamnus*	Rabbitbrush	chewing gum, medicine
		Sarcobatus	Greasewood	medicine
2530-2-B-4-3	Unit 2, Q B, L 4	*Purshia*	Bitterbrush	
2530-2-B-5-4	Unit 2, Q B, L 5	*Sarcobatus*	Greasewood	
2530-2-B-6-4	Unit 2, Q B, L 6	*Artemesia*	Sagebrush	
2530-2-B-7-8	Unit 2, Q B, L 7	*Artemesia*	Sagebrush	
2530-2-B-8-3	Unit 2, Q B, L 8	*Chrysothamnus*	Rabbitbrush	

Obsidian Sourcing and Hydration

A total of 49 specimens were submitted to Northwest Research Obsidian Studies Laboratory for geochemical sourcing and measurement of obsidian hydration rims (Figure 6.11, Table 6.12). The analysis is included as Appendix C. Eight specimens were projectile points, one was a complete biface, and 40 were pieces of debitage. The debitage included 20 specimens (producing 21 measurements) from Unit 1, and 20 from Unit 2.

The projectile points originated from four obsidian sources, including Dog Hill (n=1, or 11%), north of Harney Lake; Tule Spring (n=1, or 11%) southeast of the Silvies Valley; and Wolf Creek (n=2, or 22%), to the north of the site. Whitewater Ridge (n=5, or 56%), another source used in the manufacture of projectile points, is the obsidian source available on site in the form of stream bed cobbles.

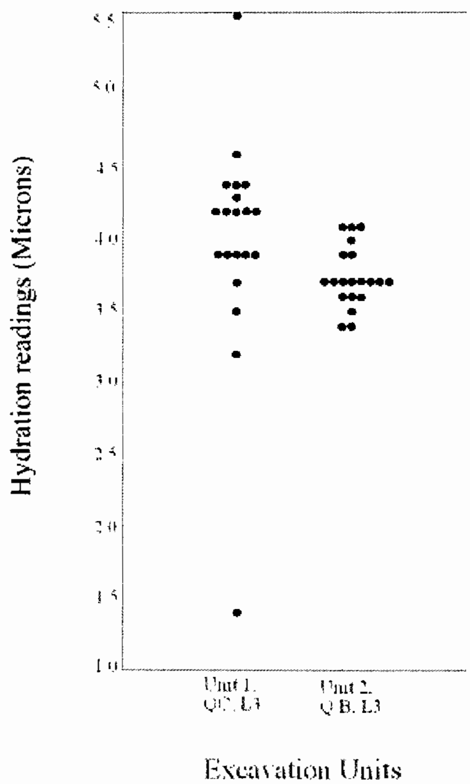

Figure 6.11 Obsidian hydration readings from Units 1 and 2 at the Knoll site.
The 9.8 micron measurement at Unit 1 is not graphed.

Table 6.12. Obsidian sourcing and hydration results from the Knoll site.

Sample	Artifact	Hydr (μ)	Source	Sample	Artifact	Hydr (μ)	Source
2530-BLM-1	NSN	4.4	Tule Spring	2530-1-C-3-11q	flake	3.9	Whitewater Ridge
2530-BLM-5	NSN	5.0	Wolf Creek	2530-1-C-3-11r	flake	5.7	Wolf Creek
2530-IF-7	bif	-	Whitewater Ridge	2530-1-C-3-11s	flake	3.9	Whitewater Ridge
2530-1-A-1-2	NSN	4.8	Whitewater Ridge	2530-1-C-3-11t	flake	3.9	Whitewater Ridge
2530-1-C-3-1	NSN	-	Whitewater Ridge	2530-2-B-3-F2-1a	flake	3.6	Whitewater Ridge
2530-1-C-3-2	NSN	4.8	Wolf Creek	2530-2-B-3-F2-1b	flake	4.1	Whitewater Ridge
2530-1-C-3-4	unk	4.1	Whitewater Ridge	2530-2-B-3-F2-1c	flake	3.9	Whitewater Ridge
2530-2-B-3-1	ECN	3.1	Whitewater Ridge	2530-2-B-3-F2-1d	flake	3.4	Whitewater Ridge
2530-2-D-surf2	bif	4.5	Dog Hill	2530-2-B-3-F2-1e	flake	4.1	Whitewater Ridge
2530-1-C-3-11a	flake	3.7	Whitewater Ridge	2530-2-B-3-F2-1f	flake	3.4	Whitewater Ridge
2530-1-C-3-11b	flake	4.2	Whitewater Ridge	2530-2-B-3-F2-1g	flake	3.7	Whitewater Ridge
2530-1-C-3-11c	flake	4.6	Wolf Creek	2530-2-B-3-F2-1h	flake	3.7	Wolf Creek
2530-1-C-3-11d	flake	4.4*	Whitewater Ridge	2530-2-B-3-F2-1i	flake	3.7	Whitewater Ridge
2530-1-C-3-11e	flake	3.9	Whitewater Ridge	2530-2-B-3-F2-1j	flake	3.7	Whitewater Ridge
2530-1-C-3-11f	flake	1.4	Whitewater Ridge	2530-2-B-3-F2-1k	flake	3.5	Wolf Creek
2530-1-C-3-11g	flake	4.2	Whitewater Ridge	2530-2-B-3-F2-1l	flake	3.9	Whitewater Ridge
2530-1-C-3-11h	flake	4.2	Whitewater Ridge	2530-2-B-3-F2-1m	flake	3.7	Whitewater Ridge
2530-1-C-3-11i	flake	4.2	Wolf Creek	2530-2-B-3-F2-1n	flake	4.0	Whitewater Ridge
2530-1-C-3-11j	flake	4.4	Whitewater Ridge	2530-2-B-3-F2-1o	flake	4.1	Whitewater Ridge
2530-1-C-3-11k	flake	4.3	Wolf Creek	2530-2-B-3-F2-1p	flake	3.6	Whitewater Ridge
2530-1-C-3-11l	flake	3.2	Whitewater Ridge	2530-2-B-3-F2-1q	flake	3.7	Whitewater Ridge
2530-1-C-3-11m	flake	4.4	Whitewater Ridge	2530-2-B-3-F2-1r	flake	3.7	Whitewater Ridge
2530-1-C-3-11n	flake	3.9	Whitewater Ridge	2530-2-B-3-F2-1s	flake	3.6	Whitewater Ridge
2530-1-C-3-11o	flake	3.5	Curtis Creek	2530-2-B-3-F2-1t	flake	3.7	Whitewater Ridge
2530-1-C-3-11p	flake	4.2	Whitewater Ridge				

* 9.8 on dorsal surface

Projectile Points/Bifaces (n=9)		**Flakes (n=40)**	
Dog Hill	(n=1, or 11%)		
Tule Spring	(n=1, or 11%)	Curtis Creek	(n=1, or 3%)
Wolf Creek	(n=2, or 22%)	Wolf Creek	(n=6, or 15%)
Whitewater Ridge	(n=5, or 56%)	Whitewater Ridge	(n=33, or 82%)

Obsidian from Whitewater Ridge, Wolf Creek, and Curtis Creek, which is found southeast of the Silvies Valley, was deposited in the form of chipping waste at the Knoll site. Whitewater Ridge, the local source, accounted for 82% of the debitage (n=33), 15% was from the Wolf Creek source (n=6), and 3% came from Curtis Creek (n=1).

The hydration measurements ranged from 1.4 to 9.8 microns (both at the North Locus), with a mean of 3.9 microns. Measurements were taken on all of the projectile points except 2530-4-B-5-2, a Humboldt point which was recovered from debitage after the samples had been submitted. Measurements were also taken on debitage from Level 3 of Unit 1 and Level 3 of Unit 2. The early component at the South Locus (levels 8 and 9) was not analyzed.

Figure 7 reveals that hydration bands at Unit 1 cover a broader range (1.4 – 5.7 microns with one outlier at 9.8 microns) than those in Unit 2, but are generally thicker and indicate that earlier occupations occurred there. The hydration readings at Unit 2 are tightly clustered between 3.4 and 4.1 microns with the majority (70%) falling between 3.4 and 3.7 microns. Only 19% of the Unit 1 measurements fall within this range.

The obsidian hydration results appear to indicate that our sampling at the North Locus captured a broad array of flakes from occupations that were dispersed across the slope or became mixed as the result of down slope movement. The sample from Unit 2 was recovered from a relatively discrete occupation that experienced little mixing. It seems unlikely that the North Locus experienced occupations that were exclusive of the South Locus, considering that the primary water feature for the area is situated at the latter locality.

Lithic Debitage Mass Analysis

Mass analysis utilizes population means including counts and weights of size-graded debitage in a replicable, quantitative manner to examine relationships of debitage in both inter- and intra-site contexts (Ahler 1989, Connolly 1999). Flake attributes such as size, weight, quantity, and the presence of cortex vary with each stage of lithic reduction, as early core and biface production yield larger flakes with more cortex than later stage biface reduction and pressure flaking. The system used here is adopted from an analysis developed for the Newberry Volcano obsidian source by Connolly and Byram (2001:68). By quantifying chipping waste through the previously mentioned variables, the characteristics of a site assemblage can be compared to those from other sites and to an experimental lithic reduction data set established for all five reduction stages (core reduction = Stage 1, biface pressure flaking = Stage 5) collected from the Newberry Volcano obsidian source (Connolly and Byram 2001:69). The mass analysis results should reflect the most dominant lithic reduction activities at a given location and, depending on other factors such as stratigraphic mixing, should allow comparisons between early and late components within a site.

Debitage from the Knoll site was processed through a series of nested screens with dimensions of 1" (G1), 1/2" (G2), 1/4" (G3), and 1/8" (G4). The flakes from each size grade were counted, weighed, and examined for the presence of cortex. The results were then compared with those from the other Harney Valley sites reported here, from the Bon site in Deschutes County (Connolly and Byram 2001), and with the overall results from the Newberry Crater project (Connolly 1999). This information is presented below in Tables 6.13 and 6.14, and summarized in the final chapter. Debitage collections from Units 1 and 2 are examined separately and together, and Unit 2 is divided into Early and Late components for comparative purposes. The inter-component comparison for Unit 2 was accomplished by analyzing the debitage most closely associated with peaks in cultural deposition for each component; levels 2-4 for the late component and levels 8 and 9 for the early component.

The presence of early and late components at the Knoll site is supported through obsidian hydration thicknesses, revealing temporal differences in occupations at the North and South loci, and bimodal distributions in debitage counts, which indicate that an early and late component are present at the South Locus. Mass analysis indicates differences between the North and South loci as well, particularly with regard to reduction stage (Tables 6.13 and 6.14). Connolly (1999) developed a formula for determining stages of lithic reduction activities at archaeological sites based on three variables : Stage = 6.048 – 0.124 (F) – 0.023 (P) – 0.091 (Q), where F is the percent count of G2 over G1 – G4, P is the mean weight of G2 (G2 weight/G2 count) in decigrams, and J is the mean weight of G3 (G3 weight/G3 count) in centigrams. The values produced from the archaeological data were inserted into this formula and the numeric result is an indicator of the relative stage of lithic reduction that occurred at the site, whether it be for the entire site or for components of the site.

Utilizing Connolly's (1999) mass analysis formula for the aggregate of both the North and South loci (Units 1 and 2) debitage resulted in a predicted stage value of 2.75 (Table 6.14), placing the Knoll site among the Bon site (35DS608), a base camp located north of Newberry Caldera, and other base camps within the Newberry Caldera (Connolly and Byram 2001:71). When the Unit 1 (North Locus) obsidian is examined separately, the stage value is found to be 2.04, similar to near-quarry lithic reduction stations examined by Connolly and Byram (2001) and anticipated at a site where obsidian cobbles are present. Collectively, the South Locus (Unit 2) material has a predicted stage value of 2.82, while the late component debitage produces a value of 2.6 and the early component material has a value of 2.72. All of these South Locus (Unit 2) results are values indicative of base camps and suggest that activities at the South Locus may not have been focused on lithic reduction activities alone.

Table 6.13 Values for the Knoll site obsidian mass analysis variables, Units 1 and 2 combined.

Variable	Computation	Value(%)
A PCTWTG1	744.6/3252.4	22.9
B PCTWTG2	1435.9/3252.4	44.1
C PCTWTG3	764.5/3252.4	23.5
D PCTWTG4	307.4/3252.4	9.5
E PCTCTG1	55/13091	0.4
F PCTCTG2	894/13091	6.8
G PCTCTG3	3335/13091	25.5
H PCTCTG4	8807/13091	67.3
I PCTWT13	744.6/2945.0	25.3
J PCTWT23	1435.9/2495.0	57.6
K PCTWT33	764.5/2495.0	30.6
L PCTCT13	55/4284	1.3
M PCTCT23	894/4284	20.9
N PCTCT33	3335/4284	77.8
O MNWT1G	744.6/55	13.54
P MNWT2DG	1435.9/894	16.06
Q MNWT3CG	764.5/3335	22.92
R MNWT4CG	307.4/8807	3.49

Stage =6.048 - 0.124(F) – 0.023(P) – 0.091(Q)
Stage =6.048 - 0.843 - 0.369 – 2.086
Stage = 2.75

The mass analysis information revealed that lithic reduction activities at the North Locus (Unit 1), an earlier occupation of the Knoll site associated with Northern Side-notched points and broader hydration rims, involved earlier stages of lithic reduction than was seen at the South Locus (Unit 2), and included a greater emphasis on quarrying. Lithic reduction at the South Locus would still have included workshop activities expected near a source of tool stone, but reflecting an assemblage dominated more by biface reduction than core reduction. It is possible that quarrying occurred at a nearby, though somewhat removed locality, and quarry blanks and preforms were then being brought to the South Locus base camp, where Feature 2 revealed the extent of lithic reduction that was occurring there.

Table 6.14. Knoll site: Lithic debitage mass analysis results for units 1 and 2, individually and combined, including early and late components in Unit 2 (obsidian only).

	Grade 1			Grade 2			Grade 3			Grade 4		
	N	Wt	Cortex	N	Wt	Cortex	N	Wt	Cortex	N	Wt	Cortex
Unit 1	4	87.4	3	104	189.9	40	348	97.4	81	788	35.6	69
		N	Wt									
Total G1-G4			1,244	410.3								
Total G1-G3			456	374.7								
Stage = 2.04												
2	51	657.2	37	790	1246.0	313	2987	667.1	559	8019	271.8	0
		N	Wt									
Total G1-G4			11,847	2842.1								
Total G1-G3			3,828	2570.3								
Stage = 2.82												
1&2Total	55	744.6	40	894	1435.9	353	3335	764.5	640	8807	307.4	69
Units 1and 2			N	Wt								
Total G1-G4			13,091	3252.4								
Total G1-G3			4,284	2945.0								
Stage = 2.75												
Unit 2: Late	23	246.3	13	291	429.6	126	1060	235.0	214	1929	78.8	187
(Levels 2 through 4)												
Late Component			N	Wt								
Total G1-G4			3,303	989.7								
Total G1-G3			1,374	910.9								
Stage = 2.60												
Early	5	51.4	4	56	91.8	24	164	38.0	28	598	22.5	63
(Levels 8 and 9)												
Early Component			N	Wt.								
Total G1-G4			823	203.7								
Total G1-G3			225	181.2								
Stage = 2.72												

Summary

Archaeological testing at the Knoll site (35HA2530) was undertaken to investigate site damage that resulted from the illegal removal of fill, and also because the site is located within an area identified by Whiting (1950:19) as having been utilized by the Harney Valley Paiutes: "Currants and other berries were picked and eaten as they ripened. Fish were caught in the streams. Any game which was encountered was killed and eaten. The families often wandered up towards Seneca and John Day and hunted deer in the timber. In the fall, some of the families went up to Canyon City, the men to hunt elk and the women to pick huckleberries." The passage does not specifically identify the Silvies Valley, but the Silvies River would have served as a natural travel corridor for those en route to the present day Seneca, Canyon City, and John Day areas. Fishing, berry picking, and hunting could all have occurred in the vicinity of the Knoll site along with the quarrying of obsidian and basalt. The Silvies Valley, while outside of the Harney Valley, is within the Harney drainage basin and thus fits into the organizational scheme of this report in both geographic and ethnographic contexts.

Archaeological evidence, including radiocarbon and obsidian hydration analysis, indicates that site use occurred earlier at the North Locus than at the South Locus. An early and late period of occupation occurred at the South Locus, supported by radiocarbon dates of ca. 1780 and 1000 BP, respectively. At the North Locus, a radiocarbon date of 450 BP documents later use of the site, and the presence of Northern Side-notched points suggests that site use also occurred as early as 4000 years ago. No radiocarbon dates support this contention, however, and the illegal removal of approximately 30 cm of fill at the North Locus made it impossible to determine stratigraphically whether both early and late components may have occurred there.

Features identified at the Knoll site included the Feature 1 rock and charcoal concentration dated to 450 BP at the North Locus, and a 1000 BP concentration of obsidian flakes and other artifacts at the South Locus identified as Feature 2. Feature 1 is difficult to assess because of the lack of faunal or floral remains that would aid in determining if the fire there was used for processing certain kinds of resources. Also, the substantial rock and charcoal concentration is not like other hearth features known in the region. It may be a rock-filled oven. There are no late Holocene projectile points around it, with the exception of a possible Elko base fragment, and late period obsidian hydration measurements are uncommon generally at the North Locus. It is possible that most associated artifacts were hauled away with the fill that had been illegally removed from the site. Feature 2 includes a tight cluster of obsidian debitage, an abrader, a metate fragment, and a number of biface fragments and other tools scattered in a loose arc around the debitage. The feature seems to be a work station oriented to lithic reduction activities and dating to ca. 1000 years ago. The Feature 2 surface is considered the late component of the South Locus (Unit 2), with a second, earlier component dating to 1780 BP beginning 30 cm below it. The early component is marked only by increased amounts of bone and debitage.

Activities carried out at both the North and South loci include lithic reduction, faunal processing, floral processing and possibly woodworking activities (represented by the abrader and spokeshaves). Obsidian geochemistry reflects local sources as well as the import of tool stone from the Stinkingwater Mountains, southeast of the site. Cut and calcined faunal remains indicate that processing and cooking of game animals occurred at both loci though more intensively at the South Locus. Grinding stones were limited in quantity but the degree of workmanship, including symmetrical shaping, pecked rims and edges, and high polish on grinding surfaces suggests that floral processing played a prominent role at the site. The presence of large metate fragments suggests that the metates were "site furniture," left there and returned to seasonally for seed, bulb, or berry processing. The pestle at the North Locus shows wear indicating that it was utilized with a mortar, as a mano, and occasionally as a hammerstone, all of which are applications useful in the processing of plant remains. A charred twig from a currant or gooseberry plant was identified at the South Locus along with species that are commonly found at the site today.

Activities at the two loci varied as well. At the North Locus, debitage mass analysis indicated that lithic reduction activities were oriented toward early stage (Stage 2) core preparation processes expected at or near quarrying sites. At the South Locus, early Stage 3 biface reduction was more common, similar to what Connolly (1999) encountered at base camps and off-quarry lithic reduction workshops at Newberry Crater and the Bon site. As mentioned above, early stage lithic processing could have occurred at the North Locus portion of the site and Stage 3 bifaces could then have been carried to the base camp at the South Locus for more refined work. Cores, bifaces, utilized flakes and paleobotanical remains were found in higher quantities at the South Locus, as were both identifiable and unidentifiable bone fragments. The sheer volume of artifacts recovered at the South Locus, especially in Unit 2 and Probe 5, indicate that use of that portion of the site was much more intensive than at the North Locus, especially around 1000 years ago. Debitage and bone were particularly well represented, but regrettably one can only speculate about what was removed from the looter's pit near Unit 2.

In summary, the Knoll site has characteristics that fit the pattern of activity expected from Whiting's (1950) ethnographic account of Burns Paiute economic practices, in which hunting, fishing and berry picking all figured into the seasonal round of that area. She specifically named currants as desirable resources, and currant or gooseberry remains were identified at the site along with the equipment to process them. Both small and large mammal remains were recovered, although not in quantities that would indicate that hunting played a prominent role at the site. Only one fish bone was recovered, in the South Locus, so fishing was perhaps incidental to other favored activities such as floral and lithic processing.

BEFORE WINTER COMES: ARCHAEOLOGICAL INVESTIGATIONS OF SETTLEMENT AND SUBSISTENCE IN HARNEY VALLEY, HARNEY COUNTY, OREGON

by

PATRICK WARREN O'GRADY

A DISSERTATION

Presented to the Department of Anthropology
and the Graduate School of the University of Oregon
in partial fulfillment of the requirements
for the degree of
Doctor of Philosophy

December 2006

"Before Winter Comes: Archaeological Investigations of Settlement and Subsistence in Harney Valley, Harney County, Oregon," a dissertation prepared by Patrick Warren O'Grady in partial fulfillment of the requirements for the Doctor of Philosophy degree in the Department of Anthropology. This dissertation has been approved and accepted by:

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Title: BEFORE WINTER COMES: ARCHAEOLOGICAL INVESTIGATIONS OF SETTLEMENT AND SUBSISTENCE IN HARNEY VALLEY, HARNEY COUNTY, OREGON

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Many archaeological researchers that have conducted investigations in the Harney Valley of southeastern Oregon use the ethnographic description of the seasonal round of the Harney Valley Paiute reported by Beatrice Blyth Whiting in her 1950 work *Paiute Sorcery* as a framework for discussions of prehistoric human use of the area. Archaeological investigations of seven sites, situated in areas identified as having been utilized by the Harney Valley Paiutes, were conducted to test the relationship between Whiting's ethnographic account and the archaeological record. Data recovery excavations occurred at the Hoyt (35HA2422), Morgan (35HA2423) and Hines (35HA2692) sites near Burns, and test excavations occurred at the Knoll (35HA2530) site in the Silvies Valley, the RJ site (35HA3013) in the Stinkingwater Mountains, and the Broken Arrow (35HA2735) and Laurie's (35HA2734) sites near Malheur Lake.

Studies of the cultural materials recovered during the excavations were undertaken to evaluate the content and complexity of each site. Analyses included typological considerations of the chipped stone tools, ground stone, bone tools, and shell, bone, and stone beads. Radiocarbon dating, obsidian sourcing and hydration, and zooarchaeological and paleobotanical analyses were also conducted when possible. Based on the results of the analyses, the seven sites reported herein were primarily used during the past 2000 years, with periods of less intensive use extending beyond 4000 BP.

The results of the archaeological investigations indicate that there is a strong correlation between the late Holocene prehistoric record and Whiting's ethnographic description. However, the relationship between human use of the centrally-located lakes and wetlands and the neighboring uplands is clearly more complex than the ethnographic record suggests. Patterns of settlement and mobility revealed through the archaeological record indicate that central places, located closer to wetlands and lacustrine settings but within relatively easy reach of the uplands, may have figured more prominently in the behavior of prehistoric populations than the seasonal round as described by Whiting. Future research will benefit from explorations of central place foraging, emphasizing the role of behavioral ecology in the placement of sites and patterns of site use within the Harney Valley and the northern Great Basin at large.

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CHAPTER VII
RJ SITE (35HA3013)

The RJ site is located on the Stinkingwater Mountains/Pine Creek divide approximately five miles west of Indian Grade Spring (Jenkins and Connolly 1990) and 35 miles northeast of Burns, in Section 2 of Township 22 South, Range 33 East, Willamette Meridian. Drainages south and west of the site descend into the Harney Valley, while those to the north and east flow into the Malheur River to join the Snake, and then the Columbia River. Site reconnaissance occurred in May of 2000 in the company of Burns District BLM Archaeologist Scott Thomas. Test excavations at the RJ site occurred from July 8 - 26, 2000.

The RJ site occupies Gravelly Ridge, a promontory overlooking broad lithosol plains, which extend southward approximately 1.5 kilometers to an unnamed spring (Figure 7.1). In the spring months, the lithosols for miles around are carpeted with kouse and wild onion blooms, while Indian carrot and Indian celery fills the drainages below. The location was well suited to our research interests, being situated in high elevation root grounds in an ethnographically documented use area (Whiting 1950:17, Couture 1978:8). Whiting (1950:17) describes women's root gathering and storage activities in the vicinity and noted that upon arrival at the root camps, the men continued on to the Drewsey (Malheur) River, which is just over the divide, to set up and repair their salmon traps in preparation for the spring runs. A nearby location is still being used regularly by two *Wada'tika* women, elders in the tribe, whose first initials provide the name for the site. One of the women reported that when she was a girl, the Paiutes would come to this location to collect roots and the women would stay at a site to the north (where the two elders currently camp) while the men would camp in the area of our excavation (Thomas, personal communication 2000).

The excavation was undertaken to provide data regarding prehistoric site use in association with the goals of this study. Site testing included the excavation of 14.5 square meters in the form of ten 50x50 cm probes, one 2x2 meter square unit, and four 1x2 meter test pits, resulting in the removal of 4.05 cubic meters of fill. Figure 7.2 shows the locations of excavation units in relation to the general topography. Unit 3 was situated at the highest point on

Figure 7.1. View of the RJ site facing south. Unit 3 is on the rise at the left of the photo.

the site, on a windswept basalt rim with a thin mantle of sediments and a broad view of the surrounding landscape to the north and east. Like Unit 3, Unit 1 was also on the ridge top, but on a slight slope to the south. Units 4 and 5 were below Unit 3 to the north, where the sharp slope of the ridge began to level out onto a sediment-laden bench above a lithosol plain. The sediments there supported a thick cover of Great Basin wild rye, currant, sagebrush, bitterbrush, and juniper. The same was true of Unit 2, which was below Unit 1 to the south, in an area where aeolian accumulations were also substantial. The principal areas of sediment accumulation appeared to be on the north and west sides of the ridgeline, with less deposition on the east, or leeward side of the ridge.

Excavation Strategies

Testing

Archaeological testing at the RJ site was undertaken on July 18, 2000. The site had been initially recorded by University of Oregon Field School students on June 20, 2000, as a lithic scatter with possible house rings. Artifacts noted on site included Desert Side-notched, Rose Spring, and Elko Corner-notched points, an abundance of basalt choppers and flake tools, and several polished pebbles. Vegetation noted on the site included the previously mentioned species as well as buckwheat, lupine, Idaho fescue, Sandberg's bluegrass, and cheatgrass (Thomas and Thompson 2000).

The University of Oregon testing effort began with the establishment of excavation units 1 – 3 at areas that were of interest due to high concentrations of cultural materials and some possibility of cultural depth (Figure 7.2). After the first three units were under way, probes 1 – 10 were excavated to explore potentially deep deposits on the north side of the promontory. The probes ran east to west at the base of a steep decline at the edge of the basalt caprock, but high on the aeolian collar in an area where cultural materials were evident. All of the probes produced debitage, but Probe 2 also produced an unusual tool modified from an Elko Eared point base, prompting additional excavation at the location.

The ridge top excavations never exceeded 30 cm in depth before a dense substructure of weathering tabular basalt fragments was encountered. Large basalt flake tools were ubiquitous, made of the material underlying the site. Ten of the basalt tools were geochemically analyzed by Northwest Research Obsidian Studies Laboratory and were found to be from the parent material, now called the Gravelly Ridges source. Obsidian and basalt debitage derived from both percussion and pressure flaking covered the ridge top. Ground stone was uncommon. Cairns were present, including two that were recently built, and one collapsed feature that was considerably older. Several stone rings, arranged atop an exposed slab of basalt, were all less than one meter in diameter. They may have been fashioned to serve as bases for windbreaks or small temporary structures. Both of the ridge top excavation units produced diagnostic projectile points, including two Rose Spring points from Unit 1 and Elko Series points from Unit 3. A Desert Side-notched point was also collected on the surface of Unit 3.

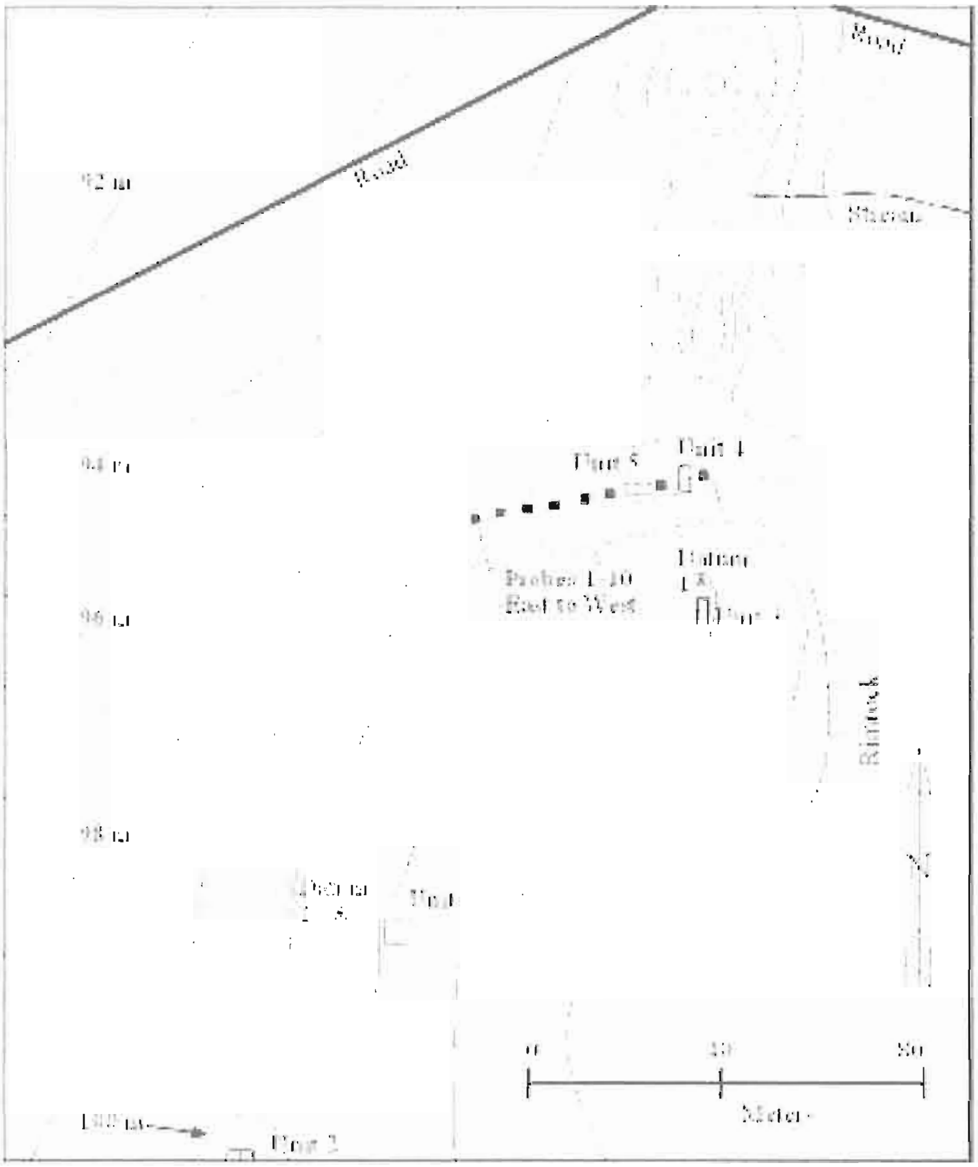


Figure 7.2. The RJ Site (35HA3013) showing excavation units and pertinent landmarks.

The two excavations placed around the collar of the ridge reached depths between 65 – 80 cm. Unit 2, on the west side of the promontory, produced a Rose Spring point, a point fragment, three biface fragments, and three drills or awls. Several charcoal stains were noted between 40 – 60 cm, and botanical remains were collected from them. Unit 4, to the north, produced an Elko Eared, an Elko Corner-notched, and a Northern Side-notched point along with three point fragments, a biface fragment, a drill, ten flake tools, two utilized flakes and three ground stone fragments; the largest concentration of ground stone noted at the site.

Excavation Units

Prior to excavation, an arbitrary datum was established at the north end of the ridge for mapping purposes. Using a Topcon GTS-203 transit, coordinates for the datum were set at 500 N/500 E, with an arbitrary elevation of 100 meters. The individual excavation units were tied into the grid system but they are reported only by their numeric designations for this report. Individual elevation datums were shot in for the excavation units and vertical control was maintained by level lines attached to datum stakes. The site was large and the juniper forest is dense, so an additional datum had to be established to tie the north and south excavation units together. Datum 1 was located just north of Unit 3 and Datum 2 was to the west of Unit 1.

As was true at the other sites here reported, the basic unit of excavation was a 2x2 meter square, divided into 1x1 meter quadrants oriented towards magnetic north. Quad A was always to the northwest, Quad B to the northeast, Quad C to the southwest and Quad D to the southeast. The paperwork for each excavation level included drawings, artifact counts, the location of *in situ* artifacts and various physical features on a plan view map, and written descriptions of sediment types. The excavators worked with great care to insure that chronologically diagnostic artifacts and other formed tools, features, utilized flakes, and noteworthy bone fragments were recorded *in situ* as much as possible. Drawings were made of selected stratigraphic profiles and photographs were taken of representative walls in some excavation units. In situ artifacts and potential features were photographed. Fill at Units 1, 3, and 5 was removed in five centimeter levels. Unit 2 was dug in 10 cm increments below level 6, due to the exceptional depth of the deposits and time constraints. Unit 4 was dug in 10 cm levels below level 4 because of time limitations. All fill was passed through 1/8 inch mesh hardware cloth. Debitage, bone, and other artifacts were retrieved during the screening process, counted, and added to the level record.

Analytic Components

Unit 2 produced two radiocarbon dates that were 580 years apart (Table 7.1). One date of 1000±40 BP was assayed on a charcoal fragment recovered in Level 4 and a second date of 1590±BP was collected on a charcoal fragment from Level 7. The artifact counts from Unit 2 indicate a single peak, reached in Level 3 (Note in Table 7.2 below that levels 7 and 8 were 10 cm thick, while the previous levels were five cm thick). The discrepancy does not seem to cause any interpretive problem, however. Two Rose Spring points were collected from levels 1 and 3 and were temporally consistent with both of the Unit 2 radiocarbon dates.

Unit 4 also has a single peak in cultural materials, which occurred in Level 4 (again, 10 cm levels were dug thereafter) and a single radiocarbon date of 2920±40 BP came from Level 4. Two Elko Series points and one Northern Side-notched point were recovered from the unit. One of the Elko points and the Northern Side-notched point was found in the radiocarbon dated level. The Elko points would be expected with a ca. 3,000 year date, but the Northern Side-notched point is commonly associated with dates between 4,000 – 7,000 years in age. The radiocarbon date from Unit 4 is the oldest date for any of the seven sites reported in this study.

No samples were submitted from the ridge top units for radiocarbon dating. Units 1 and 3 were situated in an erosional environment and the thin sediments covering the bedrock may have blown away repeatedly over time, to be replaced with more recent deposits.

Because discrete concentrations of cultural material were not apparent, the RJ site though extensive, was not subdivided into distinct loci in the same way as other sites reported in this study.

Table 7.1. Radiocarbon dates from the RJ site.

Sample no.	Beta ID	Provenience	Radiocarbon age	Cal. at intercept	Method
3013-2-A-4-2	Beta 155981	Unit 2, L 4	1000±40 BP	930 BP	AMS
3013-2-A-7-3	Beta 146123	Unit 2, L 7	1590±40 BP	1510 BP	AMS
3013-4-D-5-9	Beta 155982	Unit 4, L 5	2920±40 BP	3060 BP	AMS

The Excavations

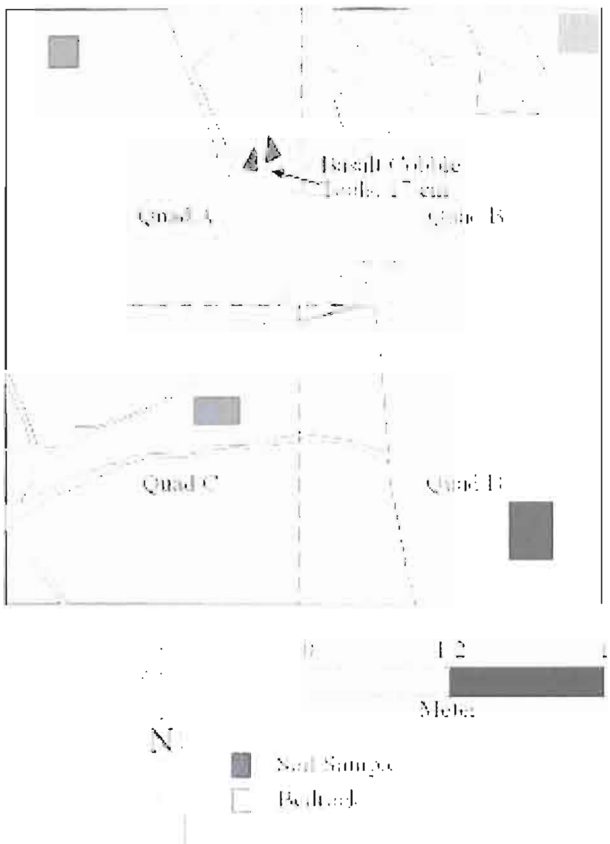


Figure 7.3. Unit 1, indicating the locations of in situ artifacts

Unit 1

Unit 1 (Figure 7.3) was located on the ridge top in the area where the initial recording of the site occurred on June 20. The unit was a 2x2 meter square situated on a lithosol surface underlain by basalt bedrock. It was anticipated that the excavation would be surficial, not exceeding 15 to 20 cm, but the presence of biface fragments, basalt flake tools, cores, and highly polished pebbles believed to be manuports made the location worthy of investigation. Excavations were carried out by two of the field school students with volunteers providing screening support, and the final depth reached almost 25 cm. Broad expanses of bedrock were exposed in the west half of the unit after 10 cm of excavation, but a number of tools and a surprising amount of lithic debitage (4357 pieces) was recovered from the fill surrounding the bedrock and from within its crevices. The tools included five projectile point tips and one midsection, three utilized flakes, three biface fragments, two cores, two basalt cobble tools and one awl fragment (Table 7.2). Two Rose Springs points were recovered, one from the debitage in Quad A, Level 1, and one from Level 2 of Quad D. Red ochre was found in Level 4 of Quad B. A basalt cobble tool was recovered from a crevice between two bedrock slabs in Level 3 and appeared to have been intentionally stored there for later use.

Table 7.2. Summary of artifacts from the RJ site, by excavation unit.

Probe	Debitage	Bone	Projectile Points	Point Frags	bifaces/ Frags	Drills/ Awls	Flake Tools	Utilized Flakes	Cores	GS	Ochre	Charcoal	Botanicals
Unit 1	Quads A, B, C, &D												
1	2064	-	-	5	1	-	-	1	-	-	-	X	-
2	1205	-	-	1	2	-	-	2	-	-	-	X	X
3	645	-	-	-	-	1	1	-	2	-	-	X	X
4	386	-	-	-	1	-	-	-	-	-	X	X	X
5	57	-	-	-	-	-	-	-	-	-	-	-	-
Unit 2	Quads A&B												
1	489	-	RS	1	-	2	-	3	-	-	-	-	-
2	495	-	-	-	1	-	-	-	-	-	-	X	-
3	449	-	RS	-	-	-	-	-	-	-	-	-	-
4	432	-	-	-	-	-	-	-	-	-	X	X	-
5	397	-	-	-	-	-	-	-	-	-	-	X	-
6	325	-	-	-	-	-	-	-	-	-	-	X	-
7*	248	-	-	-	2	-	-	1	-	-	-	X	-
8*	427	-	-	-	-	1	-	2	1	-	-	X	-
Unit 3	Quads A&C												
1	316	-	EE	-	1	1	-	5	-	1	-	-	X
2	130	-	-	-	1	1	-	-	-	-	-	X	-
3	81	-	ECN	-	1	-	-	6	-	-	-	-	
4	42	-	-	-	-	-	-	-	-	-	-	-	-
Unit 4	Quads B&D												
1	88	-	EE	-	-	-	-	-	-	-	-	X	-
2	107	-	-	-	-	-	-	-	-	-	-	X	-
3	187	-	-	-	-	-	1	-	-	-	-	X	-
4	243	-	-	-	-	-	1	-	-	1	-	X	X
5*	396	-	NSN,ECN	1	-	1	4	1	-	2	-	X	X
6*	270	-	-	1	-	-	4	-	-	-	-	X	X
7*	132	-	-	1	1	-	-	1	-	-	-	X	-
Unit 5	Quads A&B												
1	67	-	-	-	-	-	-	1	-	-	-	-	-
2	31	-	-	-	-	-	-	-	-	-	-	X	-
3	7	-	-	-	-	-	-	-	-	-	-	X	-
Totals	9716		7	10	11	7	11	23	3	5	-	-	-

*indicates 10 cm level

Table 7.2 (continued). Summary of artifacts from the RJ site probes.

Probe	Debitage	Bone	Projectile Point Points	bifaces/ Frags	Drills/ Frags	Flake Awls	Utilized Tools	Cores Flakes	GS	Ochre		Charcoal	Botanicals
P-1	1	-	-	-	-	-	-	-	-	-	-	X	-
P-2	13	-	EE	-	-	-	-	-	-	-	-	X	-
P-3	13	-	-	-	-	-	1	-	-	-	-	X	-
P-4	17	-	-	-	-	-	-	-	-	-	-	X	X
P-5	2	-	-	-	-	-	-	-	-	-	-	-	X
P-7	25	-	-	-	-	-	-	-	-	-	-	X	-
P-8	13	-	-	-	-	-	-	-	-	-	-	X	-
P-9	14	-	-	-	-	-	-	-	-	-	-	X	X
P-10	19	-	-	-	-	-	-	-	-	-	-	-	-
Totals	117	-	1	-	-	-	1	-	-	-	-	-	-

Totals for probes and excavation units combined

Debitage	9833
Bone	-
Projectile Points	7
Point Fragments	10
Bifaces/Fragments	11
Drills/Awls	7
Flake Tools	13
Utilized Flakes	23
Cores	5
Ground Stone	4

Unit 2

Unit 2 was located approximately 50 meters southwest of Unit 1, below the ridgetop in a sheltered area where fill was believed to have reached a considerable depth due to airborne sediments accumulating against the basalt promontory (Figure 7.4). An obsidian awl was noted on the surface and the detritus on a nearby anthill included a number of tiny obsidian pressure flakes. Excavation of the 1x2 unit was initiated by two volunteers and brought to completion by three students. Because of time constraints, the last two levels were dug in 10 cm increments while levels one through six were dug in five cm increments. Artifacts included three biface fragments, one core, six utilized flakes, three awl fragments, and one point fragment. Two Rose Spring points were collected, one in Level 1 of Quad A and one in Level 3 of Quad B. Ochre was collected in Level 4 of Quad A. A total of 3262 pieces of debitage was taken from the two quadrants. The fill was primarily a sandy silt with tabular basalt slabs appearing around 20 cm and increasing with depth. Three concentrations of charcoal appeared in levels 5 through 8, the first along the southwest edge of Quad A (Level 5) in a concentration of naturally occurring basalt slabs at 24 cm, the second in the northeast corner of Quad B at approximately 30 cm, and the third in the northwest corner of Quad A (Level 8) at a depth of 50 cm. Debitage was collected in consistent quantities throughout the deposits, but tools were recovered in levels 1 through 3 of

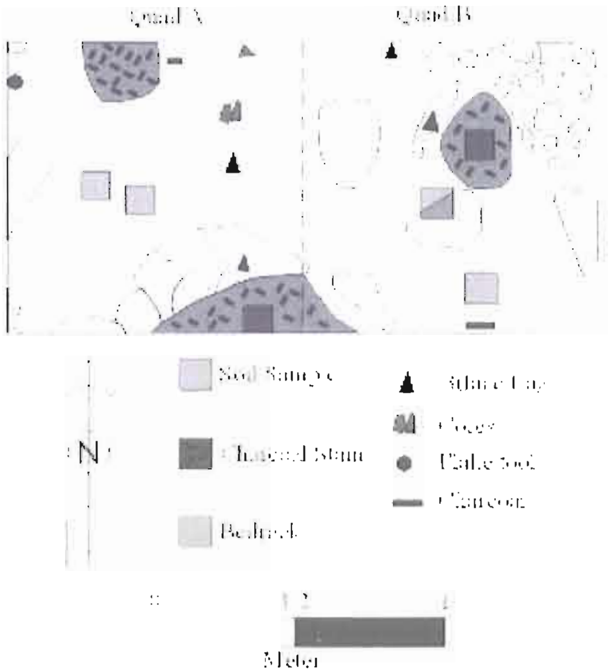


Figure 7.4. Plan view of Unit 2, indicating locations of artifacts, samples, and charcoal staining.

in levels 7 through 8, with a 15 to 20 cm gap in between. An AMS radiocarbon date of 1000±40 BP was assayed on a fragment of sagebrush charcoal collected from Level 4, Quad A of Unit 2. A second AMS date of 1590±40 BP was returned on a piece of rabbitbrush charcoal collected in Level 7 of Quad A. One of the dated fragments was collected *in situ* (3013-2-A-4-2) near a piece of ochre, and one level below a Rose Spring point. Specimen 3013-2-A-7-3 was collected in a composite charcoal sample. Charcoal samples from key excavation levels were submitted for botanical analysis, and shorter-lived species (rabbitbrush and sagebrush, versus juniper or conifer) were selected for the dating process to avoid "old wood" issues (Schiffer 1986).

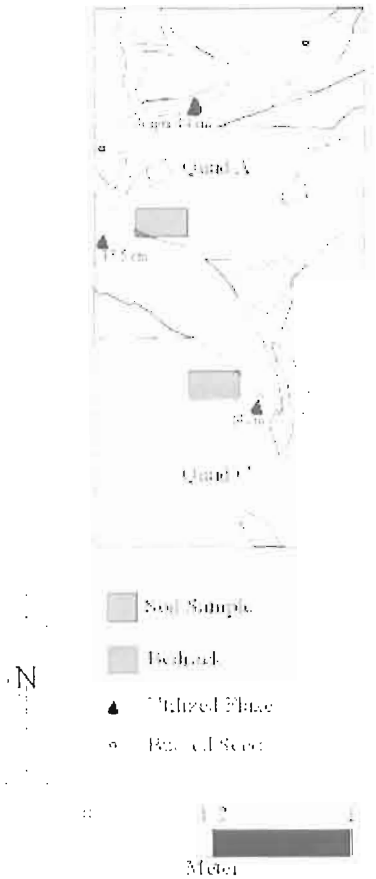


Figure 7.5. Unit 3, with locations of artifacts and samples shown.

Unit 3

Unit 3 (Figure 7.5) was placed at the northern edge of the ridge top in the location where a Desert Side-notched point had been recovered during the May reconnaissance. Probing with a steel rod indicated that the deposits there could reach depths of 70 cm, but such depths were not realized during our excavation. The unit was excavated by two students with volunteer screening assistance, and it was terminated at 20 cm of depth due to bedrock. The fill in Unit 3 was a very dark brown organically-enriched silt with an abundance of angular pebble to cobble-sized basalt fragments. Tools included an Elko Eared and an Elko Corner-notched point, three biface fragments, two drill fragments, 11 utilized flakes, two biface fragments and 569 pieces of lithic debitage. Charcoal was scarce, but a small amount was collected in Level 2.

Probes

While the first three units were being excavated, another crew dug auger probes in the silty deposits below the ridge top north of Unit 3. This location was selected because of the presence of very dark, potentially deep sediments; an abundance of percussion and pressure flakes; and localized concentrations of bifaces, cores, and drill fragments. In total, 10 probes were placed five meters apart in a line running east to west. The average depth was 30 cm, but Probes 4 and 8 reached 60 cm before encountering bedrock. Only Probe 6 lacked cultural material. Most produced debitage in quantities that would have warranted further excavation.

Three probes were of particular interest. Probe 2 reached a depth of 35 cm, producing an unusual obsidian artifact modified from an Elko Eared point base, and charcoal in Level 3. The presence of the unique tool encouraged the excavation of Unit 4 at the location. Probe 4 attained 60 cm of depth with charcoal throughout, and a basalt core was recovered in Level 4. Unit 5 was established over Probe 4. Probe 8 also reached 60 cm with debitage to 50 cm and charcoal in all levels. There appeared to be two primary areas of artifact concentration in the line of probes. They included the area between Probes 2 and 4 and the area between Probes 7 and 10. Deposits were shallow (20 cm) and artifacts minimal in Probes 1, 5, and 6. Probes 3, 7, 9, and 10 only reached 30 cm in depth, but contained some of the highest quantities of debitage. In most cases, debitage was concentrated in the upper 30 cm of deposits, perhaps indicating that most of the site use occurred rather late in time.

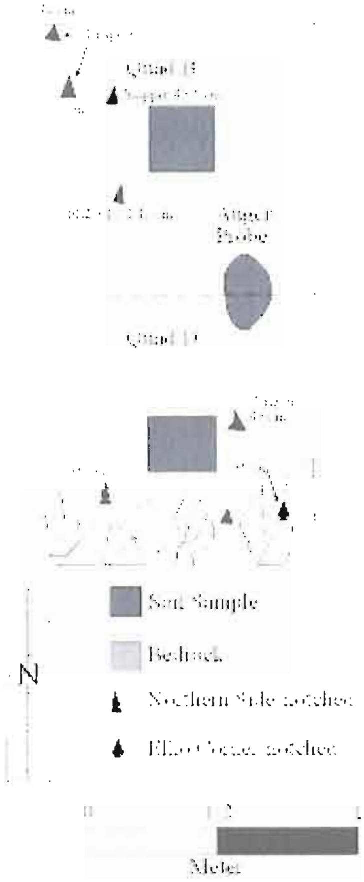


Figure 7.6. Unit 4 with locations of artifacts and samples shown.

Unit 4

The location of this 1x2 m unit was based on the results from excavation of Probe 2 (Figure 7.6). The unit was established so that Probe 2 was equally split between Quads B and D, and expansion of the unit could extend west to Quads A and C if the need arose. Sediments consisted of organically enriched dark brown silty sands, with small angular pebbles in the upper deposits that graded into larger gravels and bedrock in the lower levels. In addition to the unique artifact found in Probe 2, Unit 4 produced an Elko Eared point in Level 1 and Northern Side-notched and Elko Corner-notched points (one of each) in Level 5. Other artifacts included three point fragments, one biface fragment, one drill, ten flake tools, two utilized flakes, three pieces of groundstone, and 1423 pieces of debitage. Dispersed charcoal fragments were found throughout the deposits, including a charred specimen of processed edible tissue (PET) in Level 7 of Quad D. A total of nine charred botanical specimens were recovered in Unit 4. They were primarily from plant species occurring naturally on the site; these may have been burned during the course of range fires, but more likely were utilized by the site inhabitants. Unit 4 was excavated to a depth of 60 cm, with levels 1 – 4 dug in five cm increments and levels 5-7 dug in 10 cm levels due to time limitations. While most artifacts at the RJ site were recovered from the upper levels, the Unit 4 material was generally deeper. Most artifacts were collected below Level 4 (>20 cm). The deep cultural deposits and the presence of Elko and Northern Side-notched points suggest that this area was occupied earlier than other portions of the site.

An AMS date of 2920±40 BP was returned on a fragment of sagebrush charcoal recovered from Level 5 of Quad D. The material was collected during screening and included in a composite dating sample. The sample was analyzed by a paleobotanist (see Botanical Remains below) and submitted for radiocarbon dating upon identification to species.

Unit 5

This 1x2 m unit was established to investigate the high quantities of debitage and charcoal noted in Probe 4. The unit was placed directly over the probe location and the auger hole was in the northern half of Quad A. Excavation of the unit was carried out by three volunteers. Three 5 cm levels were dug, resulting in the recovery of one utilized flake and 105 pieces of debitage. The unit was initiated late in the project and could not be completed because of time constraints.

Artifact Assemblage

Chipped Stone Tools

Projectile Points and Hafted Tools

A total of 20 projectile points or tools made from projectile points was recovered at the RJ site, sixteen of which are temporally diagnostic (Table 7.3, Figure 7.7). Two hafted tools of other kinds are also described in this section. The majority of points are of obsidian (n=18 or 82%) and two each are made of basalt and CCS. The projectile points have been classified according to the system established by Heizer and Hester (1978) for the Great Basin at large, as modified by Thomas (1981) for the Monitor Valley in central Nevada. The points include one Cottonwood Triangular (6%), two Desert Side-notched (12%), five Rose Spring (29%), two Elko Eared (12%), four Elko Corner-notched (23%), one Northern Side-notched (6%), one Humboldt (6%), and one Malheur Stemmed (Oetting 1990). Several fragmented point bases are not typologically classifiable. They include a large obsidian dart point that appears to be side-notched (3013-ISO-3), an eared base (3013-4-D-1-1) that has been modified through retouching

Table 7.3. Metric attributes of RJ Site projectile points and hafted tools (in mm and grams).

Artifact	Type	L (mm)	W	Th	Neck W	Wt.(g)	Material
BLM 24942a	RS	12.4*	10.6	2.7	-	0.37	bas
3013-02-iso-1	scraper	NA	NA	NA	NA	NA	bas
3013-iso-2	ECN	NA	NA	NA	NA	NA	obs
3013-iso-3	LSN	NA	NA	NA	NA	NA	obs
3013-surf-cairn	ES	15.9*	17.6*	5.4	13.5	1.57	ccs
3013-surf-1	DSN	20.3	15.0*	3.3	10.9	0.74	obs
3013-surf-2	ECN	30.3*	25.2	5.0	13.1	3.39	obs
3013-surf-3	Hum	19.9	17.3	8.5	-	3.06	obs
3013-surf-4	out of key	24.1*	10.5	3.3	7.4	1.24	obs
3013-surf-5	CT	24.9	14.5	3.1	-	1.05	obs
3013-surf-6	DSN	15.7	13.6	2.8	10.1	0.54	obs
3013-P2-3-1	EE?	17.1	21.5	3.2	13.0	1.0	obs
3013-1-A-1-?	RS	12.4*	8.2	2.4	4.4	0.26	obs
3013-1-D-2-1	RS`	15.8*	12.5*	2.6	3.9	0.45	ccs
3013-2-A-1-1	RS	21.5*	10.6	2.6	3.3	0.50	obs
3013-2-B-3-1	RS	17.9*	12.4	3.0	6.0	0.49	obs
3013-2-B-8-1	bif	15.6*	9.1	3.4	-	0.51	obs
3013-3-A-1-1	EE	21.9	19.1	4.7	11.4	1.76	obs
3013-3-C-3-1	ECN	22.2*	21.3	6.0	11.1	3.63	obs
3013-4-D-1-1	out of key	16.9*	21.0*	4.5	13.9	2.19	obs
3013-4-D-5-1	NSN	22.7*	18.9	5.4	11.3	2.34	obs
3013-4-D-5-2	ECN	20.7*	15.5	4.3	9.8	1.37	obs

into an expanding-bodied tool, and a small biface fragment (3013-Surf-4) that has been notched on either side to create either a projectile point or perhaps a drill. Another large and finely crafted basalt tool (3013-02-ISO-1) appears to be a hafted scraper.

Projectile points at the RJ site reflect a time span beginning as early as 4,000 BP (Northern Side-notched points range from 7,000 to 4,000 BP) and continuing to the historic contact period (both Cottonwood Triangular and Desert Side-notched points range from ca. 1000 BP to the historic era). The abundance of both Elko and Rosegate points, which overlap between 2000 and 1000 BP, provides a relevant measure of when the site was used most regularly. Elko Series points, undoubtedly the most common temporally diagnostic artifacts found in the northern Great Basin, reflect the greater intensity of that period of occupation.

Figure 7.7. Projectile points and other hafted tools from the RJ site, shown actual size.

a. 3013-surf-5	b. 3013-surf-6	c. 3013-surf-1	d. 3013-2-B-3-1
e. 3013-1-A-1-5	f. 3013-2492a	g. 3013-1-D-2-1	h. 3013-2-A-1-1
i. 3013-3-A-1-1	j. 3013-P2-3-1	k. 3013-4-D-1-1	l. 3013-3-C-3-1
m. 3013-iso-2	n. 3013-4-D-5-2	o. 3013-surf-2	p. 3013-iso-3
q. 3013-4-D-5-1	r. 3013-surf-cairn	s. 3013-surf-3	t. 3013-2-B-8-1
u. 3013-surf-4	v. 3013-02-iso-1		

Desert Series Points. The Desert series includes both Cottonwood Triangular and Desert Side-notched varieties. Both are small points formed on a triangular blank, and both date between 750 BP and the historic contact period. All three of the Desert series points were surface finds.

Cottonwood Triangular points (Lanning 1963:252-253) are 1.5 grams in weight or less, less than 30 cm in length, and less than 4.0 mm thick (Thomas 1981:16). Cottonwood points can also include leaf shaped (Lanning 1963:252-253) and bipointed variations (Heizer and Clewlow 1968), neither of which were present at the RJ site. One triangular specimen (3013-surf-5) was collected from the surface at the RJ site.

Desert Side-notched points were described by Lanning (1963:253) as small triangular points with notches high on the sides, and Thomas (1981:18) indicates that the weight should be less than or equal to 1.5 grams with a basal width/maximum width exceeding 0.90. Two Desert Side-notched points were collected at the RJ site (3013-surf 1 and 3013-surf-6). The latter was basally notched in the Sierra variant (Baumhoff and Byrne 1959), and made of obsidian that originated from the Venator source. It had a hydration band of 1.3 microns. Artifact 3013-surf-1 originated from the Burns obsidian source and had a hydration band of 1.4 microns.

Rose Spring, Eastgate, and "Rosegate" Points. Five points identifiable to the Rosegate series were collected from the RJ site; two from Unit 1, two from Unit 2, and one from the surface. Rosegate is a derivative term incorporating points previously identified as Rose Spring (Lanning 1963) and Eastgate (Heizer and Baumhoff 1961). Thomas (1981:19) lumped the Rose Spring (Lanning 1963) and Eastgate (Heizer and Baumhoff 1961) point types together under one classification, but the two types are clearly dissimilar in both form and distribution, and in this report, Rose Spring and Eastgate are analyzed separately. Rose Spring points are small corner-notched points that commonly have expanding stems, while Eastgate points are basally notched on a triangular or slightly rounded preform, producing barbs or tangs that are even with the base. According to Thomas (1981:19) Rosegate points have a basal width of 10 mm or less, a proximal shoulder angle between 90° and 130°, and a neck width less than or equal to [basal width plus 0.5 mm.] The redefinition is not particularly useful at the RJ site, since all but point 3013-1-D-2-1 fit comfortably into the original Rose Spring classification.

Specimen 3013-1-A-1-5 was recovered from debitage during mass analysis studies and was not submitted for sourcing and hydration studies. This point is the most problematic of the five designated as Rosegate due to the fact that it lacks an expanding stem, but also lacks the stem "virtually round in cross section" that is expected of a plateau-style pin stem point (Dumond and Minor 1983:170). The point seems to have been expediently manufactured and lacks the careful crafting of some of the other points, thus the base may not have gotten the same attention it would have in other circumstances. Specimen 3013-1-D-2-1 has an expanding stem and may have been basally notched on a rounded flake. The point is manufactured from reddish CCS which has been heat-treated, as is evident by the large "pot-lid" fracture in the body of the point visible in Figure 7. Specimen 3013-2492a was surface-collected by BLM personnel. Manufactured of basalt, the point fits well with the previous two by virtue of its elongated base. Specimen 3013-2-A-1-1 is a Rosegate point lacking its base and barbs. Made of Round Top Butte obsidian, from a source located southwest of Harney Valley, the point has a hydration rim of 1.8 microns. Specimen 3013-2-B-3-1, with pronounced corner-notching and a broadly expanding base in comparison to the others, is made of Whitewater Ridge obsidian. It has a hydration reading of 1.3 microns.

Elko Series Points. Six Elko series points were collected from the RJ site, including one Elko Eared, one variant tool on an Elko Eared base, two Elko Corner-notched points, and two fragmented points that can only be attributed broadly to the Elko series. All Elko points should have a basal width of 10 mm or more, and a proximal shoulder angle between 110° and 150° (Thomas 1981:20-21). Two Elko points were surface collected, two were excavated from Unit 3, and two were recovered in Unit 4.

Elko Eared points are large, corner-notched points with a deeply indented base that, in conjunction with the corner-notching, forms "ears" for hafting purposes. The basal indentation ratio should be less than or equal to 0.93 (Thomas 1981:21). Elko Corner-notched points are included in the Elko Series and morphologically similar to Elko Eared points, but lack the deep basal indentation that produces the eared appearance, with a basal indentation ratio exceeding 0.93 (Thomas 1981:21). The widest portion of either point is just forward of the base. The two types are coeval.

Two tools can be classified as Elko Eared points by the previously mentioned characteristics, although one specimen, 3013-P2-3-1, was subsequently modified into a different tool. While the base is that of an Elko Eared, the proximal end of the point has been formed into a concave scraper, presumably hafted in the manner of a projectile point. The artifact is manufactured from Wolf Creek obsidian and has a hydration thickness of 1.6 microns. It was recovered from Probe 2 between 40 - 50 cm in depth, in association with small quantities of debitage and charcoal. Radiocarbon dating of charcoal from the same level in Unit 4, excavated as a result of the discovery in Probe 2, produced a date of 2920±40 BP. The date seems inconsistent with the obsidian hydration band on the artifact, which would be better suited to a post-2000 BP date of occupation, but is appropriate to the period of use for Elko series points. Specimen 3013-3-A-1-1 appears to have been resharpened from a broken point. It is made from Gregory Creek obsidian and lacked a measurable hydration rind.

The four remaining Elko points display a considerable range in both size and form. Specimen 3013-3-C-3-1 is a midsection with evidence of the neck, notches, and barbs still present. The point was identified during debitage analysis and was not submitted for obsidian sourcing and analysis. It is appropriate to designate the point simply as Elko series because the missing base allows no finer distinction. Specimen 3013-iso-2, also missing its base, has long barbs, deeply inset corner notching, and a finely finished appearance. Originating from the Burns obsidian source, the projectile point has a hydration rind of 4.4 microns. It, too, can only be attributed to the Elko series.

Specimen 3013-surf-2 is a large Elko Corner-notched base missing its tip and barbs. The point has a hydration thickness of 1.3 microns and the material originates at the nearby Tule Springs source. Specimen 3013-4-D-5-2 is a corner-notched point which, based on the size of the base relative to the body of the artifact, appears to have been resharpened at least once. The point is also made of Tule Springs obsidian, with a hydration reading of 2.8 microns.

Large Side-notched. Large side-notched projectile points have been identified by various regional appellations or morphological attributes in the northern Great Basin and southern Columbia Plateau. Specimen 3013-4-D-5-1, the side-notched point recovered from the RJ site, fits well in the Northern Side-notched classification established by Heizer and Hester (1978) for the Great Basin, having a straight to concave base and notches that are deep and perpendicular to the long axis. Oetting (1994) places Northern Side-notched points between 7,000 to 4,000 years in age in the northern Great Basin. The point, manufactured from obsidian, was recovered from Level 5 of Unit 4, which produced a radiocarbon date of ca. 2920 BP (Table 1). The date is about 1,000 years later than normally expected for Northern Side-notched points and it is possible that the point was once lower in the deposits and has been displaced over time. It is made of Tank creek obsidian and has a hydration rim of 3.5 microns.

A second artifact (3013-iso-3) appears to be a side-notched point based on the angle of the notches, but the degree of breakage makes further assessment difficult. Thus, the midsection is classified simply as a large side-notched point. It is manufactured from Big Stick obsidian and it has a hydration reading of 1.7 microns, less than half that of the Northern Side-notched point described above.

Humboldt Series. These points are described as "...unnotched, lanceolate, concave-base projectile points of variable size...", by Thomas (1981:17). The single Humboldt Series point fragment (3013-surf-3) was a surface find. It has a weakly indented base and is broadly lenticular in cross section. The point is made of Curtis Creek obsidian, with a hydration band measuring 3.5 microns.

Unknown. Three point fragments, both of which were collected from the surface of the RJ site, defy classification into known typologies. Specimen 3013-4-D-1-1 initially appears to be either an Elko Eared or Humboldt base, but, the proximal portion of the tool expands into a bifacially edged scraper. The basal element is straight-sided, unlike Elko Series points. The degree of flare above the base is inconsistent with the remanufacture of a broken point into a new tool; the maximum width of the body (and/or barbs) would have been well beyond the expected range for all but the largest, nontypical projectiles. The artifact was probably manufactured to be used as a hafted scraper, utilizing a fragment of a broken biface that was modified as a scraper with the hafting element added at the same time. The artifact is made of Big Stick obsidian and has a hydration reading of 3.3 microns.

Specimen 3013-surf-4 is a long, thin biface fragment which may once have been part of a projectile point or drill. The fragment has been expediently modified through strategic retouching and notching to create a new hafting element. As a result, the artifact is unclassifiable. Specimen 3013-surf-4 is made of Tule Springs obsidian and it has a hydration thickness of 3.3 microns.

Specimen 3013-surf-cairn is a white CCS base suggestive of a Malheur Stemmed point. Twenty-eight of these points were collected during the post-flood surveys of Malheur Lake and were first described by Oetting (1990:139-144) as lanceolate points with distinctive expanding stems. The length of the basal element is short in comparison with the blade and the stem expands toward the base (Oetting 1990:140). Neck widths range between 7.9 and 19.3 mm. Although some attributes of these points are suggestive of Great Basin Stemmed and other large point types, Oetting (1990:144) noted that most Malheur Stemmed points were found on sites dominated by Rosegate points.

Like the Malheur Lake points described by Oetting, the point found at the RJ site has a distinct expanding stem and shoulders. Unfortunately, the specimen is fragmentary and it is troubling to assign the artifact to a type that is rare around Malheur Lake, let alone other parts of Harney Valley, based on a fragment alone. Perhaps the base belongs to a large Elko series point, or a Side Notched 4 in the Columbia Plateau typology described by Dumond and Minor (1983:171).

Hafted Tools

Two additional artifacts (3013-2-B-8-1 and 3013-02-iso-1) are the only other hafted tools found at the RJ site (Table 7.3, Figure 7.7). They exhibit characteristics in their basal morphology that indicate they were specialized tools. Specimen 3013-2-B-8-1 is a small square-bottomed base, broken approximately at midpoint, manufactured from Curtis Creek obsidian. Edge preparation along the basal portion of the artifact is slightly inset in a manner that suggests it was attached to a handle of some kind, probably bone or wood, possibly for use as a drill or awl. The artifact had a hydration reading of 1.5 microns, placing it among the more recent artifacts found at the site.

Specimen 3013-02-iso-1 is a large finely crafted basalt tool that is reminiscent of a wood chisel in its width, length, and thinness. The distal end of the tool has a broad, thin edge well suited for scraping or shaping wood, set off from the long, slightly tapered base by weak shoulders. The base may have been wrapped with material to create a handle, or possibly hafted into a socket of bone or wood.

Shaped Bifaces

This account uses the multi-stage biface classification system employed by Jenkins and Connolly (1990) at the Indian Grade Spring site. Stage 1-5 bifaces are discussed here (Table 7.4). Stage 5 bifaces are generally classified as projectile points, and all diagnostic point fragments have been treated separately in a previous portion of the text. All of the RJ shaped biface artifacts are fragmentary. They are considered in terms of a generalized leaf-shaped biface morphology because many share similar characteristics. Tips are pointed and are thought to be the distal end of the artifact. Bases usually have rounded or slightly convex squared ends and are thought to be the proximal portion of the artifact. Midsections are frequently tapered to some

Table 7.4. Metric attributes of RJ site bifaces and fragments, in mm and grams.

Artifact	Type	L	W	Th	Wt	Notes
3013-ISO-1	St. 4	50.2	19.5	7.8	8.39	obs drill or awl base?, straight sided
3013-1-A-1-1	St. 4/5	19.8	14.9	5.4	1.52	small obs rounded biface base
3013-1-B-1-1	St. 4/5	14.5	11.1	2.8	0.40	obs projectile point tip
3013-1-B-1-2	St. 5	9.3	6.5	2.3	0.13	obs projectile point barb
3013-1-C-1-1	St. 4	16.5	15.1	3.0	0.66	obs biface tip
3013-1-C-1-?	St. 5	5.2	3.6	1.4	0.02	obs proj pt midsection, near tip
3013-1-D-1-1	St. 5	23.7	17.4	4.0	1.30	obs proj pt tip, modified for reuse as pt
3013-1-D-2-3	St. 3	18.5	8.4	3.5	0.63	obs basal biface edge frag
3013-2-A-1-5	St. 5	7.2	7.0	1.5	0.08	ccs proj pt tang
3013-2-A-2-1	St. 5	26.0	17.5	4.3	2.13	obs proj pt midsection, near tip
3013-2-A-6	St. 5	5.1	4.3	1.8	0.03	obs proj pt midsection, near tip
3013-2-A-7-1	St. 2	21.6	30.4	7.6	5.02	obs pointed base
3013-2-B-4-?	St. 5	4.4	2.9	0.6	0.06	obs RG pt barb
3013-2-B-4-?	St. 5	7.3	6.5	1.8	0.03	obs proj pt edge frag
3013-2-B-7-1	St. 3	15.0	29.2	7.4	3.40	ccs biface midsection
3013-2-B-8-1						
3013-3-A-1-2	St. 3	16.6	29.9	8.2	5.98	bas biface midsection
3013-3-C-2-2	St. 3	15.7	16.5	5.4	2.11	obs biface edge fragment
3013-3-C-3-1	St. 5	7.3	9.5	2.1	0.13	obs biface edge fragment
3013-4-B-5-2						
3013-4-B-6-1	St. 5	12.0	6.3	2.1	0.18	midsection of tip of finely tapered obs point
3013-4-B-6-?	St. 4	16.5	17.5	5.8	1.26	brown ccs biface edge fragment
3013-4-B-7-1	St. 4	8.5	10.0	2.8	0.21	obs, possible proj pt tip
3013-4-D-7-1	St. 4	22.8	12.1	5.6	0.95	obs biface edge fragment

degree, but can be straight-sided. Certainly not all bifaces have rounded bases, pointed tips, and show clear signs of tapering, but it seems most utilitarian for descriptive purposes to emphasize the shape of a common artifact form when only fragments exist. The function of the bifaces can only be implied, but they evidently served multiple purposes ranging from cutting implements to cores for the manufacture of projectile points and other tools.

A total of 22 biface fragments was recovered from the RJ site, all but one (3013-iso-1) from the excavations. They include one Stage 2, four Stage 3, five Stage 4, two Stage 4/5, and ten Stage 5 bifaces. All but four of the fragments are obsidian. One midsection is made of basalt and three CCS artifacts include an edge fragment, a midsection, and a small projectile point tang. The isolate is the base of a drill or awl.

Unit 1 produced one Stage 3 biface, one Stage 4, two Stage 4/5 (either well made preforms or less refined projectile points), and three Stage 5 fragments. Unit 2 contained one Stage 2, one Stage 3, and five Stage 5 bifaces. Unit 3 contained two Stage 3 and one Stage 5 artifact, and Unit 4 yielded three Stage 4 and one Stage 5 fragment.

In summary, the majority of the tool fragments were pieces of projectile points. They included one edge fragment, three tangs or barbs, four midsections, and three tips for a total of eleven specimens. Other bifaces included three bases, two midsections, one tip and five edge fragments for a total of ten specimens.

Stage 1 bifaces. These bifaces have thick cross-sections and large, unpatterned flake scars. They exhibit only the most rudimentary development, with rounded or thick lenticular shapes and cross-sections. The flaking pattern reflects use of the hard hammer percussion technique, and the edges of these tools can be very sinuous. None of the bifaces recovered from the RJ excavations reflected Stage 1 reduction, though a number of basalt artifacts interpreted to have been utilized for specific tasks (see core and flake tools below) were noted on site that may fit this level of categorization.

Stage 2 bifaces. Bifacial thinning is continued on these artifacts through the removal of contiguous hard hammer percussion flakes. The removal of the flakes results in the development of an artifact, which, although still crudely shaped, has a more pronounced form than stage 1 artifacts. Stage 2 bifaces are considered to be quarry blanks. One artifact fits this classification. Specimen 3013-2-A-7-1 is a fragment of a slightly pointed base, manufactured from obsidian.

Pointed bases lend the biface a lenticular shape similar to a willow leaf, though the base is more broadly convex than the distal end, or point tip.

Stage 3 bifaces. These bifaces exhibit little to no evidence of pressure flaking and have the slightly sinuous edges characteristic of large percussion flake scars created by the initial stages of bifacial reduction. The entire artifact surface has been modified through the removal of flakes which can reach the middle of the artifact. It is at this stage that major thinning of the artifact occurs, often leading to breakage. A total of four biface fragments fit this classification, two of which are obsidian, one is CCS, and one is basalt. Stage 3 artifacts often exhibit fine pressure flaking along some edges, with varying degrees of percussion flaking along other edges and across the body of the artifact, but this was not as obvious with the current specimens because two were small edge fragments in which such characteristics were not readily apparent.

One Stage 3 biface was collected from Unit 1, one from Unit 2, and two from Unit 3. Two specimens (3013-1-D-2-3 and 3013-3-C-2-2) are edge fragments manufactured of obsidian, the former a basal fragment. Two fragments (3013-2-B-7-1 and 3013-3-A-1-2) are midsections, the former made of CCS and the latter basalt.

Stage 4 bifaces. The continuation of percussion and pressure flaking techniques after Stage 3 results in bifaces with a more "finished" appearance than Stage 3 tools. Pressure flakes can reach the midline of the artifact or beyond, and frequently eliminate the large percussion flake scars from earlier reduction. Edges are strengthened by the removal of pressure flakes which increase the edge angle. Five Stage 4 artifacts were collected from the RJ site, including two obsidian tips (3013-1-C-1-1 and 3013-4-B-7-1), one obsidian edge fragment (3013-4-D-7-1) and one CCS edge fragment (3013-4-B-6-?). An additional Stage 4 biface, made of obsidian, is interpreted to be a drill or awl base. Specimen 3013-iso-? was surface collected. It has straight sides with no discernable taper and a squared base.

Stage 4/5. Two obsidian fragments recovered from Level 1 of Unit 1 (3013-1-A-1-1 and 3013-1-B-1-1) seem to be better crafted than other Stage 4 bifaces, but not with the same level of pressure flaking seen in other projectile points. As a consequence, there was some uncertainty about which category to place them in. The fragments were found in close proximity to each other, but, based on thickness alone, they are probably not from the same biface.

Point Fragments (Stage 5)

Most of the 11 point fragments recovered from the RJ site were probably from arrow points. Four are midsections, three are tips, three are tangs or barbs, and one edge fragment was recovered. One tang was made of CCS, all of the other fragments were obsidian.

Five point fragments were collected from Unit 2, four from Unit 1, and two from Unit 4. At Unit 1, it is possible that a projectile point was trampled in the shallow deposits overlying the bedrock, resulting in a scatter of pieces across the surface. That possibility seems less plausible for the point fragments found in Unit 2, where deep sandy deposits would have cushioned the effects of trampling.

Drills and Awls

All drills, awls and graving tools are included here except for 3013-iso-?, which may be part of a projectile point (Table 7.5, Figure 7.8). All were recovered from the test excavations and at least one was recovered from each excavation unit, suggesting that the use of these tools at the RJ site was common and widespread. Three drills are obsidian and two are basalt.

Figure 7.8. Selected drill fragments, shown actual size;
left 3013-4-B-5-1, right 3013-3-A-1-3.

Table 7.5. Metric attributes of drills from the RJ site.

Artifact	Type	L	W	Th	Wt	Notes
3013-1-B-3-1	obs	17.9	11.6	3.7	0.57	obsidian awl/graver, teardrop-shaped, with curved tip
3013-2-B-1-2	bas	44.6	21.8	3.8	4.16	expedient basalt flake modified into drill
3013-3-A-1-3	obs	19.5*	8.0*	4.3	1.09	obsidian drill midsection
3013-3-C-2-1	obs	9.5	3.7	1.4	0.07	straight-sided midsection of tiny drill
3013-4-B-5-1	bas	18.6*	5.3	3.1	0.32	small diameter drill midsection

Specimen 3013-1-B-3-1 is a small obsidian flake fortuitously teardrop-shaped with a broad, flat surface that could easily be held between thumb and forefinger. A thin, naturally formed spur extends from one edge, which has a series of tiny flakes resulting from its use either as a punch or graving tool. Specimens 3013-3-C-2-1 and 3013-4-B-5-1 (pictured) are midsections of small drills or awls, almost round in cross section, that were probably utilized in light-duty activities such as punching holes in leather. Specimens 3013-2-B-1-2 and 3013-3-A-1-3 (basalt and obsidian, respectively) had broad bases which could have been hafted or held firmly in the hand and twisted back and forth for use on harder materials.

Core and Flake Tools

Twelve tools noted at the RJ site may have initially been utilized as cores from which flakes were struck to manufacture other tools (Table 7.6, Figure 7.9). The cores were modified sometime thereafter to create heavy-duty cutting tools or scrapers. Some of the tools were recovered from the excavations, but others were collected as surface finds. They ranged in size from 60 to 125 mm in length, 30 to 75 mm in width, 7 to 25 mm in thickness, and 20 to 200+ grams in weight. They were either unifacially (n=10, or 83%) or bifacially flaked (n=2, or 17%) and thus could have been assigned into subcategories of utilized flakes or unshaped bifaces. It seems more appropriate to assign them a separate classification, however, based on their utility, which is likely to have been for chopping and scraping of tough materials, probably wood. Edge preparation was principally carried out through percussion flaking, though some edges have been further modified through judicious pressure flaking to achieve steeper edged working surfaces.

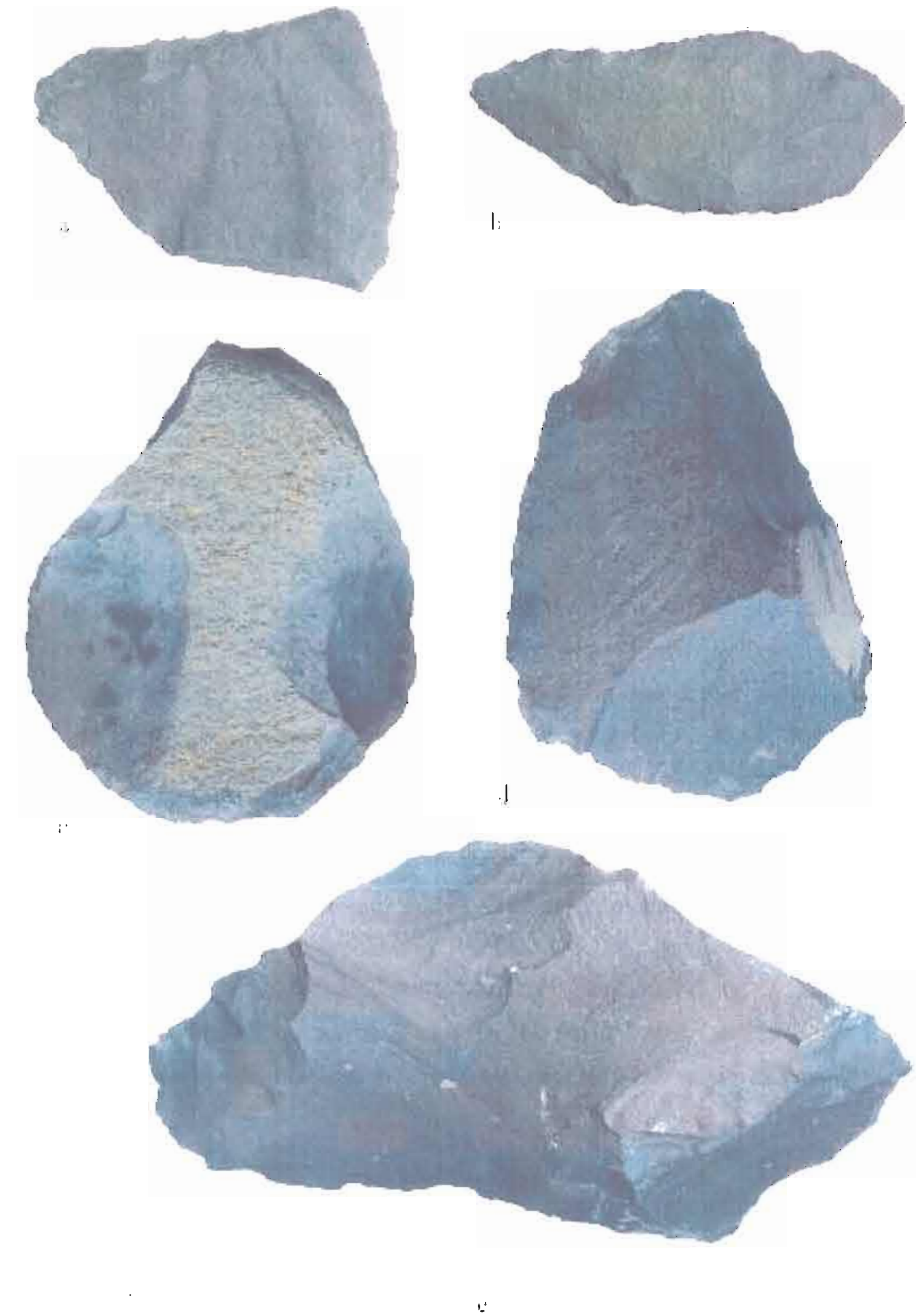
Table 7.6. RJ Site Basalt Core and Flake tools.

Artifact	Type	L	W	Th	Wt	Notes
3013-1-A-3-1	bas	71.6	66.6	23.4	158.39	possible spent core, oval, with flakes struck on two planes and heavy bifacial edge opposite a thick cortex-covered base
3013-3-A-1-4	obs	48.7	38.7	15.6	26.48	spent oval core with heavy edge on one end and spokeshave on one side, unifacial
3013-3-C-1-1	bas	64.5	30.3	13.8	21.67	triangular fragment of a once larger flake tool, unifacial edge on long side
3013-3-C-3-2	bas	61.3	63.2	17.6	89.26	spent oval core with steep-edged scraper on one end
3013-4-B-5-5	bas	86.7	69.0	22.6	137.08	spent rectangular core with heavy edge on three sides, fourth side has thick cortex, used as handle
3013-4-D-5-3	bas	60.3	47.2	6.9	27.05	triangular flake with steep-edged scrapers on each face, bifacial
3013-surf-7	bas	125.1	62.1	22.2	200+	heavy-bodied flake with cutting edge on one long side, opposite side is thick for handhold
3013-surf-8	bas	87.3	72.2	12.4	90.67	triangular flake, longest side unworked, unifacial edge on other two sides
3013-surf-9	bas	71.7	29.3	9.8	23.09	lenticular flake, bifacially worked,
3013-surf-10	bas	85.8	60.3	15.7	88.32	possibly spent core, with chisel-like edge on one end
3013-surf-11	bas	73.9	67.4	9.3	50.96	ovate flake tool with unifacial edge on rounded end, thick base opposite
3013-surf-12	bas	78.6	64.6	16.3	86.3	ovate flake tool with unifacial edge on rounded end, thick base opposite

Additional flaking has occurred from use, evident through the bifacial removal of many small flakes and smoothing of the sharp edges of percussion flake scars along the working surfaces. Based on the location of the RJ site and known activities that occurred in the site vicinity, the core and flake tools may have been utilized in the manufacture of digging sticks from juniper or mountain mahogany during forays to collect roots and tubers.

Figure 7.9. Selected large core and flake tools from the RJ site, shown actual size.

a. 3013-4-D-5-3 b. 3013-surf-9 c. 3013-surf-12
d. 3013-surf-8 e.3013-surf-7



Six of the tools were collected from the excavations, including one in Unit 1, three in Unit 3, and one in Unit 4. Six more were collected from the surface across the portion of the site where excavations took place. Ten of the tools were submitted to Northwest Research Obsidian Studies Laboratories for geochemical sourcing of the basalt (3013-1-A-3-1, 3013-3-C-3-2, 3013-4-B-5-5, 3013-4-D-5-3, 3013-surf-6, 7, 8, 9, 11, 12). All were found to originate from the same (on site) source, named Gravelly Ridge for the feature on which the RJ site rests.

Edge Modified Flakes

A total of 17 flakes exhibited edge modification that was consistent with use for various cutting and scraping tasks (Table 7.7). These artifacts include both expedient flake tools and a single spoke shave. Flakes that have carefully prepared edges suited to a variety of cutting and scraping tasks, such as end scrapers, were not present at RJ. Edge-modified flakes commonly have unifacial chipping on one side of the artifact which is the result of unintentional modification through use, with flakes being removed from the far side of the tool as it is held perpendicular to the worked object and drawn towards the user (Kiigemagi 1988:3). In two cases, bifacial chipping is exhibited due to the use of both sides of the flake for such tasks. This type of edge modification was found on the same edge in one case (3013-2-A-5-1) or at numerous locations on the artifact (3013-1-A-1). Artifacts with prepared edges include scrapers with at least one edge strengthened by steep pressure-flaking for long term use. Spoke shaves generally have a narrow crescentic notch ideal for scraping curved or rounded surfaces.

Of the 17 artifacts (10 obsidian and seven basalt flakes) that are classified as edge-modified flakes, 14 are unifaces, two (3013-1-A-1-?, and 3013-2-A-5-1) are bifacially worked, and one uniface was used as a spoke shave (3013-1-D-2-?). Five were collected in Unit 1, five in Unit 2, three in Unit 3, and four in Unit 4. The artifacts are found in abundance across the site, although they were not systematically surface collected in the same manner as other formed tools and tool fragments. Care was taken to avoid confusion between utilized flakes and those which had been trampled on the exposed basalt bedrock, or flakes with prepared edges resulting from lithic reduction activities.

Table 7.7. Metric attributes of RJ site utilized flakes.

Artifact	Type	L	W	Th	Wt	Notes
3013-1-A-1-?	obs	31.6	23.4	5.7	3.21	triangular flake with curved scraping edges on opposite long sides, bifacial
3013-1-A-2-1	bas	54.3	25.8	7.9	8.04	long narrow flake w/uniface near end of longest side, possible cutting edge
3013-1-D-2-4	obs	34.5	19.0	6.4	6.02	uniface on longest side of three sided flake
3013-1-D-2-?	bas	41.8	34.0	6.0	8.73	triangular flake with inset unifacial spokeshave
3013-1-D-3-1	obs	22.6	18.6	2.6	1.03	unifacial with edges on three sides
3013-2-A-1-4	obs	20.4	15.3	4.5	1.17	triangular flake with unifacial edge on longest side
3013-2-A-3-1	bas	64.7	33.4	7.8	27.64	rectangular tabular flake with unifacial edge on long side and one end
3013-2-A-5-1	obs	40.3	32.6	12.4	11.51	triangular frag, with bifacial edge on longest side, possible crude biface as origin
3013-2-B-7-2	bas	27.5	15.4	4.3	1.87	unifacial on longest side
3013-2-B-8-2	bas	53.9	35.9	15.2	31.82	two separate unifacial edges of polygonal flake, for heavy work
3013-3-A-1-5	obs	27.7	27.4	7.3	8.02	square flake with unifacial edge on one side
3013-3-C-1-2	bas	40.4	19.7	6.8	5.64	lenticular flake with unifacial edge on one long side
3013-3-C-3-4	obs	17.8	9.9	2.6	0.38	unifacial, with lt flaking on both long sides
3013-4-B-3-2	bas	54.8	48.1	9.3	23.93	rectangular flake with unifacial edge on longest side
3013-4-B-5-?	bas	26.1	25.1	4.0	2.22	polygonal flake with one unifacial edge on longest side
3013-4-B-5-?	bas	59.5	22.0	13.8	7.18	unifacial, one worn scraping edge and one fresh edge
3013-4-B-7-2	bas	33.0	19.6	4.3	2.57	crescentic flake with unifacial edge on curved (broadest) edge

Cores

Eight cores were collected at the RJ site (Table 7.8). Four were isolates found on the surface, one was found in Level 1 of Unit 1, one was collected from Level 6 of Unit 4, and two were recovered from Level 5 of Unit 2. All of the cores are basalt that is readily available on Gravelly Ridge. The cores found in the excavation units were generally more carefully prepared for flake removal than those collected on the surface. They had been fashioned into tabular or polyhedral forms, from which multiple flakes of relatively uniform size could be struck for

Table 7.8. Metric attributes of RJ site cores.

Artifact	Type	L	W	Th	Wt	Notes
3013-1-D-1-?	bas	72.4	61.1	26.9	82.8	triangular core with flakes struck from two planes
3013-2-A-5-?	bas	50.2	41.8	35.7	74.99	wedge-shaped, flakes struck from two planes
3013-2-A-5-?	bas	75.8	48.0	46.2	158.7	tabular, with flakes struck from five planes
3013-4-D-6-?	bas	91.2	80.5	21.6	147.57	tabular, with flakes struck from two planes
3013-surf-wp69	bas	92.2	63.0	49.3	200+	fine-grained basalt cobble, flakes struck on 5 planes E 369,411/N 4,838,005
3013-surf-wp70	bas	105.3	78.6	45.8	200+	basalt cobble fragment, flakes struck from two planes E 369360/N 4,837,950
3013-surf-wp73	bas	64.4	58.1	31.8	146.48	fine-grained basalt nodule, cracked in half, with flakes struck on 3 planes E369,417/N 4,837,961
3013-tot st-RJ2	bas	91.7	68.1	44.8	200+	fine-grained basalt cobble, flakes struck on 4 planes recorded as "total station RJ-2"

manufacture into projectile points. The cores collected from the surface were primarily cobbles or nodules with some cortex visible.

It seems surprising that there were so few formed tools manufactured from basalt on the site, given the ready availability of the material. Apparently the material was being used on site for certain purposes, such as heavy chopping and scraping tasks, and to some degree for edge-modified flakes used in other manufacturing and processing activities. Some of the material was fashioned into drills or awls, and a few bifaces were found to be made from basalt. Overall, the recovery of basalt implements, especially those broken in the early stages of manufacturing, was limited. This suggests that the tool stone may not have been of particularly good quality for manufacturing into finely flaked tools such as bifaces and projectile points, but it did prove suitable for processes such as chopping, cutting, and scraping, where roughly shaped, durable edges were needed. According to Thomas (personal communication 2006), high quality basalt suitable for manufacturing projectile points can be found in the Pine Creek drainage just north of the RJ site.

Ground Stone

Ground stone tools were virtually absent from the RJ site, limited to three metate fragments and one mano fragment. The three metate fragments were recovered in levels 4 and 5 of Unit 4, and the mano fragment was surface collected on Unit 3. The small numbers of these tools attests to the use of the site mainly for the initial procurement of certain kinds of resources, with additional processing either unnecessary or occurring elsewhere.

Couture et al. (1986:156-157) describes modern root gathering in the same area: "Roots are gathered in the morning, peeled at midday, cleaned at a water source, and spread to dry in the wind and sun while the harvesters share a picnic lunch and socialize. Those camping overnight may dig roots again in the late afternoon or early evening...After gathering the plants, the women often will find a shady spot near a stream, then spend the warm part of the afternoon peeling and washing the roots they gathered in the morning...The primary method of preserving roots is air-drying, preferably in a sunny spot out of doors, exposed to breezes." The implication from Couture et al. (1986:157) is that further processing is often unwarranted and unnecessary, although they also mention that dried roots may be ground into flour using mortars and pestles and that some of these tools have been collected from the root camps. It may be that usable ground stone tools have already been packed off the RJ site for that very purpose, been taken by looters, or were seldom used at the site. The latter seems to be the most likely explanation, since there were so few fragments found on the site and even in other looted sites where ground stone tools were used, fragmented specimens are generally common.

Other Artifacts

Ecofacts

Several stream pebbles that are rounded and highly polished were recovered on the surface of Unit 1 during the site recording, and, in part, led to the decision to establish excavation Unit 1 at the location. Two of the pebbles are dark reddish-brown in color and the third is a light greenish color (Figure 7.10). The specimens are so distinct from any other artifacts at the site that they were clearly brought to the site as manuports. The artifacts range from 13.1 to 21.7 cm in size. They may have served a utilitarian purpose or they were carried there for other reasons.

Figure 7.10. Ecofacts recovered from the surface at Unit 1, shown actual size.

Ochre

Ochre, an iron oxide that is derived from hematite, is relatively common in small amounts in Harney Valley sites. Two small pieces of red ochre were collected at the RJ site. Specimen 3013-1-B-4-3 is a 0.08 gram fragment collected in Level 4, Quad B of Unit 1. The color is 2.5YR/5/8 (red), similar in color to the Blue Mountains sample examined by Erlandson et al. (1999:519). Specimen 3013-2-A-4-3 is light red to orange in color (2.5YR/6/8 [light red]) and weighs 0.32 grams. It was collected from Level 4 of Unit 2, in Quad A. Ochre and diatomaceous earth were commonly used for personal adornment, for coloration in pictographs, and for various medicinal and utilitarian purposes.

Erlandson et al. (1999) geochemically tested eight sources from western North America as a possible means of reconstructing patterns of trade and resource acquisition. They found that the concept has potential but the establishment of a much more substantial baseline for geochemically sourced ochres will be needed before its true utility is known.

At least one ochre source is known in Harney Valley. Nodules containing red, orange, yellow and blue mineral deposits have been recovered from the Emigrant Creek drainage northwest of Burns (Emory Coons, personal communication 2001). Nodules range in size from one to ten cm and are either hollow and lined with pigment or filled with the powdery, brightly colored mineral deposits.

Faunal Remains

The recovery of faunal remains at 35HA3013 was limited only to recently deposited specimens, found as small mammal burrow deaths or scattered across the surface as a result of predator capture or other natural causes. The specimens were limited to an unidentifiable small mammal bone fragment found on the surface of Unit 1, a distal rodent humerus from Level 7, Quad B of Unit 2, and a concentration of 45 rodent bones from Level 5 of Quad D, Unit 4. The absence of bones at the RJ site may be attributable to taphonomic processes affecting the preservation of the remains. Soil chemistry, temperature extremes, and moisture resulting from both seasonal precipitation and a perched water table may have all played a part in the deterioration of faunal material. Although the RJ site is largely a root camp, acquisition of large and small game would have occurred as the opportunity arose, so some animal bone should be expected.

Botanical Remains

Paleobotanical identifications were carried out by Dr. Marge Helzer of the University of Oregon (Helzer 2001) and by Paleo-Research Labs of Golden, Colorado (Puseman and Cummings 2001 [Table 7.9]). Samples selected from Units 2 and 4 for AMS dating were sent to Dr. Helzer for identification to species prior to radiocarbon assay. Additional samples were drawn from Units 2 and 4 and from Probes 1, 4 and 8 during follow-up examinations of charcoal and soil samples, and submitted to Paleo-Research Labs for identification. In all, three species were identified in 13 samples. Included are bitterbrush, juniper, and currant. In addition to the identified species, fragments of both starchy and fruity processed edible tissue (PET) were recovered from the site along with unidentified fruit and berry tissue. The results indicate that there has been little change in vegetation since the time of site occupation. All of the plants identified are available at the site. All are known to have been used in the Great Basin generally, either medicinally, or for food, fiber, and structural elements in house construction (Fowler 1986, 1989; Couture 1978).

Table 7.9. Paleobotanical remains from the RJ site.

Sample no.	Provenience	Species	Common name	Weight
3013-2-A-5-3	Unit 2, Q A, L 5	Juniperus	Juniper berry	0.042 g
		Purshia tridentata	Bitterbrush seed	0.008 g
3013-2-B-7-5	Unit 2, Q B, L 7	Juniperus	Juniper seed	0.007 g
3013-2-B-8-4	Unit 2, Q B, L 8	PET, fruity	processed edible tissue	0.009 g
3013-4-B-6-7	Unit 4, Q B, L 6	Purshia tridentata	Bitterbrush	0.006 g
3013-4-D-3-2	Unit 4, Q D, L 3	Purshia tridentata	Bitterbrush	0.010 g
		Unidentified	Fruit w/seed	0.030 g
3013-4-D-4-3	Unit 4, Q D, L 4	Purshia tridentata	Bitterbrush seed	0.003 g
3013-4-D-5-9	Unit 4, Q D, L 5	Purshia tridentata	Bitterbrush seed	0.013 g
3013-4-D-5-10	Unit 4, Q D, L 5	Juniperus	Juniper seed	0.010 g
		cf. Ribes	currant fruit/seed	0.014 g
3013-4-D-6-4	Unit 4, Q D, L 6	Juniperus	Juniper seed	0.014 g
3013-4-D-7-3	Unit 4, Q D, L 7	PET starchy	processed edible tissue	0.003 g
3013-P1-1-2	Probe 1, L 1	PET Fruity	processed edible tissue	0.002 g
3013-P4-4-3	Probe 4, L 4	PET Fruity	processed edible tissue	0.002 g
3013-P8-5-3	Probe 8, L 5	Unidentified	fruit/berry	0.011 g

All but one of the PET specimens were recovered from Unit 4 or nearby probes. An unidentified fruit and seed fragment was collected from Unit 4, Quad D, Level 3. A currant fruit and seed fragment were collected in Level 5 of Quad D, Unit 4. PET fruity tissue was recovered from Probe 1, Level 1; and Probe 4, level 4; and an unidentified fragment of fruit or berry was found in Probe 8, level 5. Currant shrubs are common in the vicinity of Unit 4. Other fruits or berries that may be represented by the PET fruity material include serviceberry, juniper, chokecherry, bitter cherry, and wild plum, all of which were available near the site in the late summer and fall. They were generally eaten fresh, or dried for long term storage. They were dried whole or formed into cakes which were sun-dried (Puseman and Cummings 2001.

PET starchy tissues are identified through starchy storage cells and are most likely from edible roots (Puseman and Cummings 2001) such as biscuitroot, yampa, onion, balsam root, bitterroot, camas, and sego lily. Puseman and Cummings (2001) found that the one fragment of PET starchy tissue recovered from Level 7, Quad D, Unit 4 is most similar to bitterroot, though the identification is not certain. Botanical remains recovered at the nearby Indian Grade Spring site (Jenkins and Connolly 1990) included four charred camas bulbs. Camas was not present at the RJ site during our visit in the spring, but it could have been found there in the past, and it is certainly a possible source for the PET starchy material. Roots and tubers were eaten fresh, dried for winter use, boiled whole, or ground into flour. Digging sticks were utilized in the collection of roots, and the on-site preparation of these tools may account for the high quantities of heavy basalt core and flake tools at the RJ site.

Obsidian Sourcing and Hydration Analysis

A total of 67 specimens were submitted to Northwest Research Obsidian Studies Laboratory for geochemical sourcing and measurement of obsidian hydration rims (Table 7.10, Figure 7.11). Fifteen items were projectile points (n=14) or hafted tools (n=1), two were shaped bifaces, and 40 were pieces of debitage. The debitage included 28 specimens from Unit 2, and 12 from Unit 4. Additionally, ten basalt core and flake tools were submitted for geochemical sourcing and all were found to originate from Gravelly Ridge, a name newly coined for the on-site material source.

The 14 projectile points were of obsidian from ten different obsidian sources, including Big Stick, (n=2, or 14%), west of Harney Lake; Burns, (n=2, or 14%) north of Burns; Curtis Creek, (n=1, or 7%) east of Buchanan in the Stinkingwater Mountains; Gregory Creek, (n=1, or 7%) east of Juntura; Round Top Butte, (n=1, or 7%) near Glass Butte; Tank Creek, (n=1, or 7%) near Wagontire; Tule Spring (n=3, or 21%) southeast of the Silvies Valley in the Stinkingwater Mountains; Whitewater Ridge, (n=1, or 7%) near Seneca; and Wolf Creek (n=1, or 7%), to the north of the site. As might be expected of tools that are part of the day-to-day hunting kit of people on the move, the obsidian sources for projectile points reflect a broad area of use, roughly encompassing the northern half of the Harney Valley west to Wagontire, east to Juntura and Venator, and north to the Silvies Valley. None of the sources are located to the south of Malheur and Harney lakes.

The two bifaces that were analyzed are from Curtis Creek (3013-2-B-8-1) and Wolf Creek (3013-4-B-5-2). Both have similar hydration readings, at 1.5 and 1.6 microns, respectively, and both are Stage 5 bifaces, possibly fragments of non-diagnostic projectile points. The large basalt scraper (3013-iso-1) is from the Unknown Basalt 3 source.

Table 7.10. Obsidian sourcing and hydration results from the RJ site.

Sample	Artifact	Hydr (μ)	Source	Sample	Artifact	Hydr (μ)	Source
3013-iso-1	scraper	nm	Unk. Basalt 3	3013-2-B-8-3b	flake	4.2	Burns
3013-iso-2	Elko	4.4	Burns	3013-2-B-8-3c	flake	2.8	Curtis Creek
3013-iso-3	LSN	1.7	Big Stick	3013-2-B-8-3d	flake	2.7	Tule Spring
3013-surf-1	DSN	1.4	Burns	3013-2-B-8-3e	flake	2.8	Curtis Creek
3013-surf-2	ECN	1.3	Tule Spring	3013-2-B-8-3f	flake	2.9	Curtis Creek
3013-surf-3	HUM	3.5	Curtis Creek	3013-2-B-8-3g	flake	4.4	Burns
3013-surf-4	out of key	3.3	Tule Spring	3013-2-B-8-3h	flake	5.4	Burns
3013-surf-6	DSN	1.3	Venator	3013-2-B-8-3i	flake	4.6	Tule Spring
3013-P2-3-1	EE	1.6	Wolf Creek	3013-2-B-8-3j	flake	2.8	Curtis Creek
3013-2-A-1-1	RS	1.8	Round Top Butte	3013-2-B-8-3k	flake	2.7	Curtis Creek
3013-2-B-3-1	RS	1.3	Whitewater Ridge	3013-2-B-8-31	flake	4.7	Tule Spring
3013-2-B-8-1	bif	1.5	Curtis Creek	3013-2-B-8-3m	flake	4.2	Burns
3013-3-A-1-1	EE	-	Gregory Creek	3013-2-B-8-3n	flake	3.5	Burns
3013-4-B-5-2	bif	1.6	Wolf Creek	3013-2-B-8-3o	flake	2.6	Wolf Creek
3013-4-D-1-1	out of key	3.3	Big Stick	3013-2-B-8-3p	flake	3.8	Tule Spring
3013-4-D-5-1	NSN	3.5	Tank Creek	3013-2-B-8-3q	flake	3.5	Curtis Creek
3013-4-D-5-2	ECN	2.8	Tule Spring	3013-2-B-8-3r	flake	3.3	Burns
3013-2-B-3-2a	flake	2.7	Burns	3013-4-B5-6a	flake	1.8	-
3013-2-B-3-2b	flake	3.5	Tule Spring	3013-4-B-5-6b	flake	2.6	Burns
3013-2-B-3-2c	flake	3.7	Burns	3013-4-B-5-6c	flake	2.6	Tule Spring
3013-2-B-3-2d	flake	4.6	Wolf Creek	3013-4-B-5-6d	flake	2.5	Whitewater Ridge
3013-2-B-3-2e	flake	2.4	Curtis Creek	3013-4-B-5-6e	flake	2.7	Curtis Creek
3013-2-B-3-2f	flake	1.8	Curtis Creek	3013-4-B-5-6f	flake	1.1	Tule Spring
3013-2-B-3-2g	flake	-	Curtis Creek	3013-4-B-5-6g	flake	3.0	Curtis Creek
3013-2-B-3-2h	flake	1.1	Curtis Creek	3013-4-B-5-7a	flake	1.4	Tule Spring
3013-2-B-3-2i	flake	4.8	Burns	3013-4-D-5-7b	flake	2.8	Curtis Creek
3013-2-B-3-2j	flake	2.4	Curtis Creek	3013-4-D-5-7c	flake	2.8	Tule Spring
3013-2-B-8-3a	flake	4.2	Burns	3013-4-D-5-7d	flake	2.8	Wolf Creek
				3013-4-D-5-7e	flake	-	Mud Ridge

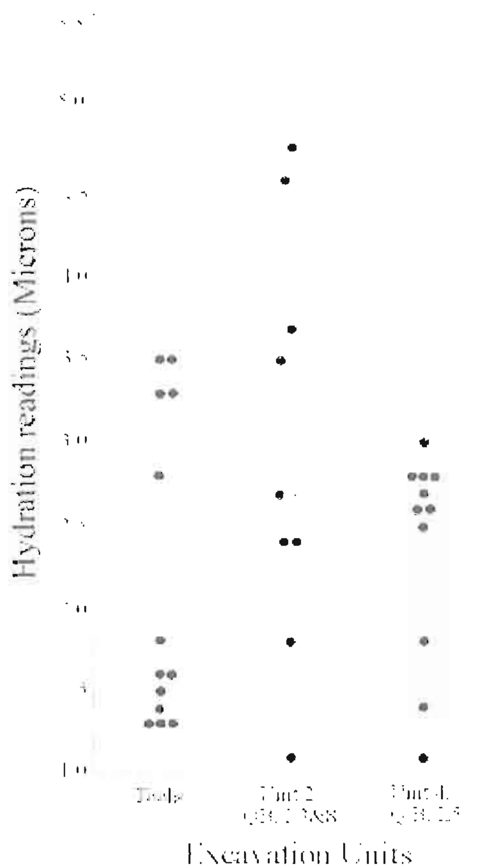


Figure 7.11. Obsidian Hydration readings from RJ excavation units. Hafted tools and flakes are represented. Filled dots in Unit 2 graph are measurements from Level 3 alone, indicating the degree of mixing that has occurred. The unfilled dots in Unit 2 are provided as contrast,

Debitage at Unit 2 is representative of fewer obsidian sources, as might be expected of tools such as middle-stage bifaces and quarry blanks that were obtained at nearby obsidian sources and may require further lithic reduction into a variety of formed tools. Burns (n=10, or 36%), Curtis Creek (n=11, or 39%), Tule Springs (n=5, or 18%), and Wolf Creek (n=2, or 7%), are all local sources represented through the debitage. The high percentage of Burns obsidian suggests that much of the travel to the site originated from northern Harney Valley, possibly from winter camps near Malheur Lake or the hot springs near Hines. Curtis Creek obsidian is available near the site, and people coming from various directions could have stopped there on their way to the RJ site.

The Unit 4 debitage produced six distinct geochemical sources and one that was unidentifiable. Burns (n=1, or 8%), Curtis Creek (n=3, or 25%), Mud Ridge (n=1, or 8%), Tule Spring (n=4, or 33%), Whitewater Ridge (n=1, or 8%), and Wolf Creek (n=1, or 8%), again are all sources available north of Harney Valley. Mud Ridge is located north of Burns Butte. Most of the obsidian came from Tule Springs, which is a locally available source.

The broadest range of hydration measurements was found on debitage recovered from Unit 2, (1.1 microns and 5.4 microns) with a mean of 3.4 for 27 flakes (one flake was unmeasureable). Hydration readings at Unit 4 ranged from 1.1 to 3.0 microns, with a mean of 2.4 for 11 flakes (one flake was unmeasureable). Figure 7.11 graphically demonstrates the difference in hydration readings between the two units. The majority of measurements from Unit 2 are concentrated between 2.4 and 4.8 microns, while the majority of Unit 4 measurements are between 2.5 and 3.0 microns. There is a clear overlap of readings in both units between 1 and 3 microns, but Unit 2 also has a significant set of measurements between 3 and 5 microns, indicating a significantly longer period of use. The hydration samples from Unit 2 were drawn from levels 3 (Level 4 produced an AMS date of 1000±BP) and 8 (Level 7 produced an AMS date of 1590±40 BP) and there is a stratigraphic difference between the levels, with Level 3 readings generally smaller than those from Level 8 (Figure 7.11) but with some overlap. Unit 4 samples were obtained from Level 5, the same level from which an AMS date of 2920±40 was returned.

The sourcing and hydration results provided an opportunity to examine patterns of obsidian use by inhabitants of the RJ site. Sourcing of the projectile points suggests that people had ranged over a broad expanse of Harney Valley and northward as far as the Silvies Valley before arriving at the site, and were not carrying any tool stone from the area south of Malheur and Harney lakes. Although much of the debitage found on site was from nearby sources, there also appeares to be a strong trend towards the use of material from the northern portion of Harney Valley. The geochemical results also indicate that source frequency is not necessarily similar from one part of the site to another, and hydration readings indicate that some portions of the site may have been used for longer periods than others. The southern exposure of the Unit 2 area may have been more desirable than the northern exposure of the Unit 4 area, particularly if the site was occupied during the late spring and early summer. The hydration results are also useful in showing that the integrity of the deposits at Unit 2 is good, with older, broader hydration measurements situated deeper in the strata than later and thinner hydration bands. This ties in well with the radiocarbon dates for Unit 2, but the correlation is less good in Unit 4. Both radiocarbon dates and obsidian hydration analysis show a significant time range of site occupation, with the radiocarbon dates confirming at least 2000 years of use. The Northern Side-notched point indicates that at least occasional use of the site extended beyond 4000 BP.

Lithic Debitage Mass Analysis

Mass analysis utilizes population means including counts and weights of size-graded debitage in a replicable, quantitative manner to examine relationships of debitage in both inter and intra-site contexts (Ahler 1989, Connolly 1999). Flake attributes such as size, weight, quantity, and the presence of cortex vary with each stage of lithic reduction, as early core and biface production yield larger flakes with more cortex than later stage biface reduction and pressure flaking (Connolly and Byram 2001:68). By quantifying chipping waste through the previously mentioned variables, a given site assemblage can be compared to those from other sites, and to an experimental lithic reduction data set established for all five reduction stages (core reduction = Stage 1, biface pressure flaking = Stage 5) collected from the Newberry Volcano obsidian source (Connolly and Byram 2001:69). The mass analysis results should reflect the most dominant lithic reduction activities at a given location and, depending on other factors such as strtagraphic mixing, may allow comparisons between early and late components within a site.

Debitage from the RJ site was processed through a series of nested screens with dimensions of 1" (G1), 1/2" (G2), 1/4" (G3), and 1/8" (G4). The flakes from each size grade were counted, weighed, and examined for the presence of cortex. The results were then compared with those from the other Harney Valley sites, the Bon site in Deschutes County (Connolly and Byram 2001), and with the overall results from the Newberry Crater project (Connolly 1999). This comparative information is presented below as Tables 7.11 and 7.12, and summarized in the final chapter. Here, debitage from Units 1 - 4 at the RJ site is examined.

Connolly (1999) developed a formula for determining stages of lithic reduction activities at archaeological sites based on three variables : Stage = 6.048 – 0.124 (F) – 0.023 (P) – 0.091 (Q), where F is the percent count of G2 over G1 – G4, P is the mean weight of G2 (G2 weight/G2 count) in decigrams, and J is the mean weight of G3 (G3 weight/G3 count) in centigrams. The values produced from the archaeological data were inserted into the formula and the numeric result is an indicator of the relative stage of lithic reduction that occurred at the site, either for the entire site or for components of the site.

Utilizing Connolly's (1999) formula for the aggregate of four units at the RJ site resulted in a predicted stage value of 2.68 (Tables 7.11 and 7.12), placing the site slightly below the Bon site (35DS608) in terms of lithic reduction stages. The Bon site is a residential base camp located north of Newberry Caldera. Other base camps located within the Newberry Caldera (Connolly 1999, Connolly and Byram 2001:71) have values similar to the RJ site, and the value equates well with the Hoyt and Knoll sites from this study. When the obsidian is examined by unit, the stage values are found to vary to some degree. Unit 1 has a stage value of 2.66, Unit 2 is 2.68, Unit 3 is 2.58, and Unit 4 is 2.90. All fall below a stage value of 3.0 but above 2.5, placing lithic reduction activities on a par with base camps occurring away from tool stone sources (Connolly and Byram 2001:71) where activities are not focused on lithic reduction alone.

Lithic reduction activities occurring at Unit 4 are somewhat different than those at other portions of the site, more in keeping with the late stages of production noted at the Bon site. The other three units are more closely grouped with each other than any one unit is with Unit 4. Aboriginal use of the area around Unit 4 may have been shorter in duration and oriented to a different set of activities than the evidence from the other RJ units would suggest, but it is noteworthy that sample sizes for Units 3 and 4 are considerably smaller than for Units 1 and 2 (Unit 1, n=2197; Unit 2, n=1273; Unit 3, n=143; Unit 4, n=378). Sample size may account for some of the difference, since both of the units with small obsidian debitage counts had the widest range of variability in stage values.

To summarize, the RJ site overall appears to have been a base camp. Occupation of the area around Unit 4 may have been more ephemeral than is seen elsewhere in the site.

Table 7.11. Values for the RJ site obsidian mass analysis variables, Units 1- 4 combined.

Variable	Computation	Value (%)
A PCTWTG1	0	0
B PCTWTG2	111.1/594.8	18.6
C PCTWTG3	306.1/594.8	51.5
D PCTWTG4	177.6/594.8	29.9
E PCTCTG1	0	0
F PCTCTG2	62/5134	1.2
G PCTCTG3	1040/5134	20.3
H PCTCTG4	4032/5134	78.5
I PCTWT13	0	0
J PCTWT23	111.1/417.2	26.6
K PCTWT33	306.1/417.2	73.4
L PCTCT13	0	0
M PCTCT23	62/1102	5.6
N PCTCT33	1040/1102	94.4
O MNWT1G	0	0
P MNWT2DG	62/111.1	5.58
Q MNWT3CG	1040/306.1	34.0
R MNWT4CG	4032/177.6	22.7

Stage =6.048 - 0.124(F) – 0.023(P) – 0.091(Q)
Stage =6.048 - 0.149- 0.128 – 3.094
Stage = 2.68

Table 7.12. RJ Site: Lithic debitage mass analysis results for units 1 - 4, individually and combined (obsidian only).

	Grade 1			Grade 2			Grade 3			Grade 4		
	N	Wt	Cortex	N	Wt	Cortex	N	Wt	Cortex	N	Wt	Cortex
Unit												
1	0	0	0	38	75.7	17	774	226.0	108	2197	111.4	104
			N	Wt								
Total G1-G4			3009	413.1								
Total G1-G3			812	301.7								
Stage = 2.66												
2	0	0	0	14	21.4	2	130	38.2	13	1273	42.4	32
			N	Wt								
Total G1-G4			1417	102.0								
Total G1-G3			144	59.6								
Stage = 2.68												
3	0	0	0	10	14.0	2	90	28.6	7	184	9.7	4
			N	Wt								
Total G1-G4			284	52.3								
Total G1-G3			100	42.6								
Stage = 2.58												
4	0	0	0	0	0	0	46	13.3	4	378	14.1	9
			N	Wt								
Total G1-G4			424	27.4								
Total G1-G3			46	13.3								
Stage = 2.90												
All	0	0	0	62	111.1	21	1040	306.1	132	4032	177.6	149
Units 1 – 4				N	Wt							
Total G1-G4			5134	594.8								
Total G1-G3			1102	417.2								
Stage = 2.68												

Summary

The RJ site (35HA3013) is located in the Stinkingwater Mountains in an area of great economic importance to the Harney Valley people due to the availability of roots and tubers which could be collected in the spring and early summer months, and fruits and berries which were available in the late summer and fall. Couture et al. (1986:153) estimate use of the "Root Camp," speaking in general terms of the Stinkingwater Mountains, to have lasted approximately six weeks during the spring of the year. It was an important social time during which roots were dug, trading, socializing and gambling occurred, marriages were arranged, and news was exchanged. Passage to and from the Malheur River occurred as the men left the women and children separately at the upland root camps and continued on to repair and set salmon traps. Women and children began collecting and processing roots, laying in stores for the lean winter months, and continued on to join the men fishing on the Malheur, after the root harvest was secured.

Archaeological investigations at the RJ site were undertaken to explore the degree to which the material remains correspond or vary from the ethnographic record. According to Whiting (1950:17): "Around the first of May, when the first green shoots broke through the ground, they left their winter camps and went to those places where they knew the edible roots abounded. Nigger Flat, in the northeast corner of the valley, was the most frequented place and many families camped here while the women dug *epos* (Yapa, Carum oreganum Wats), *hu ni bui* (Lomatium macrocarpium Cand R), *tsuga* and *sanatsuga* (unidentified). While the women were gathering these roots and and preparing the *tsuga* and some *yapa* for storage, the men visited the Drewsey River to set up and repair their salmon traps so they would be ready for the spring run. When their work was over, the women moved down to the river with their skin sacks full of roots and helped the men dry the salmon which they caught."

Couture (1978) and Couture et al. (1986), have added to this record through interviews with modern practitioners, documenting recent use of the area that is consistent with Whiting's account from over 65 years ago and which seems apparent through the archaeological record as well.

The RJ site could be divided roughly into two kinds of settings. Units 1 and 3 were situated on the ridgetop with good sun and wind exposure, important for processing and drying roots. Because of their exposed locations, the two units had little sediment deposition and excavations there were shallow. Units 2 and 4 were located below the ridge top, in sheltered areas that offered better cover from the wind and sun and which served as sediment traps for aeolian borne particles of silt and sand. Sediment accumulations were deep and stable, and organics sent for radiocarbon dating were submitted with confidence.

Archaeological evidence, including radiocarbon dates and obsidian hydration measurements, indicates that site use occurred earliest in the area of Unit 4 on the north side of the site. The span of obsidian hydration measurements suggests that occupations in the vicinity of Unit 2 began almost as early and extended over a longer period than those around Unit 4. AMS dates from Unit 2 are 1000±40 BP and 1580±40 BP, taken from levels 3 and 7 of the unit. A single date of 2920±40 BP from Unit 4, Level 5 indicates that human use of the RJ site has been going on for a long time and it is among the oldest of the seven sites reported in the current study.

No cultural features were definitively identified at the RJ site although several rock and charcoal concentrations near the bottom of Unit 2 were intriguing and provided the C-14 sample that was dated to ca.1580 BP. Two circular stone rings, arranged on basalt bedrock exposures between units 1 and 3, were also noted at the site, but the absence of cultural material in association made them difficult to assess. Conjecturally, the stones may have functioned as anchors for windbreak supports or to hold down matting for drying roots.

Activities carried out at the RJ site are best viewed holistically because of the generalized distribution of tools across the site. Activities included middle to late stage lithic reduction, floral processing and possibly woodworking, as represented by the large core and flake tools, drills, and awls. Obsidian geochemistry reflects the use of local sources as well as the import of tool stone from the northern perimeter of Harney Valley. The obsidian sources represented among the projectile points indicate a broad ranging population which traveled about the northern half of the Harney Valley, the Malheur River, the Silvies Valley, and possibly northward to the John Day area. The absence of faunal remains at the RJ site may indicate that taphonomic processes eliminated any food bones that might have been brought there, but other evidence suggests that use of the site was in any event oriented more towards other kinds of resources. Grinding stones were limited in quantity, but present. Seed grinding may not have been utilized to the same extent as in other plant procurement sites, but it is evident that the natural setting of the RJ site qualifies it pre-eminently as a root –gathering locality. The presence of large, rough-edged core and flake tools may be a distinct aspect of sites located in root camp country. Fine-grained basalt is readily available in the vicinity of the RJ site and ideal for use in fashioning locally available juniper and mountain mahogany into digging sticks for the root crop harvest. Similar tools were noted at Indian Grade Spring, a short distance southeast of the site (Jenkins and Connolly 1990:77-80).

Debitage mass analysis indicated that lithic reduction activities were oriented toward the kinds of middle to late stage (Stage 3) processes to be expected at base camps away from quarrying sites. Later stage (almost Stage 3) biface reduction was more common, similar to what Connolly (1999) encountered at base camps and off-quarry lithic reduction workshops at Newberry Crater and the Bon site (Connolly and Byram 2001).

In summary, the RJ site fits very well with the pattern of activity expected from Whiting's (1950) account of the spring root camp forays. The obsidian source data are particularly telling, showing that obsidian was generally brought to the area from the northern perimeter of Harney Valley. This probably occurred as people arrived at the root grounds in the spring. Some obsidian came from sources near the salmon fishing grounds to the north of the RJ encampment, where people would also have been at this season. The absence of faunal remains and grinding tools, the presence of large core and flake tools, and an abundance of edge modified flakes are all consistent with an orientation toward making digging sticks for the root harvest and collecting and peeling roots and tubers, to the exclusion of other activities such as hunting and other kinds of plant processing. The botanical remains indicate a variety of fruits, berries, and roots may have been utilized, including juniper berries and bitterbrush seeds, although most are unidentifiable beyond the level of processed edible tissues (PET).

CHAPTER VIII
LAURIE'S SITE (35HA3074)

Laurie's site is located on the southeast edge of Malheur Lake, across an embayment to the east of the Headquarters site and approximately ¼ mile northeast of the Broken Arrow site. The legal location for the site is Township 26 South (South of Malheur Lake), Range 32 East, Section 23 (N ½, SW ¼, SW ¼). The site is approximately one-half mile from the present-day shoreline. The Donner und Blitzen River empties into Malheur Lake to the west, near the Headquarters site, and Black Butte dominates the skyline two miles to the east.

Site reconnaissance was conducted by Laurie Thompson, Kelly Edmondson, Dianne Ness and Dan Braden on March 25, 2001. At that time, they noted a series of depressions scattered across a low rise, which appeared to be house pits (Figure 8.1). Cultural materials included a 60 x 60 meter scatter of obsidian and CCS debitage, flaked tools, ground stone, fire-cracked rock, and burned bone fragments. A metate was imbedded in the sloping interior wall of the largest depression, subsequently labeled House Pit 3 (Thompson 2001). The surface of the site was covered with sedges, grasses, and forbs, but the vegetation inside of the depressions consisted of thick concentrations of saltgrass or Great Basin wild rye, creating a dramatic visual affect that made the depressions stand out in contrast to the site at large.

Laurie's site is located at an elevation of 4104 feet. All of the house depressions surround a low rise nearly inundated during the extensive flooding that occurred in the 1980s, which reached a maximum elevation of 4102 feet (Figure 8.3). A small cluster of greasewood covers the top of the rise, a remnant of the more extensive growth that was drowned. Drift lumber from residences and farm buildings dismantled by rising water identifies the shoreline, just below the level of the house depressions.

The initial archaeological testing at Laurie's site occurred from May 28 to May 30, 2001. The intent of the testing project was to determine if cultural deposits were present and concentrated within the apparent house depressions, and if any such deposits offered a high potential for illuminating the nature of lakeside occupations. Working alone, I excavated a 1x1 meter test unit (TU-1) in the largest depression (House Pit 3), in which a metate had been noted during reconnaissance. The dimensions of the house pit were 7.5 meters from east to west

Figure 8.1. Laurie's site, with depression in foreground. Note greasewood which was above maximum flood stage, and drift lumber, which marks the 1980s lake high stand.

by 4.5 meters from north to south. There appeared to be two overlapping depressions, with the smaller and shallower of the two to the west. TU-1 was established at the overlap to determine if two separate occupation floors were present should the depression turn out to be a cultural feature. The question of occupation floors was never fully addressed due to time limitations, but the depression was clearly determined to be an archaeological feature.

TU-1 was excavated deep enough to reveal that debitage, bone, and tool fragments were highly concentrated, increased with depth, and were situated in homogenous charcoal laden deposits suggestive of an occupation surface. No pebbles or gravels other than those of cultural origin were present. The fill in the upper two levels consisted of light gray to medium brown sandy silts and clays. A pronounced transition occurred in level 3. In the upper two to three centimeters of the level, the fill changed from light, crumbly, soft, sandy clay-silts to sediments that were darker and more compact and contained higher quantities of charcoal flecking. Debitage and bone counts increased sharply, and chipped-stone tools, ground stone, and fire-cracked rock began to appear in the deposits. No temporally diagnostic artifacts were recovered during the testing phase, but the presence of compacted sediments and artifacts all near the same elevation provided convincing evidence that the beginning of a cultural surface had been reached. Dark, mottled deposits gave way to substantially darker and more charcoal-infused deposits near level 4, at approximately 45 cm below the surface. Formed artifacts were common along the southwest margin of level 3 but were more concentrated toward the northwest corner of level 4, perhaps suggesting that they were resting on a cultural surface that became depressed from the west to the east and mirrored the surface relief. Aside from the compacted sediment layer, no obvious cultural features were visible in the 1x1. Small pressure flakes appeared to be more common in the upper deposits, with larger flakes of obsidian, basalt, and CCS increasing in proximity to the compact surface. Burned bone fragments increased near that surface, correlating well with increases in charcoal and fire-cracked rock fragments.

The excavation was time consuming due to the amount of material being recovered and the inclement weather, and I was only able to remove 45 cm of fill in the time allotted for the testing phase. Once the archaeological potential of the site had been established, plans were made to return to the site and excavate House Pit 1, a smaller depression six meters west of House Pit 3. Based on the surface dimensions, the depression appeared to be an individual habitation of a size that should permit a thorough cross-sectioning of the feature deposits given the limitations of a small field crew. Such determinations would not be as easy to make in House Pit 3 due to due to its large size and the possibility of multiple overlapping features.

A University of Oregon Archaeological Field School testing project was conducted from July 5 through August 2, 2001. Additional work was carried out with the assistance of personnel from the Burns District Bureau of Land Management from June 17 to July 2, 2002. During this later work, two auger probes, one 1x1, and three 1x2 meter units were excavated at Laurie's site, resulting in the removal of 6.8 cubic meters of fill. Figures 8.2 and 8.3 show the locations of the site, possible house depressions, the shore line associated with the 1980s flooding, and the general topography. Table 8.1 summarizes the results of the excavations.

House Pit 1 was excavated in 2001, utilizing two 1x2 meter units joined to create a 1x4 meter trench spanning the length of the house pit. House Pit 2 was excavated in 2002 to explore high concentrations of cultural material that were recovered during auger probing in 2001. House Pit SP-1, also excavated in 2001, was chosen initially because it had surface dimensions consistent in size with storage pits seen elsewhere in wetland settings of the Great Basin.

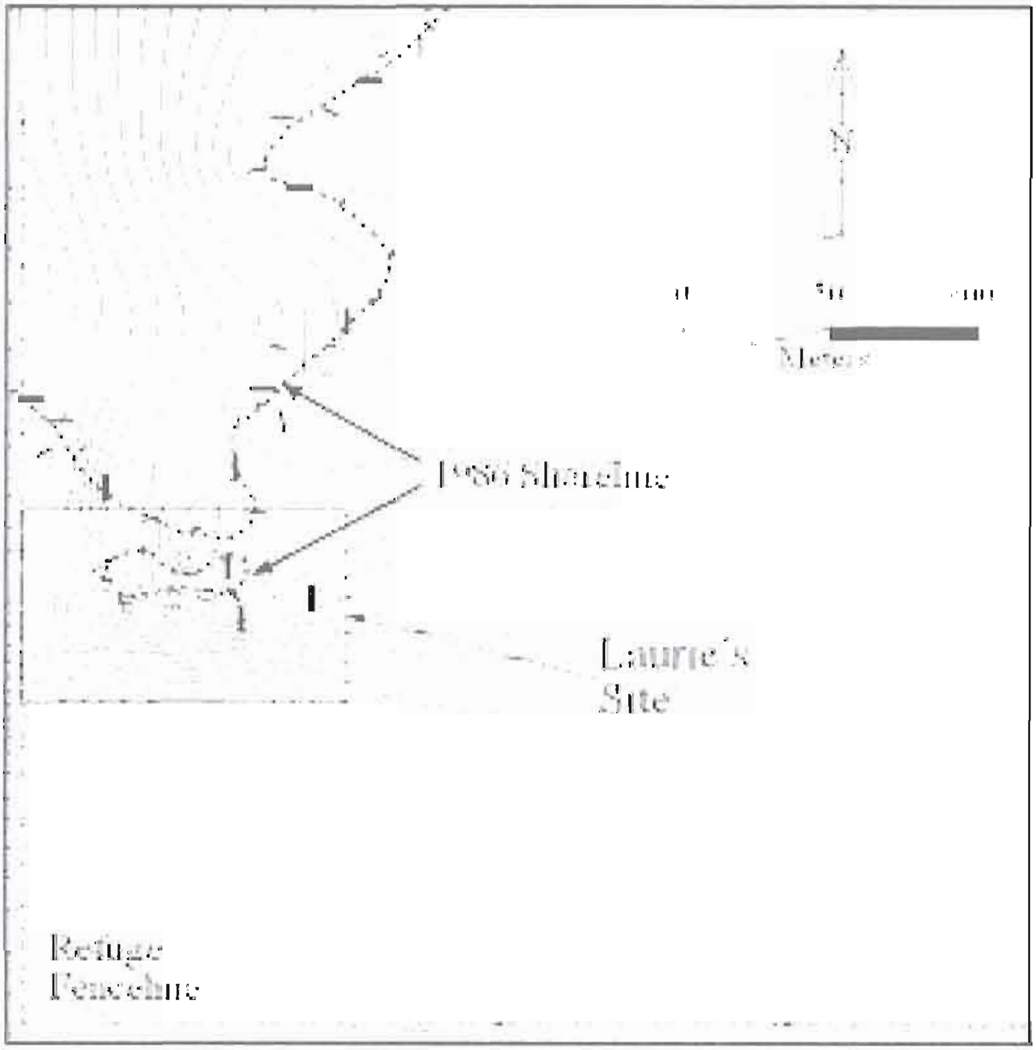


Figure 8.2 Laurie's site in topographic context.

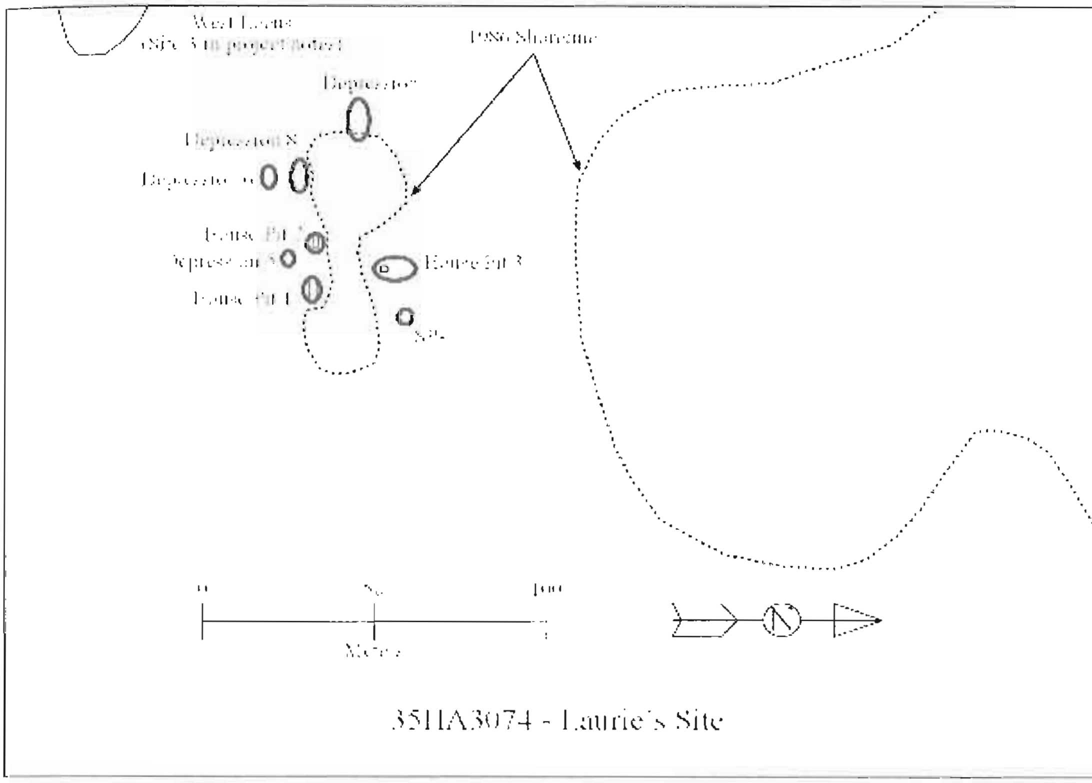


Figure 8.3. Detail map of house pits and possible house depressions at Laurie's site,

A 1x1 meter unit dug in SP-1 revealed deposits that were quite similar, however, to those seen in House Pits 1 and 2, suggesting that another living surface had been encountered, not a storage feature. The results of the field school and BLM project work are reported below.

Excavation Strategies

Testing

As mentioned previously, archaeological testing of Laurie's site occurred over the course of two years, carried out by both students and agency personnel. Because of the discrete nature of the depressions at the site, shovel and bucket auger probes were not necessary to define the archaeological features, as is often the case. Instead, with site discovery already addressed, efforts were focused on getting the best information possible out of the apparent features. To this end, two 1x2 meter units were established over House Pit 1, extending in a north to south direction across the feature to create a 1x4 meter exposure with Unit 1 to the north and Unit 2 to the south.

Excavation Units

During the course of the excavations, an arbitrary datum was established on the rise between the housepits for mapping purposes. Using a Topcon GTS-203 transit, coordinates for the datum were set at 500 N/ 500 E, with an arbitrary datum of 100 meters. The individual excavation units were tied into the grid system, but they are identified only by numeric designations here. Individual elevation datums were shot in for the excavation units and vertical control was maintained by level lines attached to datum stakes. A single site datum provided adequate coverage for recording the depressions, topography, and 1980s shoreline, but the distance between the Broken Arrow site and Laurie's site proved too great for tying the two sites together.

As in the case of the other sites reported here, the basic unit of excavation was the 2x2 meter square, divided into 1x1 meter units oriented towards magnetic north. Quad A was always to the northwest, Quad B to the northeast, Quad C to the southwest, and Quad D to the southeast. Paperwork for each level included drawings, artifact counts, the location of *in situ* artifacts and various physical features on a plan map, and written descriptions of sediment types. The excavators worked with great care to insure that chronologically diagnostic artifacts and other formed tools, features, utilized flakes and noteworthy bone fragments were recorded *in situ* as often as possible. Drawings were made of selected stratigraphic profiles and photographs were taken of representative walls in some excavation units. *In situ* artifacts and potential features were photographed. Fill was removed in 10 cm increments and passed through 1/8 inch mesh hardware cloth. Debitage, bone, and other artifacts were retrieved during the screening process, counted, and added to the level record. A total of 6.8 cubic meters of fill was excavated, resulting in the recovery of 34,510 artifacts, or 5,075 artifacts per cubic meter.

Analytic Components

A total of four AMS dates were obtained from the Laurie's site excavations (Table 8.2). A date of 1890±40 BP (Beta-167133) came from House Pit 1, Unit 2, Quad A, Level 7, associated with a cluster of artifacts including Elko points, biface fragments, ground stone, and ochre on a compacted occupation surface. House Pit 2 produced a date of 1580±40 BP (Beta-214673) from Level 9 of Unit 1, Quad C, also associated with artifacts on an occupation surface which included Elko points, a shell bead, ground stone, a stone ball, and muskrat mandibles. A second sample submitted from Level 5 of the same unit, associated with Rose Spring points, ground stone fragments, and a hearth identified as Feature 1 returned a date of 140±40 BP (Beta-214672) which is considered to be out of place in relation to other dates at the site and possibly the result of vertical displacement of more recent material by rodents. It is possible that a later hearth feature, overlooked during the course of the excavation, was intruded into the earlier deposits. Unit SP-1 produced a more plausible date of 1770±50 BP (Beta-214671) from Level 4. Organic material suitable for radiocarbon dating was scarce in the unit. A sample was drawn from 20 cm above the primary artifact-bearing sediments, which included ground stone fragments, a decorated bone tube, a muskrat mandible, and evidence of a compacted clay floor. The dated material was associated with Elko and Eastgate points.

Putting aside the very late date of 140 BP as an anomaly, the radiocarbon dates indicate that Laurie's site was utilized between 1450 and 1850 BP. Evidence for multiple occupations of the house pits during that time is not apparent, with debitage and bone counts varying by unit and quadrant, and no discernable patterns to indicate later occupational surfaces overlying the house pit floor (Figures 8.4 and 8.5) which could have 40-50 cm of cultural deposits.

House Pit 2 and SP-1 deposits may have evidence of multiple occupations. Projectile points were also mixed in the deposits and Elko and Rose Spring or Eastgate points were regularly found together. Considering the range of radiocarbon dates at Laurie's site, it might be expected that both atlatl and bow and arrow technology would be found in association between 1450 and 1850 years ago. The fact that both technologies are represented at Laurie's site in relation to cultural features (described below) is interesting but not unusual.

Table 8.1 Radiocarbon dates from Laurie's site.

Sample no.	Beta ID	Provenience	Radiocarbon age	Cal. At intercept
3074-2-A-7	Beta 167133	House 1, Unit 2, QA L 7	1890±40 BP	1840 Cal BP
3074-SP1-A-4	Beta 214671	Unit SP1, L4	1770±50 BP	1700 Cal BP
3074-C-1-5-C	Beta 214672	House 2, Unit 1, QC, L5	140±40 BP	0,20,140,220,260 Cal BP
3074-2-1-9-C	Beta 214673	House 2, Unit 1, QC, L9	1580±40 BP	1430,1470,1480 Cal BP

House Pit 1

Units 1 and 2 were excavated at House Pit 1 in 2001 (Figures 8.4 – 8.7). The units incorporated Quads A and C of a 2x2 meter square, and were conjoined to create a 1x4 meter exposure running north to south. Had time permitted, quads B and D could have been opened to the east to expose approximately one-third of a living floor, but the long excavation trench worked well to reveal a good-sized portion of the floor, a possible entrance, and boundaries of the house pit on both the north and south sides. Figure 8.6 identifies the locations of all artifacts recovered in situ during the course of the excavations. The majority of the cultural materials were recovered from levels 4 through 8 and artifacts were most concentrated in Level 6. Areas of particular interest include the possible division between the interior and exterior house pit deposits identified by the dashed line on the northeastern side of the map (Unit 1, Quad A). Less sediment compaction, and deposits suggestive of clay floor remnants, are situated to the west of the dashed line, while the sediments to the east were lighter in color, bonded by calcium carbonates, and lacked the concentration of artifacts seen on the interior. The definition between interior and exterior is not as distinct as was seen at the south end of the excavation (Unit 2, Quad C), where interior and exterior deposits are separated by a definite texture and color change and an absence of cultural materials. In Figure 8.6, the change is from light to dark for representational purposes, but sediment tints seen in the field were actually the opposite. The difference in stratigraphic boundaries from north to south may be attributable to an entrance having once been located at the northeast edge of the excavation. The numerous artifacts located outside of the opening could have been deposited during the course of activities outside of the structure or by foot traffic in and out of it.

In the interior of the house pit, a cluster of artifacts located in Quad A of Unit 2 is defined as Feature1, and a dark hearth stain overlapping quads A and C of Unit 1 has been

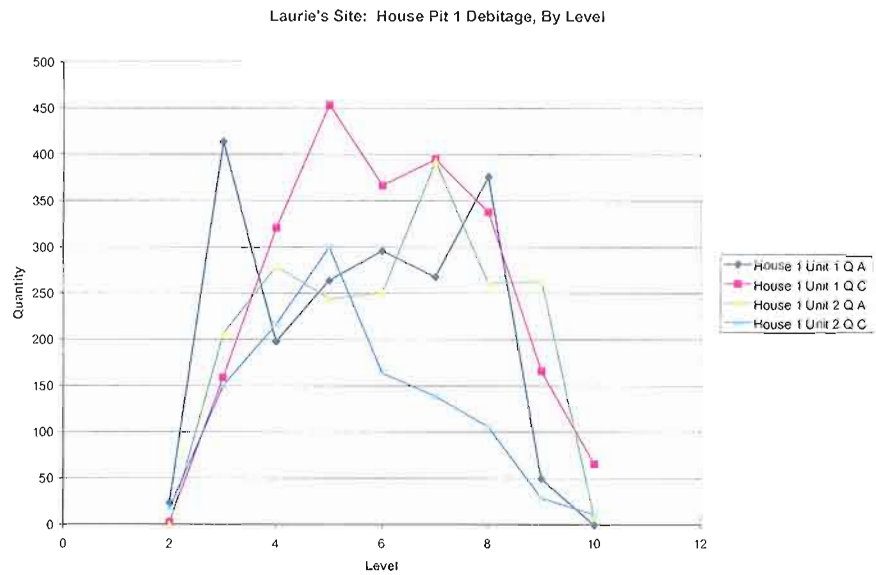


Figure 8.4. Laurie's site: House Pit 1 debitage counts.

Figure 8.5. Laurie's site: House Pit 1 bone counts.

designated as Feature 2, based on the charcoal infused sediments, the presence of fire-cracked rock and burned bone, and the relative lack of other cultural materials immediately adjacent to it. The house pit itself, though clearly a cultural feature, was not assigned a feature number since all of the 2001 excavation work was carried out within its confines and provides the context for its use.

Artifacts noted during the excavations included bone tools, beads, botanical remains, marine and freshwater shell, cores, ground stone, utilized flakes, scrapers, projectile points, bifaces, drills, chipping debris, faunal remains, and fire-cracked rock (Table 8.2). The features will be described first, followed by the various classes of artifacts in turn.

Table 8.2. Summary of artifacts from Laurie's site, by quadrant.

Level	Debitage	Bone	Projectile Points	Point Frags	Bifaces/ Frags	Drills/ Awls	Beads	Bone Tools	Utilized Flakes	Cores	GS	Ochre	Charcoal
House 1, Unit 1, Quads A and C													
1A	24	10	-	-	-	-	-	-	1	-	1	-	-
1C	3	7	RS	-	-	-	-	-	1	-	-	-	-
2A	414	510	-	1TIP	1	-	-	-	1	-	4	-	-
2C	159	113	-	-	-	-	-	-	2	-	-	-	-
3A	198	331	ES/MS	1TIP	-	1	-	-	2	-	1	-	X
3C	321	725	-	-	3	-	-	1	-	-	-	-	X
4A	264	475	-	1TNG	-	-	-	-	1	-	4	-	-
4C	454	1575	-	1TIP,1TNG	2	-	-	-	2	-	1	-	X
5A	296	841	-	1TNG	-	-	-	-	3	-	7	-	X
5C	367	1278	RS	1TIP	-	-	2	-	-	-	8	-	X
6A	268	571	-	1TIP	-	-	-	2	4	1	5	-	X
6C	395	1646	RS/ELKO	1TNG,1TIP	4	-	1	1	6,1F2	-	7	-	X
7A	376	643	EG	1TNG,1TIP	1	1	-	1	6	1	1	-	X
7C	338	786	EE,STEM	-	-	-	-	-	2	-	3	X	X
8A	50	50	-	1TIP,1?	-	-	-	1floor,1gl?-	-	-	-	X	
8C	166	352	RG	-	-	-	-	-	1	-	-	-	X
9A	-	-	-	-	-	-	-	-	-	-	-	-	-
9C	66,w/F2	250,w/F2	-	-	-	-	-	-	-	-	-	-	-
Total	4,159	10,163											

Table 8.2 (continued). Summary of artifacts from Laurie's site, by quadrant.

Level	Debitage	Bone	Projectile Points	Point Frags	Bifaces/ Frags	Drills/ Awls	Beads	Bone Tools	Utilized Flakes	Cores	GS	Ochre	Charcoal
House 1, Unit 2, Quads A and C													
1A	-	4	-	-	-	-	-	-	-	-	-	-	-
1C	18	12	-	-	-	-	-	-	-	-	-	-	-
2A	206	360	2RS	TIP	2	1	-	-	1	-	-	-	X
2C	150	358	NSN	TIP,BASE	2	-	-	-	-	-	-	-	-
3A	279	988	RS	-	1	1	-	1	4	-	-	-	X
3C	216	580	EG	-	-	-	1	-	1	-	1	-	X
4A	244	668	2 RS	-	-	-	-	-	2	-	-	X	X
4C	300	674	3EG,1RS,1?	2T	2	-	1	-	3	1	-	-	X
5A	251	865	-	1T,1TNG	-	-	1	-	3	-	-	-	X
5C	164	394	-	-	-	-	-	-	-	-	-	-	X
6A	393,w/F1	820,wF1	EE	2T	2	-	-	-	4F1	-	5	X&F1	X
6C	139	308	-	-	1	-	-	1	-	-	1	-	X
7A	261	798	ECN	1T,1B	-	-	-	-	2	-	1	X	X
7C	106	233	-	-	-	-	-	-	-	-	1	-	X
8A	263	453	-	-	-	-	-	4	3	-	1	X	X
8C	29	99	-	1?	-	-	-	-	-	-	-	-	X
9A	8	13	-	-	-	-	-	-	-	-	-	-	X
9C	11	19	-	-	1	-	-	-	-	-	-	-	X
Total	3,038	7,646											

Table 8.2 (continued). Summary of artifacts from Laurie's site, by quadrant.

Level	Debitage	Bone	Projectile Points	Point Frags	Bifaces/ Frags	Drills/ Awls	Beads	Bone Tools	Utilized Flakes	Cores	GS	Ochre	Charcoal
House 2, Unit 1, Quads A and C													
1A	1	-	-	-	-	-	-	-	-	-	-	-	-
1C	-	-	-	-	-	-	-	-	-	-	-	-	-
2A	31	-	-	-	-	-	-	-	-	-	-	-	X
2C	-	10	-	-	-	-	-	-	-	-	-	-	X
3A	109	55	-	-	-	-	-	-	-	-	2 manos	-	X
3C	-	-	-	-	-	-	-	-	-	-	-	-	X
4A	238	210	-	-	base	-	-	-	-	-	-	-	X
4C	65	35	-	-	-	-	-	-	-	-	-	-	X
5A	231	199	-	-	-	-	-	-	-	-	mano	-	X
5C	204	145	-	-	-	-	-	-	-	-	-	-	X
6A	295	255		TIP	-	-	-	-	-	-	metate	-	X
6C	219	265	RS	-	-	-	-	-	-	-	-	-	X
7A	291	224	RS	TIP	-	-	-	-	-	-	3 manos, 1 metate	X	X
											1 unknown	X	X
7C	185	312	-	-	-	-	-	-	-	-	-	-	X
8A	198	503	NSN	-	edge	-	1	-	-	-	-	-	X
8C	273	649	-	-	base	-	-	-	-	-	-	-	X
9A	91	156	EE,ECN	-	base	-	1	-	-	-	-	-	X
9C	202	45	-	-	-	-	-	1	-	-	-	-	X
10A	44	391	-	-	-	-	-	-	-	-	mano, ball	-	X
10C	151	398	EG,EE	2 TIPS	tip,edge	-	-	-	-	1	-	-	X
11A	-	-	-	-	-	-	-	-	-	-	-	-	X
11C	11	46	-	-	-	-	-	-	-	-	-	-	X
Total	2,839	3,898											
SP-1													
1	21	45	-	-	-	-	-	-	-	-	-	-	X
2	37	111	-	-	-	-	-	-	-	-	-	-	X
3	48	234	-	-	-	-	-	-	-	-	-	-	X
4	52	393	Elko,EG	-	-	-	-	-	-	-	-	-	X
5	150	469	-	-	-	-	1	-	-	-	-	-	X
6	144	367	-	-	-	-	-	-	-	-	-	-	X
7	108	200	-	-	-	-	1	1	-	-	-	-	X
8	14	117	-	-	-	-	-	-	-	-	-	-	X
9	4	5	-	-	-	-	-	-	-	-	-	-	X
Total	578	1,941											

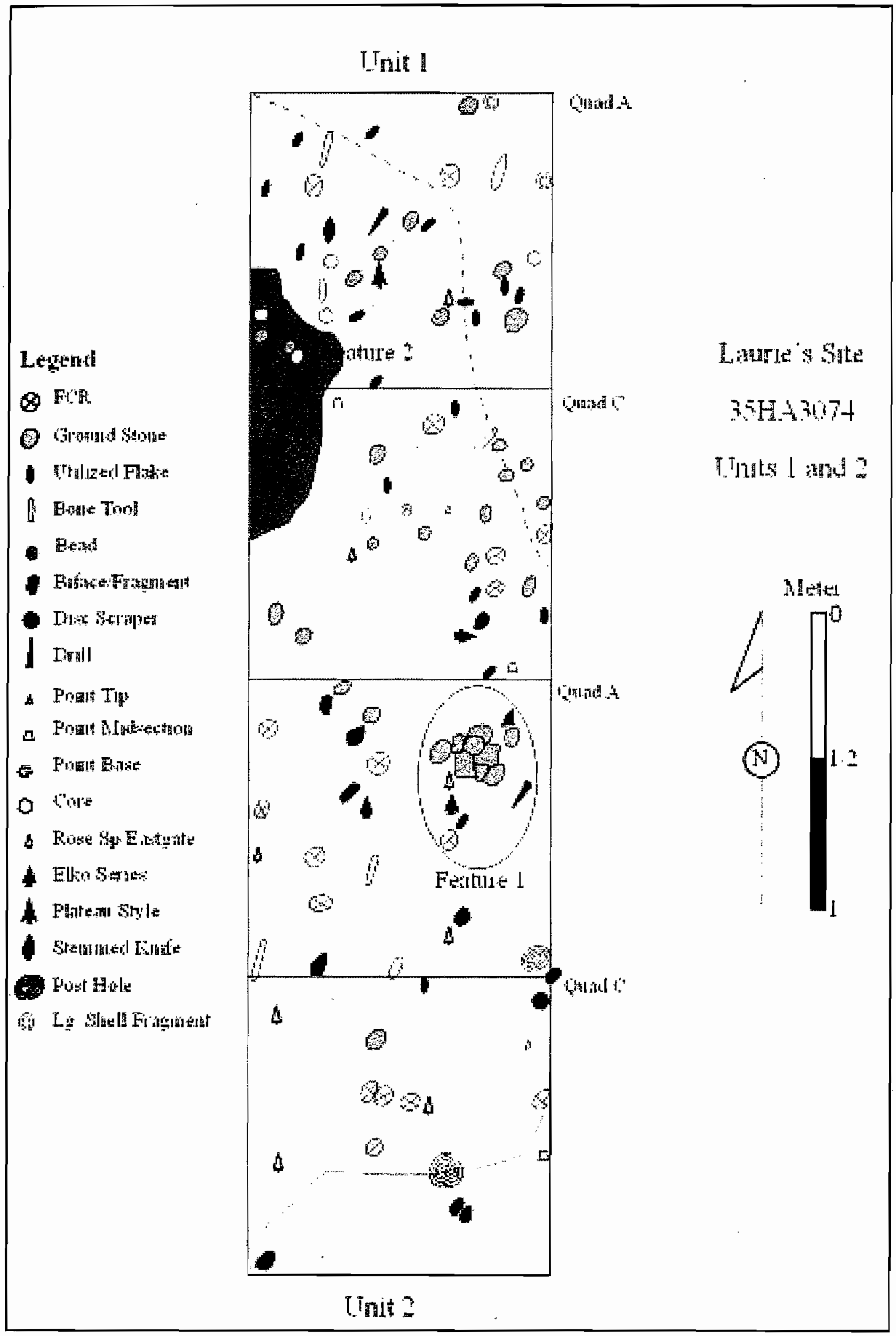


Figure 8.6. Laurie's site, House 1, Units 1 and 2, excavated in 2001.

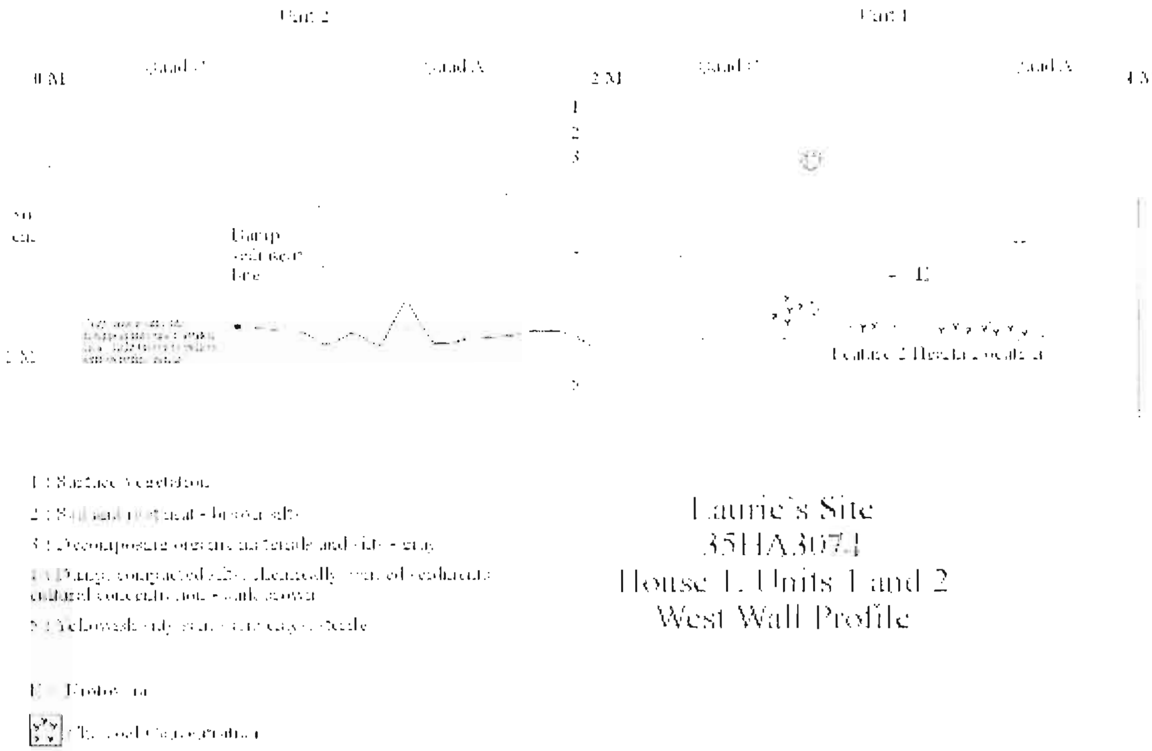


Figure 8.7. Laurie's site, House 1, Units 1 and 2 profile, west wall.

Feature 1

Located in levels 6 and 7 of Quad A, Unit 2, the Feature 1 artifact cluster consisted of eight artifacts stacked together and several located in close association. The artifacts in the cluster included a CCS biface fragment (01-2-A-6-F1), a complete bifacial mano (01-2-A-F1-1a), a large mano fragment (01-2-A-F1-1c), a small mano edge fragment (01-2-A-F1-1c2), a metate fragment (01-2-A-F1-1b), a large unidentifiable fragment of ground stone (01-2-A-F1-1f), and two obsidian cores (01-2-A-F1-1a and 01-2-A-F1-1b). Other artifacts found in close association included an obsidian core (01-2-A-F1-1c), a CCS drill midsection (01-2-A-2), two obsidian utilized flakes (01-2-A-2 and 01-2-A-2[2]) an Elko Corner-notched point made of obsidian (3074-2-A-F1), and a Rose Spring point (3074-2-A-2), also made of obsidian. The artifact cluster composed a 20x30 cm pile stacked 14 cm high (from 51 to 65 cm in depth) and all of the other artifacts associated with the Feature 1 cluster were found within 20 cm of the pile between 55-60 cm in depth.

Debitage counts peaked in Level 6 of Quad A at 393 pieces. Bone counts decreased from 865 fragments in Level 5 to 820 in Level 6, but the two levels yielded the highest quantities in Unit 2. Muskrat mandibles, in this case two matching sides, were also collected from Level 6 in the vicinity of Feature 1 and tend to be associated with dense cultural layers at Laurie's site. A fragment of willow recovered from Level 7 was submitted for radiocarbon dating, yielding a date of 1890±40 BP. Although the sample was not directly associated with Feature 1, it does provide a context for the artifacts found at or above that level within the house pit.

Feature 2

The Feature 2 hearth was encountered near the bottom of Quad A, Level 7 at a depth of 79 cm and extended over into Quad C. Approximately half of the feature was exposed during the excavation, with dimensions of 65 cm from north to south by 25 cm east to west. The hearth is roughly semi-circular in shape with a saucer-shaped profile, and though a few pieces of fire-cracked rock were found in its interior, the feature is not stone-ringed. The maximum depth of the feature was 92 cm (Level 9), terminating in the sterile sediments that underlie the floor of House Pit 1. Substantial quantities of artifacts were found in the surrounding deposits, including ground stone, beads, large flake tools, utilized flakes, bifaces, cores, bone tools, and Elko and Rose Spring projectile points. Relatively few were found in close proximity, however.

The Feature 2 hearth appears to be built directly on the floor of House Pit 1, the surface of which has considerable topography either as a result of natural processes or excavation by the inhabitants. A total of 66 pieces of debitage and 250 bone fragments was recovered from the hearth deposits. Debitage and bone counts peak in levels above the hearth (bone in Level 5 of Quad A, debitage in Level 6), but the undulating floor has both deep pockets and elevated mounds that distort the relationship between the floor surface and associated features. It may be that the area discerned as the Feature 1 hearth is a portion of a larger feature that was deposited in shallow depressions of the house pit floor, thus avoiding mixture with the other cultural deposits from foot traffic.

Aside from the Feature 1 artifact cluster and the Feature 2 hearth, there were other concentrations of cultural materials that also deserve mention at this time to provide a backdrop for the artifact descriptions that follow. Two dark circular stains containing laminations from in-filling may be evidence of post-holes related to the house pit structure. One is located in the southeast corner of Quad A, Unit 2, and the second is in the south-central portion of Quad C, in the same unit. Both are situated at appropriate locations for structural supports, near transitional areas between interior and exterior deposits. Internally, the two stains contained light and dark bands of sediments that were deposited in much the same way as tree rings, and it is thought that in-filling of different sediments occurred around structural elements that had been thrust into the ground during house construction. Wind or human activity may have caused the supports to move around and widen openings into which nearby sediments fell, with subsequent movement of the supports creating sharply angled or almost vertical (rather than horizontal) sediment deposition. Unfortunately, botanical analysis of the sediments recovered in the Unit 2, Quad C stain failed to produce evidence of willow or other possible structural materials.

Two bone tubes that were recovered at the bottom of the cultural deposits in Quad A of Unit 1 were pieced together in the laboratory and identified to be parts of a broken bird bone whistle or game call. The two pieces were separated by approximately 50 cm and both had settled into relatively protected pockets in the floor of the house where they were spared further damage.

Three bone tools were also recovered in Quad A of Unit 2. Collected in Level 8 between 82 and 86 cm, the artifacts consist of a finely crafted awl, a spatulate tool, and a bone awl or point that was collected from the screen. The artifacts were found at the bottom of the cultural deposits near the transition to sterile sediments, and also appear to have settled into, or were placed within, a sheltered depression in the house floor. The application for the awl and spatulate tool is unknown, but the fine degree of workmanship exercised in their construction suggests that they were probably not created for hard use such as flintknapping; they are better suited to clothing or basketry manufacture. The bone awl or point is not as finely wrought as the other two artifacts. The specimen was recovered from the screen at the same time that the other two artifacts were being uncovered, so it is from the same general area and elevation.

As Figure 8.6 (above) suggests, a dense accumulation of cultural materials blankets the floor of House Pit 1. Beads were common but never concentrated, debitage and bone were recovered in great numbers, and fire-cracked rock, utilized flakes, and ground stone were scattered across the house floor. It seemed clear that many of the ground stone fragments found in House Pit 1 had seen secondary use as either hearth or cooking stones, although there was also an abundance of mano and metate fragments that would have been serviceable for plant processing. Rodent activity undoubtedly had a significant impact on the integrity of the pit house deposits and multiple burrow traces were recorded on each level record during the excavation. Concerns regarding the redistribution of artifacts in House Pit 1 due to rodent activity are offset somewhat by the presence of Features 1 and 2, the postholes, and the artifact concentrations described above.

House Pit 2

Unit 1, a 1x2 meter excavation unit, was excavated in House Pit 2 during the 2002 field season. The unit was placed in an area that was auger tested in 2001 and produced 40 to 50 bone fragments per bucket at depths exceeding 30 cm. Using the salt grass, which lines the depression, as a guide to the house pit dimensions, the 1x2 was established so that Quad A was upslope on the edge of the pit and Quad C extended to the center. Artifacts did not begin to appear until Level 3, when the sloping edge was excavated level with the central portion of the depression. At a depth of 60 cm (Level 6), a dark stain similar in constituents to the cultural fill in House Pit 1 began to emerge over most of Quad C (Figure 8.8). A dark, charcoal-laden hearth feature identified as Feature 1 developed in the southeast quarter of Quad C. The Feature 1 hearth was approximately 10 cm thick (60 to 70 cm in elevation) and approximately one quarter of the hearth was uncovered by our excavation, having dimensions of 65 cm north to south by 50 cm east to west. A Rose Spring point was recovered from within the hearth (3074-02-1-C-6) along with broken mano fragments probably utilized as hearth or cooking stones, debitage, and bone fragments.

While the Feature 1 hearth sediments were heavily infused with charcoal, there was little organic material present of size and quality suitable for radiocarbon dating. A date of 140±BP was returned on a charcoal sample from Level 5 of Quad C, and is considered to be out of context.

At approximately 85 cm in depth, a compacted surface similar to the floor deposits in House Pit 1 began to appear, which extended to a depth of 110 cm. Artifacts were concentrated in this portion of the deposit and included ground stone, shell beads, biface fragments, long bone fragments, muskrat mandibles, Rose Spring and Elko points, a Northern Side-notched point that appears to have been reworked, and a stone ball. The cultural sediments were underlain by sterile silty sands, and the floor of House Pit 2 had considerably less topography than was noted at House Pit 1. No clear evidence of a hearth was noted in House Pit, but a piece of charcoal

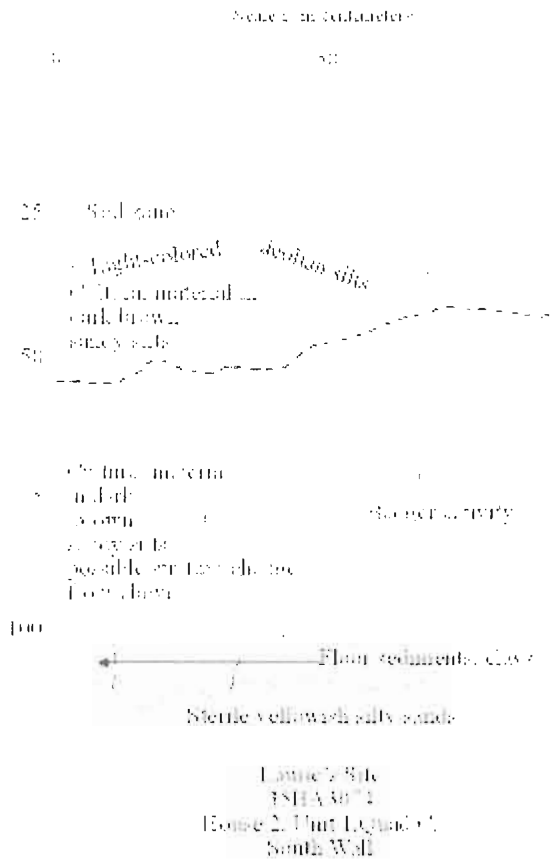


Figure 8.8. Laurie's site House 2 Unit 1 south wall profile

collected *in situ* from Level 9 of Quad C produced an AMS date of 1580±BP, consistent with the Rose Spring and Elko points recovered in association.

The House Pit 2 deposits produced clear evidence of bimodal distributions of both bone and debitage (Figure 8.9 and 8.10), suggesting that more than one occupation occurred there. Both bone and debitage counts for each quad mirror each other, with the key difference being that Quad C deposits begin at a lower elevation than Quad A. As was the case in House Pit 1, Rose Spring, Eastgate, and Elko points were found in association and believed to have been used coevally. The Northern Side-notched point appears to have been reworked and may have been curated for use during the time the House Pit was occupied.

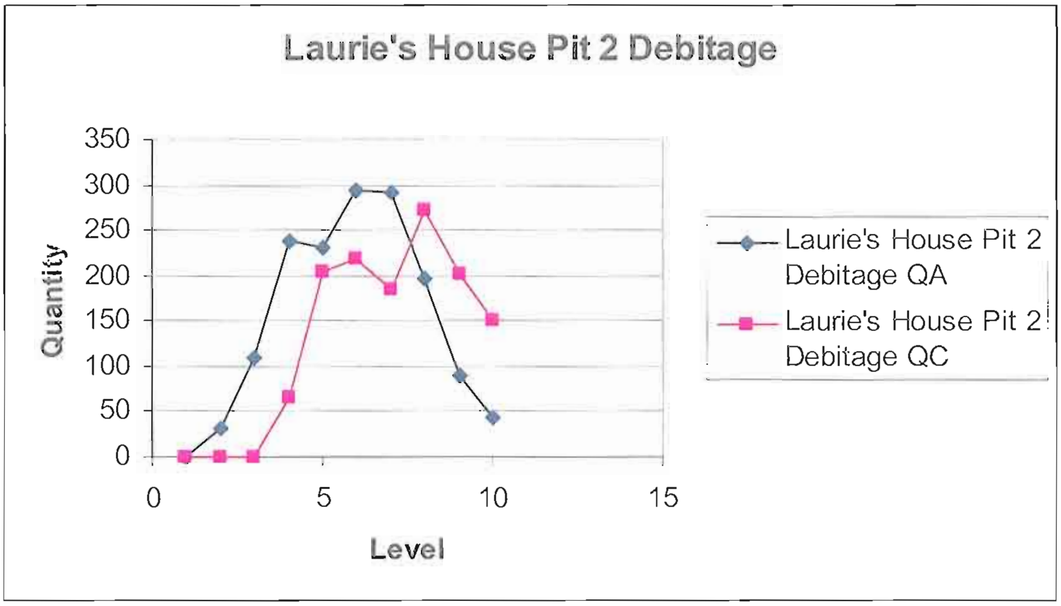


Figure 8.9. Debitage counts for House Pit 2, by level.

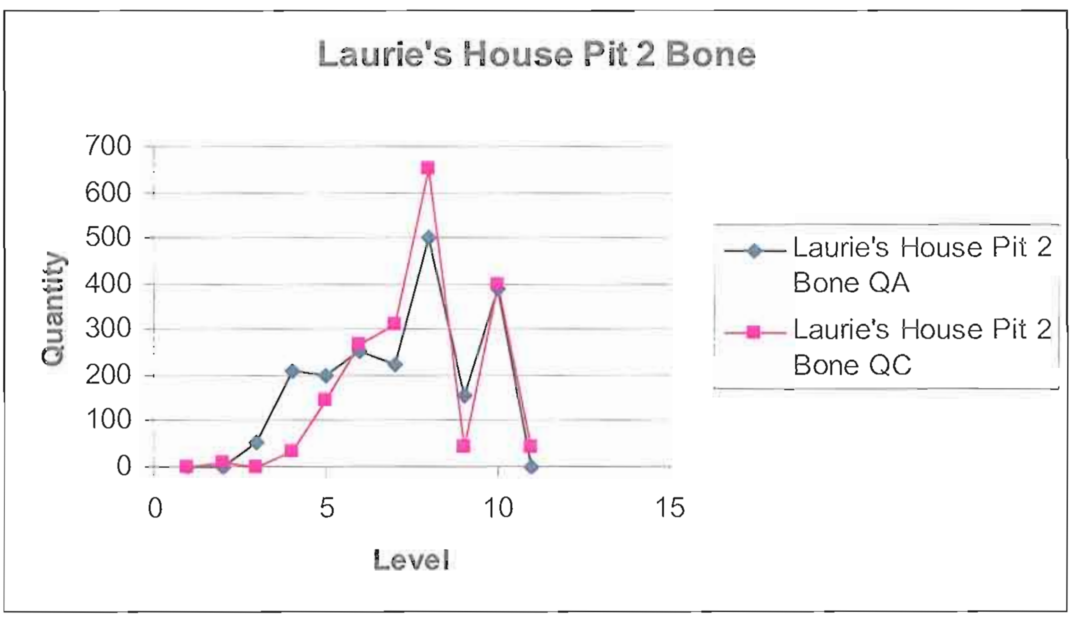


Figure 8.10. Bone counts for House Pit 2, by level.

The West Locus

An area approximately 15 meters north to south by 10 meters east to west was originally identified as Site 3, then renamed the West Locus of Laurie's site after extensive survey of the area indicated that a continuous scatter of artifacts linked the West Locus to Laurie's site. The locus is considered noteworthy because a number of artifacts, including 3074-3-surf-1, a large obsidian triangular preform; 3074-3-surf-2, an obsidian Eastgate point; 3074-3-surf-3, an unclassifiable obsidian point base; 3074-3-surf-4, a contracting stem point manufactured from CCS; 3074-3-02-1, a square-based biface made of obsidian , and 3074-3-02-2, a biface base, were all collected from a small, concentrated area. Also noted were ground stone fragments. No saltgrass-filled depressions were visible, like those on the adjacent rise where our excavations occurred. Only a portion of the artifact concentration is located on BLM property; more is across the fence on the Malheur National Wildlife Refuge.

House Pit 3

Initially thought to be a storage pit, based on the assumption that the salt grass cover reflected the probable dimensions of the subsurface feature, work in House Pit 3 was limited to a 1x1 meter unit, designated SP-1. The unit was situated to explore cultural deposits noted during augering that occurred in 2001. The 2001 exploration indicated that debitage and bone was present below the surface and the sediments were similar in constituents to the house pit deposits. No clear evidence of a storage feature was noted during the exploratory phase. It was determined that additional work should be carried out at the location to evaluate the nature of the deposits. Unit SP-1 was established in the northwest corner of the saltgrass concentration taking up not quite half of its surface area, and excavated to a depth of 90 cm. Rodent and badger holes were common throughout the deposits, but there were compelling glimpses of intact cultural deposits as well. Debitage did not begin to appear in quantity until Level 4, but bone was found in large numbers after Level 1, and both materials peaked in concentration in Level 5 (Figure 8.11 and 8.12).

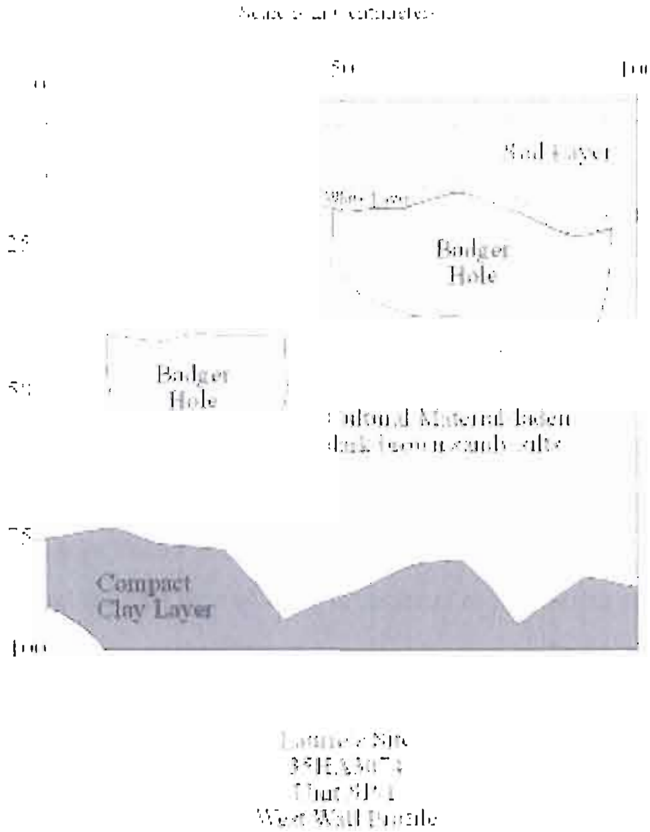


Figure 8.11. Laurie's site Unit SP-1 wall profile.

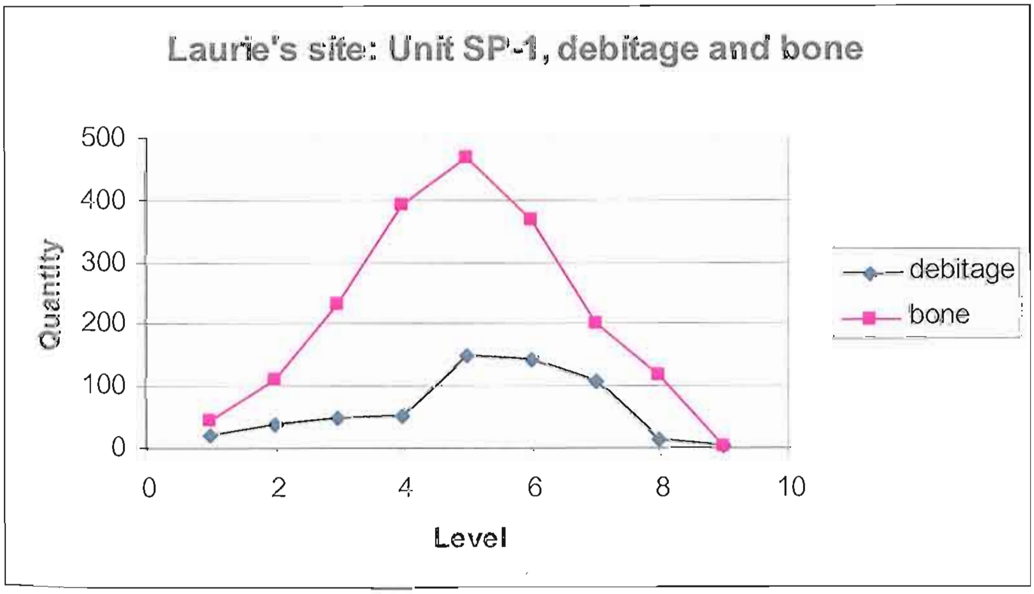


Figure 8.12. Laurie's site Unit SP-1 bone and debitage counts, by level.

As was the case in the other house pits, muskrat mandibles were common, as were small fragments of ground stone believed to have secondary use as hearth or cooking stones. Areas of thin, compacted clay that may be similar to those described by Musil (1995:103, 167) at the McCoy Creek site were noted at the beginning of Level 7 (70 cm) and continued through Level 9. The compacted clay was not identifiable as a coherent feature such as a house floor, at SP-1, and no other features were identified at Unit SP-1. A decorated bone tube was recovered from Level 7, and an Elko and Rose Spring point were found in Level 4. An AMS date of 1770±50 BP was returned on charcoal collected in situ from Level 4.

It appears that the three units were all excavated into house pits at Laurie's site, although the salt grass concentration covering the surface of House Pit 3 did not seem as true to the buried dimensions of the cultural features as was seen in House Pits 1 and 2. The 2001 excavation at House Pit 1 uncovered the east side of what is believed to be a brush wickiup, including the probable entrance, a portion of the floor, a hearth identified as Feature 2, and post holes relating to the superstructure. The Feature 1 artifact cluster was found on the occupation surface, and clusters of bone tools were concentrated in protected areas of the house floor. The 2002 work at House Pit 2 revealed the Feature 1 hearth and an associated occupation surface, overlying the north edge of an earlier house floor. At House Pit 3, no cultural features were apparent, but clay deposits were found in levels 7 through 9, with high concentrations of artifacts perched above them in levels 4 through 6. It is reasonable to propose, based on the quantities and variety of cultural materials and the presence of the unique decorated bone tube, that SP-1 was excavated within a house pit, with the majority of the cultural material resting on a degraded clay floor.

All of the house pits contain small and highly fragmented animal bone fragments, most from small mammals, fish, and birds, and clusters of unaltered muskrat mandibles on the occupation surfaces. Ground stone is plentiful, but largely found in small fragments that are suggestive of their use as hearth or cooking stones. In all cases, Elko, Rose Spring, and Eastgate points are found in association. Beads were recovered only in House Pit 1.

Artifact Assemblage

Chipped Stone Tools

Projectile Points

A total of 41 projectile points was recovered at Laurie's site; 36 of which are temporally diagnostic (Table 8.3, Figures 8.13 and 8.14). Five artifacts (13%) that are considered to have characteristics strongly consistent with projectile points but lack diagnostic attributes, including a large knife-like point, a preform, a biface base and two unclassifiable points are also described in this section. The majority of points are manufactured from obsidian (n=34or 88%), two are made of CCS (5%), and three are basalt (7%). The projectile points have been classified according to the system established by Thomas (1981) for the Monitor Valley in central Nevada and Heizer and Hester (1978) for the Great Basin at large. The points include 11 Rose Spring (28 %), eight Eastgate (20 %), one Rosegate (2 %), five Elko Eared (12 %), three Elko Corner-notched (7 %), two Elko Series (5 %), two Northern Side-notched (5 %), one Contracting Stem (2 %) two stemmed points (5%), and one Malheur Stemmed (2 %). The two typologically unclassifiable points recovered from the excavations include a portion of an obsidian base that could be from a Humboldt point (3074-2-C-4-1c). No Cottonwood or Desert series points were collected at Laurie's site.

Figure 8.13. Selected projectile points from Laurie's site, shown actual size:
Rose Spring, a-i; Eastgate, j-p; Elko, q-t.

a. 02-3074-1-c-6	b. 01-3074-2-A-4-1b	c. 01-3074-1-c-6-1a	d. 01-3074-2-a-2
e. 01-3074-1-c-5	f. 01-3074-2-a-3	g. 01-3074-1-c-2	h. 01-3074-2-a-2-1a
i. 02-3074-1-a-7	j. 01-3074-2-c-4-1a	k. 01-3074-2-c-3	l. 01-3074-2-c-4
m.02-3074-1-c-10a	n. 02-3074-SP1-4b	o. 01-3074-2-c-4-1d	p. 01-3074-1-a-7
q. 02-3074-3-surf-2	r. 01-3074-1-c-6-16	s. 02-3074-1-a-9a	t. 01-3074-SP1-4a

Rose Spring and Eastgate, (or "Rosegate" Points). Rosegate is a derivative term incorporating points previously identified as Rose Spring (Lanning 1963) and Eastgate (Heizer and Baumhoff 1961) into a single classification. Thomas (1981:19) lumped the Rose Spring (Lanning 1963) and Eastgate (Heizer and Baumhoff 1961) point types together under one classification, but the two types are clearly dissimilar in both form and distribution, and in this report, Rose Spring and Eastgate are analyzed separately. Rose Spring points are small corner-notched points that commonly have expanding stems, while Eastgate points are basally notched on a triangular or slightly rounded preform, producing barbs or tangs that are even with the base. According to Thomas (1981:19) Rosegate points have a basal width of 10 mm or less, a proximal shoulder angle between 90° and 130°, and a neck width less than or equal to [basal width plus 0.5 mm.] There is a substantial contingent of researchers who utilize the Rosegate designation in the Harney Valley and Great Basin at large, but here the preference is to continue the use of the designations Rose Spring and Eastgate except when breakage or retouching limits the ability to discern differences between the two varieties. Twenty points identifiable as Rose Spring (n=11, or 55 %), Eastgate (n=8, or 40 %) or Rosegate (n=1, or 5 %) were collected from Laurie's site (Figures 8.13 and 8.14). They included nine Rose Spring, five Eastgate, and one Rosegate recovered from House Pit 1; two Rose Spring and one Eastgate recovered from House Pit 2, one Eastgate recovered from House Pit 3, and one Eastgate recovered at the West Locus.

Rose Spring and Eastgate points were found scattered throughout most excavation levels in Unit 1 of House Pit 1, but were concentrated in the upper levels of Unit 2. A total of four Rose Spring and three Eastgate points were found in levels 2 through 4 of both quadrants, and three Elko Corner-notched points were collected from levels 6 through 7 of Quad A. No diagnostic points were recovered from Level 5.

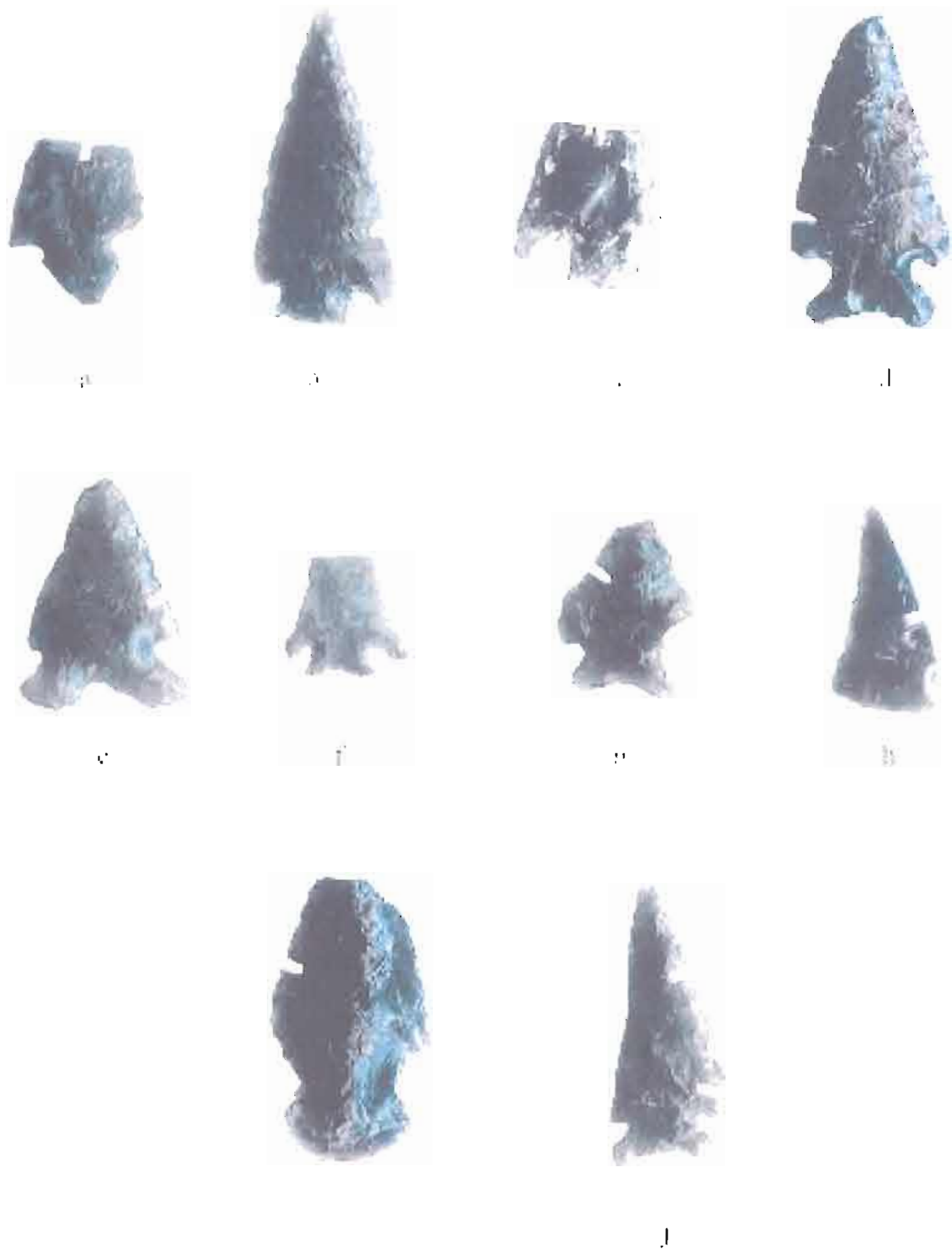


Figure 8.14. Selected artifacts from Laurie's site, shown actual size:
Elko Corner-notched, a-c; Elko Eared, d-g; Unknown, h; Malheur Stemmed, i;
Northern Side-notched, j.

a. 02-3074-1-a-9b b. 01-3074-2-A-7 c. 02-3074-1-a-9b d. 01-3074-1-c-7
e. 01-3074-2-a-6 f. 01-3074-1-a-4 g. 02-3074-1-c-10b h. 01-3074-2-c-4-1c
i. 01-3074-1-a-3 j. 02-3074-1-a-8

Table 8.3. Metric attributes of Laurie's site (35HA3074) projectile points, in mm.

Artifact	Type	L (mm)	W	Th	Neck W	Wt.(g)	Material
3074-1-A-3	ES/MS	39.5*	23.1	7.0	13.1	5.6	obs
3074-1-A-4	EE	16.0*	17.25	2.7	7.3	0.6	obs
3074-1-A-5	knife	77.8*	26.8	8.6	-	17.5	obs
2074-1-A-7	EG	21.8*	22.0	3.6	-	1.5	obs
3074-1-C-2	RS	12.2*	14.4*	2.5	5.8	0.29	obs
3074-1-C-5	RS	13.5	7.8	2.45	3.65	0.2	obs
3074-1-C-6-1a	RS	29.25	15.9*	3.75	5.45	1.1	obs
3074-1-C-6-1b	Elko	33.0*	.17.3	3.95	6.8	2.1	obs
3074-1-C-7	EE	21.8*	19.8*	8.8	9.7	9.8	bas
3074-1-C-7(2)	Stem	42.3	27.0	8.8	20.0	9.79	bas
3074-1-C-8	RG	6.9*	8.8*	2.6	6.3	0.13	obs
3074-2-A-F1	ECN	-	-	4.15	9.5	1.7	obs
3074-2-A-2	RS	21.8*	11.25	2.8	4.85	0.6	obs
3074-2-A-2-1a	RS	17.6*	13.4*	3.05	5.4	0.7	obs
3074-2-A-3	RS	20.2	14.5	0.6	5.15	3.0	ccs
3074-2-A-4-1a	RS	5.5*	10.6*	2.5	4.2	0.1	obs
3074-2-A-4-1b	RS	29.4	10.3	3.3	4.6	0.8	obs
3074-2-A-6	EE	31.5	24.0	5.35	15.5	3.1	obs
3074-2-A-7	ECN	45.4	20.65	4.4	9.4	3.1	obs
3074-2-C-2	NSN	11.7*	23.8	4.4	11.6	1.2	obs
3074-2-C-3	EG	25.9*	16.4	3.7	3.85	1.0	bas
3074-2-C-4	EG	17.2*	14.8*	3.0	3.8	0.4	obs
3074-2-C-4-1a?	EG	22.9	16.4*	3.05	5.4	0.7	obs
3074-2-C-4-1b	RS	17.85	13.1*	3.1	5.3	0.5	obs
3074-2-C-4-1c	UNK	28.5*	17.2*	5.2	-	1.5	obs
3074-2-C-4-1d	EG	19.1*	18.55	3.3	4.5	0.7	obs
3074-3-surf-1	preform	61.5	29.55	5.85	-	10.5	obs
3074-3-surf-2	EG	26.2*	14.5*	4.45	-	1.3	obs
3074-3-surf-3	UNK	-	-	3.2	-	0.3	obs
3074-3-surf-4	CS	10.0*	18.4*	5.3	5.4	1.1	ccs
3074-3-02-1	sq base bif	31.2*	29.5	5.9	-	6.96	obs
3074-3-02-2	Stem	18.8*	19.4*	5.6	-	1.7	obs
3074-02-1-A-7	RS	19.4	16.2	3.4	5.7	0.58	obs
3074-02-1-A-8	NSN	36.7	15.3	3.9	10.0	1.95	obs
3074-02-1-A-9a	EE	35.4	18.4	4.6	9.8	2.16	obs
3074-02-1-A-9b	ECN	21.7*	21.2*	5.3	9.1	2.19	obs
3074-02-1-C-6	RS	25.4	9.4	33.5	4.7	0.62	obs
3074-02-1-C-10a	EG	19.3	20.3	2.8	5.5	0.62	obs
3074-02-1-C-10b	EE	22.2*	19.5*	4.0	10.9	1.52	obs
3074-02-SP1-4A	Elko	29.7*	18.6*	5.0	8.1	2.94	obs
3074-02-SP1-4b	EG	21.1	18.2	2.6	4.6	0.45	obs

*=not complete

The 11 Rose Spring points collected at Laurie's site exhibit some variation in terms of their general morphology. Most have expanding stems and deep corner notching that produces broad barbs, while a few have almost straight-sided bases with minimal development of barbs. All but one of the points are manufactured from obsidian, the other is made of a reddish-colored CCS (01-3074-2-A-3). All but one of the Rose Spring points are from sources north and east of the Harney Valley, including Coyote Wells (1), Tule Spring (4), Whitewater Ridge (1), and Wolf

Creek (2). One point (02-3074-1-C-6) is made of obsidian from Beaty's Butte, west of Catlow Valley and far south of the site. Obsidian hydration readings are broadly dispersed for Rose Spring points, ranging from 1.6 to 3.3 microns, with a mean of 2.6 for the seven points analyzed. The hydration readings were tightly grouped in House Pit 1, Unit 2, where three points produced measurements of 2.2, 2.4, and 2.6 microns (3074-2-A-2, 3074-2-C-4-1b, and 3074-2-A-2-1a, respectively).

One Eastgate point (3074-2-C-3) is made from basalt, the rest are obsidian. All of the Eastgate obsidian points originated from sources to the north and east of the site, including Indian Creek (2), Tule Spring (1), and Venator (3). The hydration readings are more tightly constricted for this group, ranging from 1.6 to 2.3 microns with a mean of 1.9 for the five points that were analyzed. Both of the points recovered from House Pit 1, Unit 2, Quad C had hydration measurements of 2.3 microns (3074-2-C-4 and 3074-2-C-4-1d). Two of the Eastgate points are distinguished from the others by their bifurcated bases. One (02-3074-1-C-10a) was recovered from the floor of House Pit 2, Unit 1, the other (02-3074-SP1-4b) from House Pit 3, Unit SP-1, Level 4. Both points originated from the Venator obsidian source.

The Rosegate point (3074-1-C-8), manufactured from obsidian, was not geochemically sourced or measured for hydration. The point is too fragmented to classify further.

Elko Series Points. Ten Elko series points (24 %) were collected from Laurie's site, including five Elko Eared, three Elko Corner-notched points, and two fragmented points that can only be attributed to the Elko series (Figures 8.13 and 8.14). All Elko points should have a basal width of 10 mm or more, and a proximal shoulder angle between 110° and 150° (Thomas 1981:20-21). One Elko Series, three Elko Eared, and two Elko Corner-notched points were collected from House Pit 1, one Elko Corner-notched and two Elko Eared points came from House Pit 2, and one Elko Series point was found in House Pit 3.

Elko Eared points are large, corner-notched points with a deeply indented base that, in conjunction with the corner-notching, form "ears" for hafting purposes. The basal indentation ratio should be less than or equal to 0.93 (Thomas 1981:21). Elko Corner-notched points are included in the Elko Series and morphologically similar to Elko Eared points, but lack the deep basal indentation that produces the eared appearance, with a basal indentation ratio exceeding 0.93 (Thomas 1981:21). The widest portion of either point is just forward of the base. Both types are coeval.

The Elko points from Laurie's site display a considerable range in both size and form but most are fairly robust, with broad, lenticular cross-sections and evidence of considerable resharpening. Intensive resharpening can consistent with projectile points that have been carried over long distances and utilized to their full potential, and two of the Elko points from Laurie's site have been brought to the site from far afield. Specimen 3074-2-A-F1, an Elko Corner-notched point recovered in association with the Feature 1 rock cluster in House Pit 1, Unit 2, originates from the Owyhee source near the Oregon – Idaho border. Specimen 3074-1-C-7, an Elko Eared point collected in Unit 1 of House Pit 1, is made of obsidian from the Whitehorse source located near the Trout Creek Mountains just north of the Oregon – Nevada border. The majority are from nearby sources including Burns (1), Tule Springs (1) and Venator (5), found north and east of the site.

Obsidian hydration measurements ranged from 1.3 to 2.7 microns with a mean of 2.1 microns for eight points. The two measurable points in House Pit 1, Unit 2, Quad A, had readings of 2.7 microns apiece and the points measured in Unit 2 were substantially broader at 1.3 and 2.1 microns for specimens 3074-1-C-6-1b (Elko Series) and 3074-1-C-7 (Elko Eared), respectively.

Large Side-notched. Large side-notched projectile points have been identified by various regional appellations or morphological attributes in the northern Great Basin and southern Columbia Plateau. Specimen 02-3074-1-A-8, recovered from Level 8 of House Pit 2, fits well in the Northern Side-notched classification established by Heizer and Hester (1978) for the Great Basin, having a straight to concave base and notches that are deep and perpendicular to the long axis (Figure 8.14). Oetting (1994) places Northern Side-notched points between 7,000 to 4,000 years in age in the northern Great Basin. Chronologically, the point is out of place in the ca. 1500 year-old house pit by about 2,500 years. The point also has a thin hydration rind for an artifact of such antiquity, at 1.7 microns, and it is very possible that it may be a variant of an Elko Eared point, considering its deeply concave base. The artifact originates from the Tule Springs obsidian source, to the northeast.

A second artifact (3074-2-C-2) also fits well in the Northern Side-notched category. It is manufactured of obsidian and was recovered during the debitage analysis, well after the sourcing and hydration samples were submitted for analysis.

Malheur Stemmed. Specimen 3074-1-A-3 (Figure 8.14) is an obsidian base and midsection suggestive of a Malheur Stemmed point. Twenty-eight of these points were collected during the post-flood surveys of Malheur Lake and were first described by Oetting (1990:139-144) as lanceolate points with distinctive expanding stems. The length of the basal element is short in comparison with the blade and the stem expands toward the base (Oetting 1990:140). Neck widths range between 7.9 and 19.3 mm. Although some attributes of these points are suggestive of Great Basin Stemmed and other large point types, Oetting (1990:144) noted that most Malheur Stemmed points were found on sites dominated by Rosegate points.

Like the Malheur Lake points described by Oetting, the Laurie's site point has a distinct expanding stem and shoulders. It has a neck width of 13.1 mm, in keeping with Oetting's (1990) dimensional range. Specimen 3074-1-A-3 produced a hydration measurement of 2.6 microns and the point is manufactured from Whitewater Ridge obsidian. The point also fits the Side Notched 4 category in the Columbia Plateau typology described by Dumond and Minor (1983:171).

Stemmed Points. Two additional artifacts can be classified as stemmed points, but they are not to be confused with the Western or Great Basin Stemmed series of points dating to the early Holocene (Willig et al. 1988) because they lack the necessary attributes. Specimen 3074-1-C-7(2) is a stemmed base manufactured from basalt, with one sharply offset shoulder remaining. It was found in Unit 1, Level 7, Quad C of House Pit 1, in close proximity to the Feature 2 hearth and a concentration of Rose Spring and Elko Corner-notched points. The largely percussion-flaked tool exhibits little additional pressure flaking along the edge margins and lacks the basal edge grinding that is expected of the early Holocene stemmed points. It is probable that the artifact is part of a late Holocene knife.

Specimen 3074-3-02-2 is a small contracting stem base with a portion of a weak shoulder on one side (Figure 8.15). The size is consistent with that of a Gatecliff Contracting Stem point (Thomas 1981), but no other points recovered at Laurie's site can be classified to the Gatecliff Series. The artifact may simply be a portion of a small biface with flaking that has created a shoulder-like appearance. Specimen 3074-3-02-2 was collected from the surface of the West Locus, where it was associated with Stage 4-5 bifaces. It originated from the Venator obsidian source and had a hydration measurement of 3.0 microns.

Unknown. Several biface fragments have characteristics that are consistent with projectile points, but morphological attributes that are not classifiable into known typologies. Specimen 3074-2-C-4-1c (Figure 8.14) appears to be a projectile point base. However, the tool has a "waisted" appearance and a slightly convex base that can not be associated with known point types. The artifact originates from Quad C, Level 4 of House Pit 1, Unit 2, and it was found in close association with Rose Spring and Eastgate points. It is made of obsidian from the Venator source and produced a hydration measurement of 2.5 microns, well in keeping with the other artifacts recovered from Unit 2.

Specimen 3074-1-A-5 is a large biface, broken distally, that appears to have weak shoulders. It was recovered from Quad A, Level 5 of House Pit 1, Unit 1 in association with Rose Spring, Elko, and Eastgate points. The obsidian artifact is 77.8 mm in length by 26.8 mm in width and it is considered to be a knife fragment, although the shoulders create some uncertainty about that assessment. It is manufactured from Tule Spring obsidian and has a hydration measurement of 2.4 microns. Although large bifaces with weak shoulders may be indicative of some early Holocene projectile points, that is not considered to be the case here. The association with late Holocene point styles in deposits with good context, the thin hydration reading, and the absence of basal edge grinding all argue in favor of its use as a late Holocene knife or spear point rather than an early Holocene projectile point. Specimen 3074-3-Surf-3 is a projectile point base fragment that is broken in such a manner that some uncertainty exists regarding its appropriate classification. It appears to have "ears" similar to an Elko Eared point, but the base is larger than is commonly seen in the Elko Series. The artifact is made of Beatys Butte obsidian and has a hydration measurement of 2.8 microns.

Shaped Bifaces

This category is based on the multi-stage biface classification system employed by Jenkins and Connolly (1990) at the Indian Grade Spring site. Stage 1-5 bifaces are discussed here. A total of 66 bifaces was collected from the excavations at Laurie's site, including 56 from the 2001 House Pit 1 excavations and 10 from the 2002 House Pit 2 excavations (Table 8.4, Figure 8.15). The majority of the bifaces consist of projectile point fragments that include tips, midsections, edge fragments, tangs, barbs, and bases. The determination that the artifacts are projectile point fragments is based on the amount of fine flaking observed (Stage 4 or 5, see

Table 8.4. Metric attributes of Laurie's site bifaces and fragments, in mm and grams.

Artifact	Type	L	W	Th	Wt	Notes
				House Pit 1		
01-1-A-2	St. 5	11.4	8.8	2.0	0.16	obs proj pt tip
01-1-A-2(2)	St. 5	10.2	6.3	3.2	0.2	white ccs proj pt edge
01-1-A-3	St. 5	7.2	6.1	1.9	0.05	obs proj pt tip, small pt
01-1-A-4	St. 5	6.6	6.0	2.1	0.07	obs proj pt tang
01-1-A-5	St. 5	5.9	3.0	1.5	0.01	obs proj pt tang
01-1-A-6	St. 5	11.8	9.0	2.1	0.16	obs proj pt tip
01-1-A-7	St. 3	40.7	31.0	5.5	7.04	obs triangular quarry blank
01-1-A-7(2)	St. 5	4.8	4.2	1.1	0.02	obs proj pt tang
01-1-A-7(3)	St. 5	4.1	5.7	1.8	0.02	obs proj pt tip
01-1-A-7-1a	St. 3	18.8	7.5	5.9	0,7	obs biface edge frag
01-1-A-8	St. 5	7.0	4.8	2.0	0.03	obs proj pt tip
01-1-A-8(2)	St. 5	12.6	6.5	2.3	0.13	gray obs proj pt barb, large
01-1-C-2-1a	St. 5	12.3	11.9	3.2	0.4	obs proj pt midsection
01-1.C-2-1a(2)		St. 5	12.4	7.7	1.9	0.16 obs proj pt tip
01-1-C-3	St. 5	18.0	16.5	6.4	2.12	obs proj pt midsection, large pt
01-1-C-3(2)	St. 3	17.4	5.8	7.4	0.58	obs edge frag
01-1-C-3(3)	St. 2	14.8	12.6	3.5	0.77	beige ccs rounded base, drill?
01-1-C-3(4)	St. 5	6.5	7.4	2.6	0.09	obs proj pt tang, large pt
01-1-C-4	St. 2	15.2	23.3	4.1	1.31	brown ccs rounded base, small
01-1-C-4(2)	St. 5	7.4	5.5	1.7	0.6	obs proj pt midsection, small pt
01-1-C-4(3)	St. 5	6.9	5.5	1.4	0.05	bas proj pt barb, large pt
01-1-C-4(4)	St. 5	8.7	5.7	1.7	0.07	beige ccs edge fragment
01-1-C-5	St. 5	22.9	6.3	1.7	0.21	obs proj pt tip, small pt
01-1-C-6	St. 5	18.2	16.2	3.3	1.6	obs proj pt midsection
01-1-C-6-1a	St. 4	13.4	17.5	2.7	0.57	obs proj pt tip, large pt
01-1-C-6(2)	St. 5	9.1	5.7	1.7	0.07	red obs proj pt tip, small pt
01-1-C-6(3)	St. 5	4.7	8.9	1.9	0.04	obs proj pt tip
01-2-A-2	St. 5	12.8	13.0	2.8	0.34	obs proj pt tip, large pt
01-2-A-2b	St. 2	19.7	29.3	7.7	5.54	obs lg biface midsection
01-2-A-3	St. 2	21.2	20.8	4.2	1.98	obs triangular preform base
01-2-A-4	St. 5	18.0	13.5	6.6	1.59	brown ccs tip, possible crescent frag
01-2-A-4(2)	St. 2	25.6	26.2	5.3	3.5	obs triangular preform base
01-2-A-4(3)	St. 5	7.0	8.1	2.3	0.12	obs proj pt midsection
01-2-A-4-1a	St. 5	13.6	7.2	3.3	0.25	obs proj pt tip
01-2-A-5	St. 5	14.5	12.1	2.4	0.3	basalt proj pt tip, large pt
01-2-A-5(2)	St. 5	5.5	4.9	1.6	0.03	obs proj pt tang
01-2-A-6	St. 3	19.8	39.7	9.4	9.71	brown ccs midsect, lg, near base
01-2-A-6-F1	St. 2	21.0	34.9	9.1	7.98	brown ccs edge frag, rough flaking
01-2-A-6-1a	St. 2	38.8	28.9	8.3	5.63	obs edge frag, use wear flaking on broken/unbroken edges
01-2-A-6-1b	St. 5	16.5	18.7	3.7	0.8	obs proj pt tip, large pt
01-2-A-6(2)	St. 5	12.2	6.1	2.3	0.13	obs proj pt tip, small pt
01-2-A-7	St. 5	18.4	10.9	2.7	0.47	obs proj pt tip
01-2-A-7-1a	St. 5	7.7	5.8	2.2	0.1	obs proj pt tang or ear, lg pt
01-2-A-7-1a(2)		St. 4	42.6	27.3	5.9	7.35 brown ccs leaf-shaped preform
01-2-A-7(2)	St. 3	68.2	35.6	12.6	34.21	basalt crude knife
01-2-A-8	St. 5	8.1	11.3	2.2	0.33	obs proj pt tip
01-2-A-8-1a	St. 5	5.4	5.4	1.9	0.7	obs base frag?
01-2-C-2	St. 2	25.3	35.7	11.3	9.69	gray/white ccs lg biface midsection, near base
01-2-C-4	St. 2	24.9	32.0	8.9	5.68	obs rounded biface base, large, use wear flaking on edges
01-2-C-4-1a	St. 4	18.4	18.7	8.5	3.7	brown ccs edge frag
01-2-C-4(2)	St. 5	9.1	12.5	2.8	0.2	obs proj pt tip, large pt
01-2-C-4(3)	St. 4	30.5	18.1	3.8	2.01	basalt biface tip, poss knife
01-2-C-4(4)	St. 3	42.0	38.6	11.5	21.56	basalt disc scraper
01-2-C-9	St. 4	24.7	19.4	4.2	1.57	obs triangular □erform, complete

Table 8.4. (continued). Metric attributes of Laurie's site bifaces and fragments, in mm and grams.

Artifact	Type	L	W	Th	Wt	Notes
				House Pit 2		
01-2-C-6	St. 5	38.0	24.3	8.8	12.46	finely flaked basalt knife frag, wear on edges and arrisses
01-2-C-8	St. 5	5.5	2.7	1.7	0.01	obs proj pt tip
02-2-1-A-4	St. 3	37.8	36.9	8.9	12.99	gray obs, rounded base, worn edges and arrisses
02-2-1-A-6	St. 5	13.2	6.8	2.0	0.13	finely wrought obs proj pt tip
02-2-1-A-7	St. 5	10.0	7.8	1.9	0.12	obs proj pt tip
02-2-1-A-8	St. 3	27.7	33.2	8.2	6.04	obs edge frag, appears to be notched, possibly hafted
02-2-1-A-9	St. 3	23.0	27.8	8.4	6.28	brown ccs rounded base, teardrop-shaped tool
02-2-1-C-8	St. 2	18.1	27.6	5.8	2.29	obs rounded base, sinuous edges
02-2-1-C-10(1)	St. 2	46.9	26.8	7.9	8.88	brown ccs biface tip, broken diagonally
02-2-1-C-10(2)	St. 4	26.7	24.0	6.9	6.08	brown ccs midsection, one edge very worn
02-2-1-C-10(3)	St. 5	11.3	9.3	2.7	0.16	obs proj pt tip
02-2-1-C-10(4)	St. 5	22.0	13.4	3.7	0.9	obs proj pt tip, large pt

below), size, and evidence that additional shaping (such as basal notching) was utilized to enhance utilitarian or stylistic attributes. Of the 56 bifaces originating from House 1, 63% (n=35) were projectile point fragments, as were 40% (n=4) of the bifaces at House 2. No bifaces were recovered from House Pit 3.

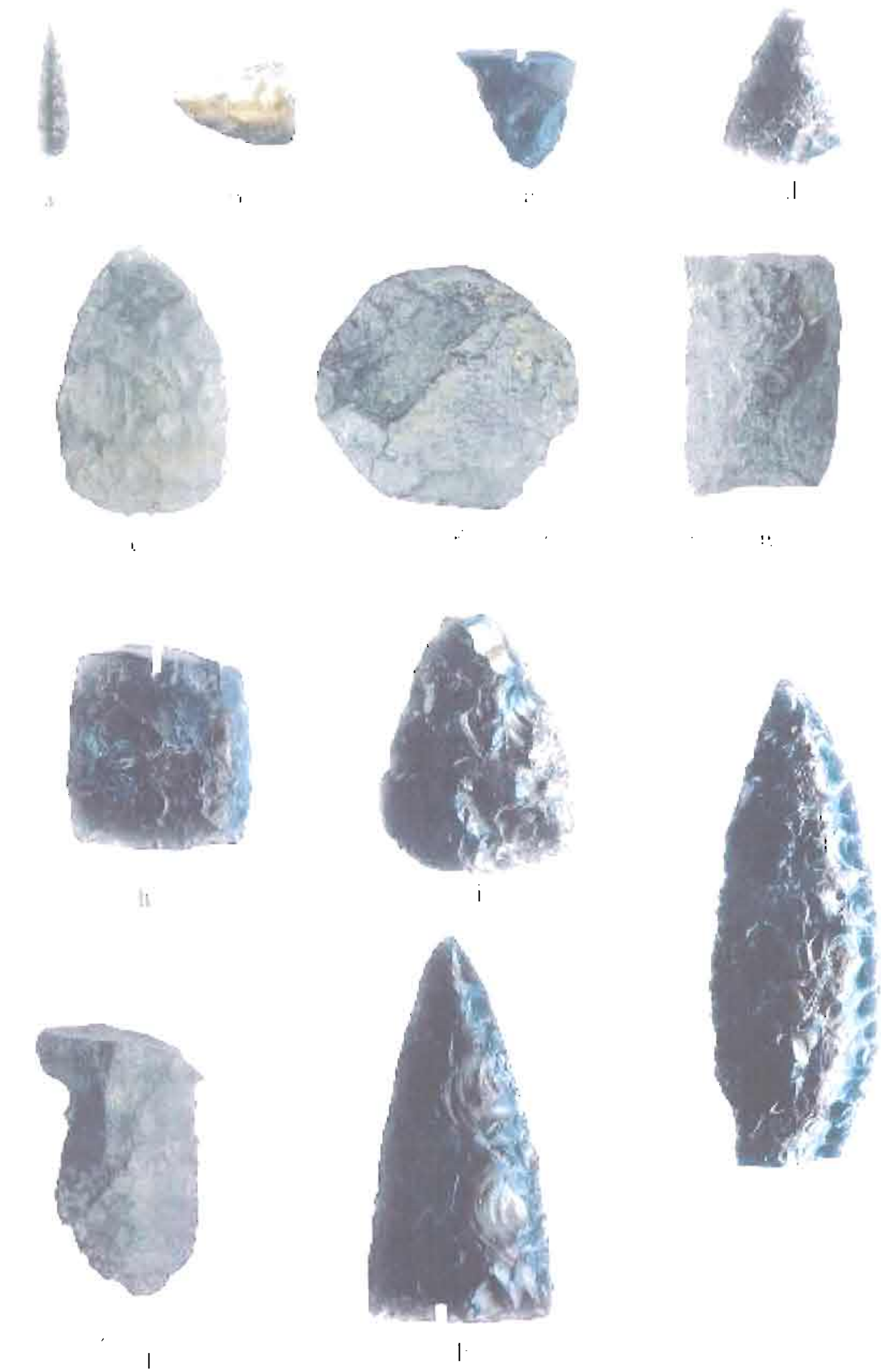
Stage 5 bifaces are generally classified as projectile points, and all diagnostic point fragments have been treated separately in a previous portion of the text. Most of the artifacts are fragmentary. They are considered in terms of a generalized leaf-shaped biface morphology because many share similar characteristics. Tips are pointed and are thought to be the distal ends of the artifacts. Bases usually have rounded or slightly convex squared ends and are thought to be the proximal portions of the artifacts. Midsections are frequently tapered to some degree, but can be straight-sided. Certainly not all bifaces have rounded bases, pointed tips, and show clear signs of tapering, but it seems most utilitarian for descriptive purposes to emphasize the shape of a common artifact form when only fragments exist. Bifaces often served multiple purposes, ranging from cutting implements to cores for the manufacture of projectile points and other tools.

Stage 1 bifaces. These bifaces have thick cross-sections and large, unpatterned flake scars. They exhibit only the most rudimentary development, with rounded or thick lenticular shapes and cross-sections. The flaking pattern reflects use of the hard hammer percussion technique, and the edges of these tools can be very sinuous. None of the bifaces recovered from Laurie's site reflect Stage 1 reduction.

Stage 2 bifaces. Bifacial thinning is continued on these artifacts through the removal of contiguous hard hammer percussion flakes. The removal of the flakes results in the development of an artifact, which, although still crudely shaped, has a more pronounced form than Stage 1 artifacts. Stage 2 bifaces are considered to be quarry blanks. Eleven artifacts fit this classification, including two from Unit 1, Quad C; five from Unit 2 Quad A, and two from Unit 2, Quad C of House Pit 1. No Stage 2 bifaces were collected from Unit 1, Quad A. House Pit 2 produced two in Quad C. Of the 11 Stage 2 bifaces, five were made from CCS and six were obsidian. A limited degree of patterning is evident in the distribution of the two types of tool stone. Unit 1 Quad C produced two bifaces made of CCS. Unit 2, Quad A had four obsidian bifaces and one of CCS. The CCS biface was recovered in association with the Feature 1 artifact cluster. The small number of Stage 2 bifaces at Laurie's site limits any conclusions that can be drawn regarding their distribution.

Figure 8.15. Selected bifaces from Laurie's site, shown actual size.
Specimens c, j, k, and l are discussed in the projectile point section above.

a. 01-3074-1-C-5	b. 01-3074-2-A-4	c. 02-3074-3-02-2	d. 01-3074-2-C-9
e. 01-3074-2-A-7-1a	f. 01-3074-2-C-4	g. 01-3074-2-C-6	h. 01-3074-2-C-6
i. 01-3074-1-A-7	j. 01-3074-1-C-7	k. 01-3074-3-surf-1	l. 01-3074-1-A-5



Stage 3 bifaces. The second-most common reduction stage at Laurie's site, these bifaces exhibit little to no evidence of pressure flaking and have the slightly sinuous edges characteristic of large percussion flake scars created by the initial stages of bifacial reduction. The entire artifact surface has been modified through the removal of flakes, the scars of which can reach the middle of the artifact. It is at Stage 3 that major thinning of a biface occurs, often leading to breakage. Most of the artifacts exhibited fine pressure flaking along some edges, with varying degrees of percussion flaking along other edges and across the body of the artifact. A total of nine biface fragments fit this classification, five of which are of obsidian and two each of CCS and basalt. They include two from Quad A and one from Quad C, of Unit 1 of House Pit 1; and two from Quad A and one from Quad C, of Unit 2. House Pit 2 produced three in Quad A, none in Quad C, and there were none from House Pit 3.

The Stage 3 bifaces included four edge fragments, a midsection, a crude knife, a quarry blank, two bases, and a disc-shaped scraper. Specimen 01-2-C-4(4), the basalt disc, was collected from Level 4, Quad C of Unit 2, House Pit 1. The object may have originally served as a core, from which flakes were struck to create other tools. The artifact was also utilized as a scraper with additional flake removal that was a by-product of heavy use and from pressure flaking of some edges. The scraper was used with enough intensity to cause smoothing of exterior edges as well as on interior flake scars across the body of the disc.

Stage 4 bifaces. The continuation of percussion and pressure flaking techniques after Stage 3 results in bifaces with a more "finished" appearance than Stage 3 tools. Pressure flake scars can reach the midline of the artifact or carry further, frequently eliminating the large percussion flake scars from earlier reduction. Edges are strengthened by the removal of pressure flakes, which increases the edge angle. Six Stage 4 artifacts were collected from Laurie's site, including one obsidian point tip, one CCS midsection, one CCS and one obsidian preform, a CCS edge fragment, and a basalt biface tip. House Pit 1 contained one Stage 4 biface in Quad C of Unit 1, as well as one in Quad A and three in Quad C of Unit 2. House Pit 2 produced one in Quad C. The CCS midsection from House Pit 2 (02-2-1-C-10[2]) is manufactured from brown semi-translucent material and one edge has a substantially greater degree of wear than the opposite. Both of the preforms would have been utilized to manufacture small tools such as arrow points. Specimen 01-2-a-7-1a(2), made from brown CCS, is a leaf –shaped preform. Specimen 01-2-C-9 is a triangular preform that is made of obsidian.

Projectile Point Fragments (Stage 5). The 40 Stage 5 biface fragments found at Laurie's site can be divided into two groups, projectile points composing the largest group with 37 specimens (93%) and other finely finished tools accounting for the remainder. Of the 37 projectile point fragments, 23 (62%) are believed to be point tips, followed by six tangs (16%), five midsections (14%), two barbs (5%), and one edge fragment (3%). One to three point fragments were found in most levels of each quad at House Pit 1 for a total of 36. Four were found in House Pit 2 and none were reported from House Pit 3. The probable reason for the low numbers in House Pits 2 and 3 is because debitage analysis was not carried out there, and many of the point fragments from House Pit 1 were only identifiable after thorough cleaning prior to the analysis. A total of 34 of the Stage 5 bifaces was made of obsidian and three each are basalt and CCS.

Among the more noteworthy Stage 5 bifaces recovered during the excavation (aside from the diagnostic projectile points) was a brown CCS biface tip that is reminiscent of a Great Basin Transverse point (Clewlow 1968, Tadlock 1966). The robustly proportioned tip fragment has one straight edge and the opposite is convex in the form of a crescent. Both edges are either heavily worn or ground. While the artifact could also easily be the tip of a well-worn and slightly asymmetrical biface, the combination of thickness, edge wear, and shape combine to suggest otherwise. It is similar in morphology to others collected from around Malheur and Harney lakes that I have studied in various private collections.

The 66 bifaces reported here equate to almost ten per cubic meter of excavation (66/6.8 m^3= 9.7) at Laurie's site. The fact that 61% of the bifaces are Stage 5 is striking and suggests that much of the lithic reduction at the site involved the use of preforms or quarry blanks that were nearly finished by the time they were brought to the site. It is not clear whether projectile point breakage is occurring during flint knapping or in relation to other activities such as during the procurement of game. Large bifacial cores are not present to any great degree, and the evidence from obsidian sourcing suggests that most of the early stage lithic reduction activities was occurring at tool stone sources to the north and east of the site.

Drills and Awls

Four drill and awl fragments came from the House 1 excavations, with three collected in Levels 2 and 3, and one collected in Level 7 (Table 8.5, Figure 8.16). One complete specimen of brown and cream colored CCS, (3074-01-1-A-3) has a base that expands to a bulbous shape presumably for hand held use. One CCS tip (3074-01-1-A-7) is lenticular in cross section and straight-sided, culminating in a tip with little taper. The midsection (3074-01-2-A-2) is also lenticular in cross section and straight-sided, but more roughly flaked that the other straight-sided specimens. The basalt tool (3074-01-2-A-3) has a thin, diamond shape and fine, chevron-patterned flaking extending to the midline of the artifact. It does not appear to be a projectile point fragment and is too thin in cross section to have served effectively as a drill. The artifact would have functioned well as an awl, or perforator, utilized for punching holes in leather or other low density materials.

Edge-modified Flakes

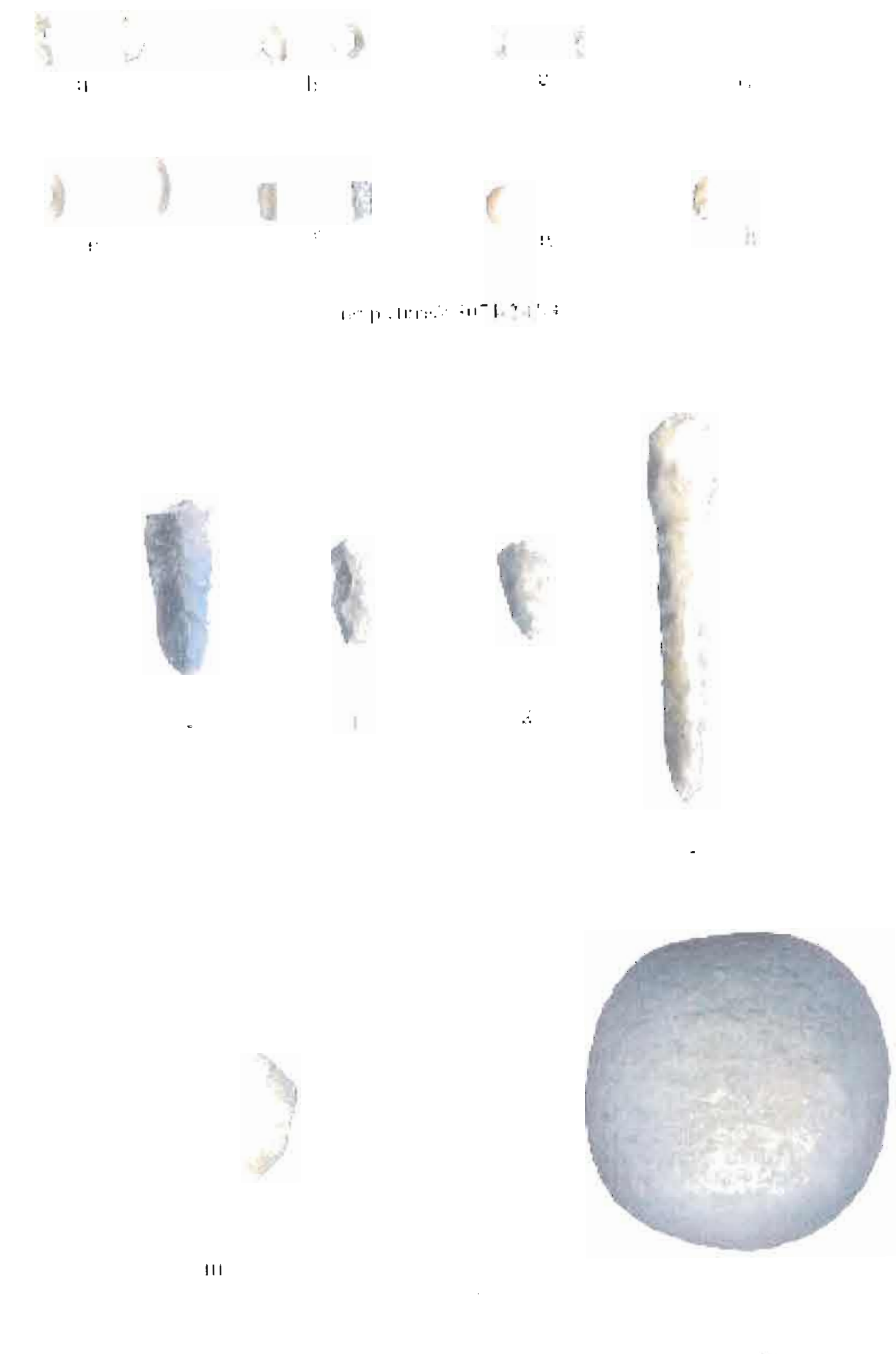
A total of 21 edge-modified flakes was collected at Laurie's site, all from House Pit 1. Those artifacts meeting the classification of an edge-modified flake must exhibit regular, patterned, flaking on at least one edge that is clearly intentional, excluding the possibility that flaking has resulted from trampling or other agents of edge-damage. As was the case for the projectile point fragments above, many of the artifacts identified as edge-modified were discovered during debitage analysis after the flakes had been thoroughly cleaned. The lack of such artifacts from House Pits 2 and 3 may be directly attributable to this factor.

Table 8.5. Metric attributes of drills and awls from Laurie's site.

Artifact	Type	L	W	Th	Wt	Notes
01-1-A-3	CCS	61.7	11.6	5.6	4.07	complete straight-sided, w/base
01-1-A-7	CCS	14.8	8.2	4.9	0.6	tip, straight-sided
01-2-A-2	CCS	16.2	6.5	3.8	0.42	midsection, straight-sided
01-2-A-3	BAS	26.5	11.0	4.6	1.01	basalt, tapered perforator

Figure 8.16. Selected artifacts from Laurie's site, including beads, drills, a graver, and stone ball, shown actual size.

a. 01-3074-1-C-5-1a
b. 02-3074-2-A-1-8
c. 02-3074-SP1-A-7
d. 02-3074-SP1-A-5
e. 01-3074-1-C-6
f. 01-3074-3-D-3
g. 01-3074-2-C-4
h. 01-3074-2-A-5
i. 01-3074-2-A-3
j. 01-3074-2-A-2
k. 01-3074-1-A-7
l. 01-3074-1-A-3
m. 01-3074-1-A-6
n. 02-2-1-A-10



Most edge-modified flakes were less than five cm long and four cm wide, although one large basalt flake was ten cm by six cm in size (Table 8.6). Unit 1 contained 14 edge-modified flakes, with ten in Quad A and four in Quad C. Unit 2 produced seven, including five in Quad A and two in Quad C. Of the 21 edge-modified flakes, 12 were obsidian, seven were basalt, and two were CCS. Clustering of the flakes is noticeable in Level 6 of both Quads A and C of Unit1, perhaps associated with activities occurring near the Feature 2 hearth.

Most of the flakes (n=17 or 81%) had a single unifacial edge. Two flakes have bifacial edges (01-2-A-5 and 01-2-A-8[2]) and are manufactured from CCS and basalt, respectively. One artifact (01-1-C-2-1a) is a steep-edged, but expedient scraper made of obsidian. Specimen 01-1-A-6 (Figure 1.13), made of white CCS, has a small spur on the broadest end which may have functioned as a graver. The spur shows evidence of careful preparation as well as wear, and

Table 8.6. Metric attributes of Laurie's site edge-modified flakes.

Artifact	Type	L	W	Th	Wt	Notes
01-1-A-1	obs	27.5	18.5	4.0	2.08	rectangular, single unifacial edge
01-1-A-3	bas	51.3	35.8	6.0	11.65	oval, single unifacial edge
01-1-A-5	bas	51.8	35.7	11.0	13.37	oval, one unifacial crescentic edge
01-1-A-5-1a	obs	37.6	27.3	4.0	3.45	triangular, unifacial edge on entire width
01-1-A-6	ccs	28.6	19.5	4.1	1.79	polygonal white ccs with graver on widest end
01-1-A-6(2)	bas	44.3	28.4	8.2	6.82	polygonal, single unifacial serrated edge
01-1-A-6-1a	obs	24.3	13.7	5.8	2.17	rectangular, single unifacial edge
01-1-C-6-1a	bas	97.5	59.7	12.4	78.14	lg flake tool, multiple unifacial edges
01-1-A-6-1b	obs	21.0	12.9	2.7	0.65	polygonal, single unifacial edge
01-1-C-6(3)	obs	29.5	20.0	4.7	2.58	oval, single unifacial edge
01-1-A-7	bas	22.2	22.5	4.8	3.17	rectangular, single unifacial edge
01-1-A-7-1c	bas	32.6	24.8	6.9	6.99	heavy rectangular flake with single, unifacial edge
01-1-C-2-1a	obs	17.9	14.4	3.1	0.98	rectangular, single steep unifacial edge
01-1-C-6	obs	25.7	20.9	4.4	1.95	triangular, single unifacial edge
01-2-A-2	obs	42.1	16.0	3.8	2.85	polygonal, single unifacial edge on long side
01-2-A-2(2)	obs	35.7	20.4	9.6	6.01	polygonal, single unifacial lightly used crescentic edge
01-2-A-5	ccs	29.6	27.9	12.2	11.8	rectangular, single bifacial edge
01-2-A-8	obs	4.8	8.4	3.7	0.49	rectangular, single unifacial edge
01-2-A-8(2)	bas	10.7	17.2	4.8	0.69	triangular, bifacial edge on two short sides
01-2-C-3	obs	18.5	16.7	2.0	0.69	triangular, lightly used on one edge
01-2-C-4-1a	obs	31.9	19.2	7.0	3.22	triangular flake, small unifacial edge on one end of longest side,

suggests that incising of bone or wood, possibly decorative in nature, may have been occurring at the site. One flake (01-2-A-2[2]) may have been used as a spokeshave or curved-edge scraper, but the artifact has only been lightly used.

Cores

Nine cores were collected from House Pit 1 and one from House Pit 2 at Laurie's site (Table8.7). Three of the cores (01-2-A-F1-1a,b, and c) were included in the Feature 2 artifact cluster, all of which are made of obsidian. Of the ten cores, five are obsidian, three are basalt, and two are CCS. Five of the cores (01-1-A-7, 01-1-C-6, 01-2-A-F1-1a and b, and 02-2-1-C-10) are large flakes from which other flakes have been removed to make tools. Three cores (01-1-A-5-1b, 01-1-A-6, and 01-2-C-4) are prepared, in that they have been shaped by the removal of bulk

Table 8.7. Metric attributes of Laurie's site cores.

Artifact	Type	L	W	Th	Wt	Notes
					House Pit 1	
01-1-A-5-1b	bas	81.4	58.7	33.7	189.38	large prepared core with flakes struck on four planes
01-1-A-6	ccs	24.2	20.6	27.3	18.65	prepared core with flakes struck on four planes
01-1-A-7`	bas	66.1	38.9	8.4	12.85	large basalt flake with thin flakes struck from both sides
01-1-C-6	obs	44.7	25.1	14.0	11.16	small obsidian core made from large flake, with flakes struck on two planes, from broadest sides, with narrow side as striking platform
01-2-A-F1-1a	obs	30.5	29.6	8.9	7.32	small flake with flakes struck from both sides
01-2-A-F1-1b	obs	55.0	43.7	13.0	25.6	large flake with multiple flakes struck from one side
01-2-A-F1-1C	obs	44.8	24.8	20.9	18.04	gray obsidian, large chunk with flakes struck from four planes
01-2-C-4	bas	31.8	31.0	10.3	9.14	basalt prepared core, round disc with flakes taken off one side toward the center
01-2-C-7	obs	50.0	41.8	19.5	34.64	obsidan nodule with cortex, multiple flakes struck on opposite side
					House Pit 2	
02-2-1-C-10	ccs	39.5	23.6	11.2	8.75	small ccs core made from large flake, with flakes struck on two planes on broadest sides with narrow side as striking platform

to create striking planes for maximum flake yield. One of these, Specimen 01-2-C-4, is a basalt disc pictured in Figure 1.12 and described in the biface section (Stage 3), because it was later modified for use as a scraper. Two cores (01-2-A-F1-1c and 01-2-C-7) are expedient, the former being a large obsidian fragment from which flakes were struck without apparent pattern or edge preparation, the latter simply a broken obsidian nodule that has flakes removed from the side lacking cortex.

Ground Stone

Ground stone tools are those which exhibit shaping or wear by abrasion that is usually associated with the processing of botanical resources, particularly roots, bulbs, and seeds, but can also result from the preparation of faunal resources. Ground stone tools include manos, metates, stone balls, and abrading stones. Few of the 37 pieces of ground stone recovered from Laurie's site (Table 8.8) are either complete or of a size useful for their original purpose. Much of the material is broken into small fragments, often charred, and probably utilized in a secondary fashion for hearth rocks or cooking stones. The ground stone fragments are primarily from metates (n=21, or 57%), followed by manos (n=12, or 32%), bowls (n=1, or 3%), and unidentifiable fragments (n=2, or 5%). One complete stone ball (02-2-1-A-10[2]) was also recovered from House Pit 2 (Figure 8.16) and an abrader was collected from the surface nearby.

Despite their fragmented state, all but two of the artifacts have enough characteristics to determine whether they are parts of either manos or metates. The mano fragments are generally bifacial, somewhat lenticular in cross section with convex grinding surfaces, and have pecked

Table 8.8. Metric attributes of Laurie's site ground stone.

Artifact	Type	L	W	Th	Wt	Notes
					House Pit 1	
01-1-A-1	metate	64.2	50.0	27.1	116.91	edge frag, highly faceted, unifacial, sharply squared pecked edge
01-1-A-2-1a	metate	36.3	23.2	13.0	15.02	interior frag of thin bifacial specimen, plate-like, fine-grained basalt
01-1-A-2-1b	metate	24.6	22.2	15.1	12.07	interior, unifacial
01-1-A-3-1	metate	45.8	37.2	9.9	18.36	interior, unifacial, thin, plate-like specimen
01-1-A-4	metate	47.9	28.5	24.4	39.6	interior frag, unifacial
01-1-A-4-1a	mano/metate	40.5	51.1	25.5	64.5	either mano or metate edge frag, unifacial, with edge pecked round
01-1-A-4-1b	mano	32.4	31.9	40.5	31.78	small frag of bifacial mano with edge rounded by pecking
01-1-A-4-2	metate	48.1	43.0	38.5	75.03	edge frag, unifacial, lightly shaped edge
01-1-A-4-3	metate	15.5	11.5	11.3	2.63	interior frag, unifacial
01-1-A-5-2	metate	50.5	41.5	38.3	88.15	edge frag, unifacial, sharply squared pecked edge
01-1-A-5-3	metate	26.7	26.5	30.9	31.36	interior frag, unifacial, vesicular bas.
01-1-A-6-5	metate	40.1	42.9	35.8	60.98	interior, bifacial, one facet flat, opposite deeply dished
01-1-A-6-6	metate	33.6	26.5	14.0	17.26	interior, unifacial
01-1-A-7-7	metate	47.7	36.0	21.5	34.73	interior, unifacial
01-1-A-8-2	metate	38.1	39.1	23.6	24.45	edge, unifacial, pecked andshaped to convex edge, squared rim
01-B-3-2	metate	31.8	28.2	13.6	17.09	edge frag, unifacial, thin and plate-
					like	
01-1-C-3-1a	mano	18.6	17.5	17.9	6.88	small edge frag, edge pecked round
01-1-C-4	metate	44.1	26.2	40.0	51.06	interior frag of thick, bifacial piece
01-1-C-4-3	mano	40.4	42.7	29.8	45.68	edge frag split at midline, unifacial, edge pecked round
01-1-C-5-1	metate	42.2	28.0	16.0	25.25	interior, bifacial, fine grained and highly faceted
01-1-C-5-1a	mano	20.0	22.5	33.3	17.89	small frag, bifacial, edge pecked round
01-1-C-5-1b	metete	30.5	26.8	15.9	15.95	interior, thin bifacial, plate-like
01-1-C-5-1c	metate	48.1	45.5	22.3	64.01	plate-like, with flat highly faceted upper surface, sharp edge, pecked to meet flat bottom
01-1-C-5-1d	metate	55.7	75.2	46.6	200+	edge frag of bifacial specimen, edge pecked round, lightweight stone (tuff?)
01-1-C-6-1a	metate	32.0	26.8	31.8	31.39	interior frag of bifacial specimen, well made, with high degree of smoothing
01-1-C-6-1b	metate	45.8	31.1	25.1	51.01	interior frag, bifacial, one side more highly faceted
01-1-C-6-1c	metate	42.9	48.5	36.2	119.27	interior bifacial frag
01-1-C-6-1c(2)	mano	54.5	72.8	13.5	74.65	faceted surface, broken transversely and laterally
01-1-C-6-1d	metate	79.5	38.1	37.9	119.95	interior frag, fine-grained basalt
01-1-C-6-1f	metate	49.5	44.1	51.8	144.8	interior fragment, one faceted side
01-1-C-7	metate	49.8	16.8	20.0	27.3	fine-grained basalt, bifacial, uniform and carefully manufactured
01-1-C-7-1a	mano	26.2	37.5	21.1	21.99	partial edge of mano, edge pecked round
01-1-C-7-1b	mano	21.0	18.7	32.4	16.39	edge frag, bifacial, pecked round
01-2-A-6	bowl rim	15.8	11.5	9/6	1.26	thin, well-shaped rim fragment with slight curve, may be plate frag,

Table 8.8 (continued). Metric attributes of Laurie's site ground stone.

Artifact	Type	L	W	Th	Wt	Notes
					House Pit 2	
01-2-A-7	mano	58.6	74.1	28.3	170.08	edge frag, bifacial, with well shaped rounded edge
01-2-C-3	metate	98.9	49.1	12.9	68.47	interior fragment with one faceted side, thin, plate-like piece
01-2-C-7	metate	31.6	18.4	17.4	11.95	edge fragment. Bifacial, flat, smooth-pecked edge
02-2-1-A-3	mano	40.0*	45.7*	39.3	78.82	edge fragment, with pecked edge, bifacial
02-2-1-A-3(2)	mano	35.0*	37.1*	25.0*	30.8	pecked edge frag, broken at midline
02-2-1-A-5	mano	61.6	46.7	43.2	123.52	corner fragment of large thick mano with pecked edges, bifacial
02-2-1-A-6	metate	47.6	41.4	18.7	42.23	small interior fragment of thin, bifacially utilized metate, one side ground more substantially
01-2-A-F1-1a	mano	110.2	88.3	52.7	200+	complete, bifacial, all edges pecked round, one end wedge-shaped, no evidence of hammer blows
01-2-A-F1-1b	metate	42.5	40.2	31.6	72.57	interior frag, unifacial
01-2-A-F1-1c	mano	78.4	87.0	48.6	200+	well made, 2/3, entirely shaped and ground bifacial specimen
01-2-A-F1-1c(2)	mano	29.3	47.9	43.8	55.22	small edge fragment, unifacial, pecked edge
01-2-A-F1-1f	unknown	75.6	50.2	46.0	112.87	lg fragment with one curved ground surface
02-2-1-A-10	mano	88.7*	88.8	32.0	200+	large bifacial mano with pecked edges, both ends broken
02-2-1-A-10(2)	ball	52.3	51.9	45.4	186.83	medium-grained basalt, roughly shaped and flattened on two sides
					Surface	
02-surf-1	abrader	38.7	19.9	19.5	14.93	single grooved abrader, groove 6 mm by 1.5 mm deep, collected near House 2

and rounded edges that are easily distinguished from metate rims. All but one of the mano specimens are edge fragments, the single interior mano fragment has bifacial faceting. Five of the metate specimens are rim fragments. The metate fragments are often thinner than the manos, almost plate-like in some cases, and the edges can be pecked either square or round, but the thinner specimens can have sharply defined edges similar to a platter. Interior fragments compose the majority of the specimens. Many of these have bifacial working surfaces which are either concave or flat.

House Pit 1 produced 32 ground stone fragments, including 23 from Unit 1 and nine from Unit 2. They include 19 metate fragments and 10 mano fragments, one piece that may be a bowl rim, and two that are unidentifiable. The Unit 1 specimens were recovered from levels 1 through 4 in Quad A, and from levels 3 through 7 in Quad C. In Quad A, Level 1 yielded one metate fragment, there were two metate fragments in Level 2, two mano fragments in Level 3, and a mano fragment, a metate fragment, and an unidentifiable fragment in Level 4. In Quad C, one piece (a mano fragment) was found in Level 3, a metate fragment in Level 4, a mano and three metate fragments in Level 5, five metate fragments and a mano fragment in Level 6, and three metate fragments in Level 7. Unit 2 produced the bowl rim and a mano fragment in Quad A, levels 6 and 7 respectively. In Quad C, a metate fragment was found in Level 3, and Level 7. A complete mano, two mano fragments, a metate fragment, and an unknown ground stone fragment were collected from the Feature 1 artifact cluster.

The manos collected in association with the Feature 1 artifact cluster included a complete bifacial specimen (01-2-A-F1-1a) that is 11 cm long, 8.8 cm wide, and 5.3 cm thick. The mano has one broad end and the opposite tapers to a wedge-shape. Specimen 01-2-A-F1-1c is approximately two-thirds of a mano that would have been very similar in size to the former. The artifact is ground on all sides in the same manner as a pestle, but clearly has two faceted surfaces. The third ground stone artifact associated with the Feature 1 artifact cluster is a small mano edge fragment (01-2-A-F1-1c[2]) with a portion of one grinding surface remaining. The metate fragment (01-2-A-F1-1[b]) is a small interior piece that is unifacially faceted and has an unfinished surface opposite. Specimen 01-2-A-F1-1f is a large fragment of ground stone broken in such a manner that it is unclear if it a metate or mano fragment. The object has one convex-curved grinding surface suggestive of a mano.

The possible bowl rim, Specimen 01-2-A-6, is a thin piece of basalt with a sharply defined but rounded edge that has a slight curve suggestive of a stone bowl. The object could be the edge of a platter but the curve is more pronounced than one might expect from such an artifact.

House Pit 2 had few fragments of ground stone in comparison to House Pit 1. They included one metate fragment, two mano fragments, and the stone ball. All of the ground stone items were collected from levels 5 through 10 of Quad A.

Stone Ball

The stone ball, Specimen 02-2-1-A-10(2), is made of a medium-grained basalt and is ground smooth but is slightly asymmetrical (Figure 8.16). It is approximately 5.2 cm in diameter, except where one side is slightly flatter and the diameter is 4.5 cm. It was found on the compacted floor of House Pit 2, in Level 10 of Quad A. An AMS date of 1580±40 BP was returned on charcoal from Level 9 of Quad C, just above the stone ball.

Abrader

One abrader was collected from the surface of Laurie's site approximately five meters from the north edge of House Pit 2. Specimen 02-surf-1 is a small, single grooved abrader 3.9 cm long 1.99 cm wide and 1.95 cm thick, with a groove that is 6 mm wide and 1.5 mm deep. It is made of gray pumiceous material akin to welded tuff, but with greater porosity.

Other Artifacts

Ochre

Two ochre fragments were collected from House Pit 1 (Table 8.9). One piece (01-2-A-F10was collected from the deposits directly associated with the Feature 1 artifact cluster. A second piece (01-1-C-7) was in quad C of Unit 1 at the same elevation as the feature. The pieces are very small and it was not possible to tell if the ochre had been modified by grinding or the addition of binders (Erlandson et al., 1999:524) after collection. Coloration was determined through the use of a Munsell color chart. Both pieces are red, but the Unit 1 specimen is slightly lighter in color. Erlandson et al. (1999) document the utility of ochre sourcing and identify several sources in Oregon. Naturally-occurring ochre nodules have been collected near Laurie's site, in the Emigrant Creek drainage north of Harney Valley.

Table 8.9. Ochre Samples recovered at Laurie's site.

Sample	Provenience	color
01-1-C-7	Unit 1, Quad C, 73 cm bs	10YR/6/8, light red
01-2-A-F1	Unit 2, Quad A, Feature 1	2.5YR/5/8, red

Beads

Ten beads were collected from Laurie's site, including seven manufactured from shell, one of stone, and two made of small mammal bone fragments (Table 8.10, Figure 8.16 and 8.17). The shell beads include three Olivella saucer beads (Bennyhoff and Hughes 1987), of which two (01-2-C-4 and 01-2-A-5) are Type G2a, Small Saucer, and one (01-1-C-5-1a) is Type G2b, Large Saucer; one Oval Saddle Type F1 (01-1-C-6), an unidentified carbonized shell bead fragment (01-2-C-3), and two unidentified shell disc fragments.

Beads recovered during the 2001 field season were analyzed by Leah Largaespada of the University of Oregon (Largaespada 2001). The shell beads were identified utilizing Largaespada's comparative collection, and measurements were taken with the use of an Olympus petrographic microscope mounted to a Sony video monitor equipped with a digital micrometer. Beads collected during the 2002 season were identified by the author utilizing the beads previously analyzed by Largaespada (2001)and Bennyhoff and Hughes (1987) as an identification guide, and measured with handheld calipers.

The shell beads were manufactured from clam and Olivella. The Olivella beads include several varieties identified by Bennyhoff and Hughes (1987) as having temporal significance. Specimen 01-1-C-6, recovered from Quad C, Level 6 of Unit 1, is a Type F1 (Oval Saddle) originating from central California. Bennyhoff and Hughes (1987:127-128) consider Type F1 beads to be a marker for the Early/Middle period Transition phase in the Alameda, Napa, and Cosumnes districts of central California (Bennyhoff and Hughes 1987:129), placing them between 3300 to 3100 BP there. Two Olivella Type G2a (Small Saucer) beads were recovered from Unit 2, and a G2b (Large Saucer) bead was recovered from Unit 1. Bennyhoff and Hughes (1987:132) consider the most common source for the large and small saucer beads to be central or southern California, associated with the early phase of the Middle period, from ca. 3300 BP to 2700 BP.

Northern Paiute informants reported in recent times, that Olivella beads were obtained in California, near San Francisco (Park, in Fowler 1989:114). They reported that the shells were picked up at the sea shore and not purchased. It is possible that beads were traded northward into Harney Valley following such collecting events.

Specimen 3074-2-C-3 is half of a small stone bead that is broken in two pieces and too small to measure with hand calipers. The material is dark gray to black in color and the type of stone is unknown.

Two bone beads were also found during the excavations. The first is half of a small mammal bone that is split lengthwise, but retains a high degree of polish and beveling associated with grinding of the ends. The bead was found in Unit 1, Quad C of House Pit 1. The second bone bead is Specimen 02-1-C-9, collected from House Pit 2 (Figure 1.15). The small mammal bone tube is highly polished and glossy, with smooth, beveled ends. The bead was recovered from the floor deposits in association with Eastgate and Elko points, and the stone ball.

Table 8.10. Metric attributes of Laurie's site beads.

Artifact	Type	L	W	Th	Drill hole Diam.	Notes
01-1-C-5	bone	-	-	-	-	described in the bone artifact table (8.9) below
01-1-C-5-1a	shell	10.2	9.18	0.58	1.74	Olivella saucer (Bennyhoff and Hughes Type G2b), drill hole slightly off center
01-1-C-6	shell	10.22	8.54	0.89	3.62	variant on oval saddle (Bennyhoff and Hughes Type F1), biconically drilled, curvature of 2.08
01-2-C-3	shell?	8.54	8.54	1.04	2.18	probably carbonized shell, ½ of original
01-2-C-4	shell	6.44	6.44	0.56`	1.98	1/2 Olivella saucer (Bennyhoff and Hughes Type G2a), epidermal layer intact, drill hole off center
01-2-A-5	shell	7.32	7.32	0.54	1.98	½ of wall disc bead (Bennyhoff and Hughes Type G2a, small saucer), epidermis intact
02-1-C-9	-	-	-	-	-	described in the bone artifact table (8.9) below
02-SP1-A-5	shell	5.5	3.0*	0.8	1.5	probably carbonized shell, ½ of original
02-SP1-A-7	shell	5.5	4.7	0.7	0.8	clam shell disc, biconically drilled
02-1-A-8	shell	6.8	5.9	0.8	2.6	clam shell disc

Bone Tools

The bone tools that were collected from Laurie's site reflect activities that are not regularly encountered in open sites elsewhere in Harney Valley, except where occupations were repeated and prolonged (Table 8.11, Figure 8.17). The presence of a decorated bone tube, a whistle, awls, and spatulate tools suggests that a variety of activities relating to clothing and equipment maintenance, personal adornment, and basketry manufacture, may have been carried out at the site. Resources relating to those activities were probably being collected elsewhere and transported back to the site.

Table 8.11. Metric attributes of Laurie's site bone tools, in mm.

Artifact	Type	L	W	Th	Wt.	Notes
01-1-A-6	tube	36.2	3.2-3.8	-	0.51	small mammal longbone tube, both ends cut and roughly smoothed, possible bead?
01-1-A-7(FL)	whistle	107.6	8.6	7.3	5.13	Large bird ulna tube with a single rectangular notch approximately 1/3 of the length from the bit. Notch is 6.8 mm wide by 13.0 mm long.
01-1.C-3	unknown	12.5	3.0-3.4	-	0.13	Possibly a large gorge or small septum ornament, (?) fragment.
01-2-A-8	awl	134.7	12.6	8.0	7.23	Large mammal longbone frag with awl tip on one side and spatulate end opposite, highly polished and variably affected by taphonomic processes.
01-2-A-8-1a	spatulate	94.7	8.6	5.8	5.23	large mammal longbone rod, oval cross section, one end rounded, other is spatulate, striations from shaping on shaft still visible, rounded end roughened by use
01-2-A-8-1b	tube	30.5	5.9	2.8*	0.30	Fragment of a highly polished bone tube, split at midline, probably Lepus sp., both ends broken.
01-2-A-8-1c	awl	43.6	6.9	3.9	1.11	Med-large mamm bone frag, split lengthwise, with cancellous interior (radius or fibula frag, near articular end?), cortical portion sharpened to fine point with polished wear on interior and exterior surface. Most striations run lengthwise, but a few run diagonal to the length of the artifact.
02-1-C-9	bead	add	add	add	add	highly polished tube with beveled and polished ends, probable bead
02-SP1-A-7	tube	58.3	9.1	8.1	2.83	Incised bone tube with notches on three sides; seven on one, 15 on a second, and six on a third, ends broken, more notches could have been present. Bone is avian, ?.

Figure 8.17. Bone objects from Laurie's site, shown actual size.

a. 01-2-A-8-1c   b. 02-SP1-A-7   c. 01-1-C-3   d. 02-1-C-9   e. 01-2-A-8-1b
f. 01-1-A-7(FL)   g. 01-2-A-8-1a   h. 01-2-A-8-1   not pictured: 01-1-A

Of particular interest are the spatulate tool and the awl that were recovered from Level 8 of House Pit 1, Unit 2, Quad A along with two other bone tools. Specimen 01-2-A-8-1 is a large mammal longbone fragment that has been carefully fashioned into a fine-tipped awl on one end and a spatulate tool on the opposite end. The awl would have been useful for a variety of tasks, particularly involving the manufacture of clothing. The awl combined with the spatulate tool suggests some other kind of use, perhaps in basketry manufacture. The awl tip would have proven useful in creating openings between the basketry elements for the passage of fibers as the basket is woven and the spatulate end could have been utilized to compress the woven elements as the work progresses. Specimen 01-2-A-8-1a was found near the awl also at floor level. Spatulate tools are often associated with pressure flaking stone tools and this artifact has the dimensions of such a tool, but the degree of wear is not consistent with flintknapping. Specimens 01-2-A-8-1(b and c) are a small bone awl and polished bone tube that were found in close association with the other two tools. The awl is fashioned from a large mammal bone fragment and the tube appears to be a longbone fragment from a lagomorph, probably a jackrabbit. The four bone tools may have been components of a set.

The bone whistle (01-1-A07[FL]) is made from the ulna of a large bird. Broken in half, the whistle was recovered at the transitional zone between the artifact laden house floor and the sterile sediments underneath. It has a single rectangular notch that is 6.8 mm wide by 13 mm in length and approximately one-third of the length of the artifact from the mouthpiece, which has been smoothed.

Obsidian Sourcing and Hydration

A total of 50 artifacts recovered from Laurie's site was submitted to Northwest Research Obsidian Studies Laboratory (NROSL) for obsidian sourcing and hydration analysis (Skinner and Thatcher 2002). The artifacts include 27 projectile points, two bifaces, one basalt flake, and 20 obsidian flakes (Table 8.12, Figure 8.18).

Table 8.12. Obsidian sourcing and hydration results from Laurie's site.

Sample	Artifact	Hydr.	Source
House 1, Unit 1			
3074-1-A-3	Exp. Stem	2.6	Whitewater
3074-1-C-2	Rose Spring	3.3	Tule Spring
3074-1-A-5	knife	2.4	Tule Spring
3074-1-C-5	Rose Spring	NA	Tule Spring
3074-1-C-6-1a	Rose Spring	2.6	Tule Spring
3074-1-C-6-1b	Elko	1.3	Venator
3074-1-A-7	Eastgate	1.6	Venator
3074-1-C-7	Elko Eared	2.1	Whitehorse
House 1, Unit 2			
3074-2-A-2	Rose Spring	2.2	Wolf Creek
3074-2-A-2-1a	Rose Spring	2.6	Coyote Wells
3074-2-A-4-1b	Rose Spring	NA	Wolf Creek
3074-2-C-4	Eastgate	2.3	Tule Spring
3074-2-C-4-1a	Eastgate	NA	Indian Creek
3074-2-C-4-1b	Rose Spring	2.4	Tule Spring
3074-2-C-4-1c	Unknown	2.5	Venator
3074-2-C-4-1d	Eastgate	2.3	Indian Creek
3074-2-A-6	Elko CN	2.7	Venator
3074-2-A-7	Elko CN	2.7	Venator
3074-2-A-F1	Elko CN	NA	Owyhee
3074-2-A-7a	flake	1.6	Venator
3074-2-A-7b	flake	NA	Tule Spring
3074-2-A-7c	flake	1.9	Tule Spring
3074-2-A-7d	flake	2.3	Tule Spring
3074-2-A-7e	flake	1.4	Venator
3074-2-A-7f	flake	1.8	Venator
3074-2-A-7g	flake	2.8	Venator
3074-2-A-7h	flake	NA	Tule Spring
3074-2-A-7i	flake	NA	Venator
3074-2-A-7j	flake	2.3	Tule Spring
3074-2-A-7k	flake	2.8	Tule Spring
3074-2-A-7l	flake	2.6	Tule Spring
3074-2-A-7m	flake	2.4	Tule Spring
3074-2-A-7n	flake	2.3	Tule Spring
3074-2-A-7o	flake	1.3	Unknown 3
3074-2-A-7p	flake	NA	Tule Spring
3074-2-A-7q	flake	2.0	Unknown 2
3074-2-A-7r	flake	1.7	Unknown 3
3074-2-C-7a	flake	1.6	Venator
3074-2-C-7b	flake	1.9	Indian Creek

Sample	Artifact	Hydr.	Source
	House 2, Unit 1		
02-3074-1-c-6	Rose Spring	1.9	Whitewater
02-3074-1-A-7	Rose Spring	3.2	Beatys Butte
02-3074-1-A-8	Side-notched	1.7	Tule Spring
02-3074-1-A-9a	Elko CN	1.9	Burns
02-3074-1-A-9b	Elko CN	2.7	Tule Spring
02-3074-1-A-9c	Bas. Flake,	F1	-Unk. Basalt 2
02-3074-1-C-9	biface	2.0	Tule Spring
02-3074-1-C-10a	Eastgate	1.5	Venator
02-3074-1-C-10b	Elko CN	1.8	Venator
Unit SP-1			
02-3074-SP1-4a	Elko?	1.5	Venator
02-3074-SP1-4b	Eastgate	1.6	Venator
West Locus			
3074-3-surf 1	biface	2.4	Venator
3074-3-surf-2	biface	3.0	Venator
3074-3-surf-3	biface	2.7	Beatys Butte

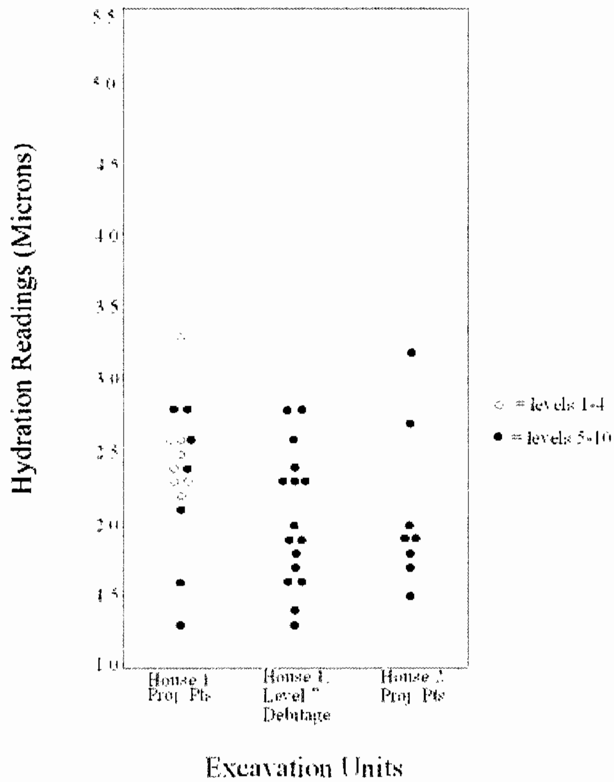


Figure 8.18. Obsidian hydration measurements from Laurie's site.

The 27 projectile points are almost exclusively from sources located either to the north or east of the site with the sole exception being an Eastgate point that originated from the Beaty's Butte source to the southwest. The sources include Burns (n=1), Coyote Wells (n=1), Indian Creek (n=2), Owyhee (n=1), Tule Springs (n=7), Venator (n=9), Whitehorse (n=1), Whitewater Ridge (n=2), and Wolf Creek (n=2). The same is true of the debitage, which originated from Tule Springs (n=10), Venator (n=1), Indian Creek (n=1), Unknown 2 (n=1), or Unknown 3 (n=2). The knife (3074-1-A-5), and the biface (02-3074-1-C-9) both were made of Venator obsidian. A large basalt flake (02-3074-1-A-9c) recovered in association with the Feature 1 hearth in House Pit 2 was also submitted to NROSL for geochemical identification and (provisionally) identified as Unknown Basalt 2.

The debitage was selected entirely from House Pit 1, Unit 2, Quad A, Level 7, closely associated with the Feature 1 artifact cluster and Feature 2 hearth. It was hoped that one obsidian source would dominate the debitage sample and an AMS date produced from the Feature 2 hearth would aid in the development of a provisional hydration rate for the primary obsidian source.

This did not turn out to be the case. Half of the debitage came from the Tule Spring source and the other half from three other sources, and the range of hydration measurements was too broad (from 1.3 to 2.8 microns, with a range of 1.9 to 2.8 microns for Tule Spring alone). The results of the debitage hydration analysis does cast light on the perception that the location of Rose Spring and Eastgate points in levels 2 through 4 might be representative of an occupation that is distinct and separate from the underlying deposits (levels 6 and 7) containing Elko Corner-notched points. It appears now that, based on both the projectile point types and the range of obsidian hydration measurements from house floor deposits underlying the Rose Spring and Eastgate points, the house was used and re-used, perhaps in repeated episodes, over a considerable period of time.

Lithic Debitage Mass Analysis

Mass analysis utilizes counts and weights of size-graded debitage in a replicable, quantitative manner to examine implications of debitage assemblages in both inter and intra-site contexts (Ahler 1989, Connolly 1999). Flake attributes such as size, weight, quantity, and the presence of cortex vary with each stage of lithic reduction, as early core and biface production yield larger flakes with more cortex than later stage biface reduction and pressure flaking (Connolly and Byram 2001:68). By quantifying chipping waste through the previously mentioned variables, a given site assemblage can be compared to those from other sites, and to an experimental lithic reduction data set established for all five reduction stages (core reduction = Stage 1, biface pressure flaking = Stage 5) collected from the Newberry Volcano obsidian source (Connolly and Byram 2001:69). The mass analysis results should reflect the most dominant lithic reduction activities at a given location and, depending on other factors such as stratigraphic mixing, may allow comparisons between early and late components within a site.

Debitage from Laurie's site was processed through a series of nested screens with dimensions of 1" (G1), 1/2" (G2), 1/4" (G3), and 1/8" (G4). The flakes from each size grade were counted, weighed, and examined for the presence of cortex. The results were then compared with those from the other Harney Valley sites, the Bon site in Deschutes County

(Connolly and Byram 2001), and with the overall results from the Newberry Crater project (Connolly 1999). This information is presented below as Tables 8.13 and 8.14, and summarized in the final chapter. Here, debitage from Units 1 and 2 is examined.

Connolly (1999) developed a formula for determining stages of lithic reduction activities at archaeological sites based on three variables : Stage = 6.048 – 0.124 (F) – 0.023 (P) – 0.091 (Q), where F is the percent count of G2 over G1 – G4, P is the mean weight of G2 (G2 weight/G2 count) in decigrams, and J is the mean weight of G3 (G3 weight/G3 count) in centigrams. The values produced from the archaeological data were inserted into the formula and the numeric result is an indicator of the relative stage of lithic reduction that occurred at the site, either for the entire site or for components of the site.

Utilizing Connolly's (1999) formula for the aggregate of the four units at Laurie's site resulted in a predicted stage value of 2.43 (Tables 8.13 and 8.14), placing the site below the Bon site (35DS608) in terms of lithic reduction stages. The Bon site is a residential base camp located north of Newberry Caldera. Component 34-2, at the Paulina Lake site (35DS34), which functioned as a base camp located within the Newberry Caldera (Connolly 1999, Connolly and Byram 2001:69) has values similar to Laurie's site, and the value equates well with the Hoyt and Broken Arrow sites from this study. When the obsidian is examined by unit, the stage values are found to vary to a substantial degree. Unit 1 has a stage value of 2.02 and Unit 2 is 3.7. The Unit 2 value is in keeping with residential bases at a distance from the tool stone quarries, where activities are not focused on lithic reduction alone.

Table 8.13. Values for the Laurie's site obsidian mass analysis variables, Units 1 and 2 combined.

Variable	Computation	Value (%)
A PCTWTG1	34.9/458.8	7.6
B PCTWTG2	166.5/458.8	36.3
C PCTWTG3	151.8/458.8	33.1
D PCTWTG4	105.6/458.8	23.0
E PCTCTG1	4/3865	0.1
F PCTCTG2	76/3863	2.0
G PCTCTG3	482/3863	12.5
H PCTCTG4	3303/3863	85.5
I PCTWT13	34.9/353.2	9.9
J PCTWT23	166.5/353.2	47.1
K PCTWT33	151.8/353.2	43.0
L PCTCT13	4/562	0.7
M PCTCT23	76/562	13.5
N PCTCT33	482/562	85.8
O MNWT1G	34.9/4	8.73
P MNWT2DG	166.5/76	21.91
Q MNWT3CG	151.8/482	31.5
R MNWT4CG	105.63303	3.2

Stage =6.048 - 0.124(F) – 0.023(P) – 0.091(Q)
Stage =6.048 - 0.248- 0.504 – 2.87
Stage = 2.43

Table 8.14. Laurie's site: Lithic debitage mass analysis results for Units 1 and 2, individually and combined (obsidian only).

	Grade 1			Grade 2			Grade 3			Grade 4		
Unit	N	Wt	Cortex	N	Wt	Cortex	N	Wt	Cortex	N	Wt	Cortex
1	3	21.9	2	47	92.0	4	262	95.6	18	1638	48.7	31
2	1	13.0	0	29	74.5	6	220	38.2	17	1665	56.9	27
All Units 1 – 2	4	34.9	2	76	166.5	10	482	66.2	35	3303	105.6	58

Unit 1:
N Wt
Total G1-G41948258.2
Total G1-G3 310 209.5
Stage =2.02

Unit 2:
N Wt
Total G1-G41915 182.6
Total G1-G3 250 125.7
Stage = 3.7

All Units 1 – 2:
N Wt
Total G1-G43863440.8
Total G1-G3 560 335.2
Stage = 2.43

Botanical Remains

Paleobotanical identifications were carried out by Dr. Marge Helzer of the University of Oregon. (Helzer 2002). Samples were selected from both units of House Pit 1 (Tables 8.15 and 8.16). None of the samples from House Pits 2 or 3 were submitted for analysis. Botanical analysis occurred in two stages. The first stage involved the identification of charcoal specimens for radiocarbon dating purposes, and the material was derived either from composite samples obtained during screening, or from *in situ* specimens when possible. The intent of the charcoal analysis was to obtain specimens from short-lived plant species for greater accuracy in dating the site. Soil flotation analysis was undertaken to determine the variety and nature of plant remains that might have been utilized by the inhabitants of House Pit 1. The results of the analyses are summarized below.

Charcoal samples from Unit 1, Quad A, included specimens from levels 5 and 8 and the samples from Quad C included material from levels 5 through 8 and the Feature 2 hearth. Those from Unit 2, Quad A, originated from levels 6 through 9, including a floor sample and the Feature 1 artifact cluster. The Unit 2 Quad C sample included four samples from Level 4. The flotation samples were derived from Unit 1, Quad C, levels 3 through 6, and one sample collected from the posthole in Quad C of Unit 2.

The botanical remains identified in the charcoal samples included chenopods, greasewood, juniper, mountain mahogany, rabbitbrush, sagebrush, saltbush, and willow; a total of eight varieties. All but mountain mahogany can be found in the vicinity of the site today. Mountain mahogany was clearly imported to the site from the uplands. Willow was utilized in basketry and wickiup construction, mountain mahogany was a favored material for atlatl, bow, and digging stick construction. All of the other plant materials are known to have been used medicinally or for food and fiber (Fowler 1986, 1989; Couture 1978). The Feature 1 artifact cluster sample yielded sagebrush, saltbush, greasewood, and mountain mahogany charcoal, and the Feature 2 hearth contained sagebrush and charcoal. Charcoal submitted from the Unit 2, Quad C floor deposits (Level 9) contained only sagebrush.

The plant material recovered from the soil flotations had all of the previously mentioned varieties of charcoal, plus a wide variety of economically important seeds. Included were the seeds of bluegrass, buckwheat, bulrush, cattails, chenopod/amaranths (cheno-ams), greasewood, rabbitbrush, and wada (for which the *Wada'tika* are named). All are known to have been used for food or medicinal purposes (Fowler 1986, 1989; Couture 1978), and all would have been readily available in the nearby lake and marshland setting. The plant seeds were distributed throughout the samples, with the exception that buckwheat and bluegrass were only recovered from Level 3 and wada was only absent from that same level. The post hole sample was the only flotation sample that produced juniper charcoal. It is notable that uniper was present in all of the Unit 2 samples that were submitted and absent from the Unit 1 material.

Table 8.15. Paleobotanical remains from Laurie's site (35HA3074).

Sample no.	Provenience	Species	Common name	Weight
3074-1-C-3	Unit 1, Q C, L 3 (30-35 cm)	Cheno-Am	Chenopod/Amaranth seed	<0.01g
		Cheno-Am	Chenopod/Amaranth embryo	<0.01g
		Scirpus	bulrush seed	<0.01g
		Typha	cattail seed	<0.01g
		Chrysothamnus	rabbitbrush seed	<0.01g
		Erigonium	buckwheat seed	<0.01g
		Poa	bluegrass seed	<0.01g
		Chrysothamnus	rabbitbrush charcoal	<0.01g
		Sarcobatus	greasewood charcoal	<0.01g
		Unidentifiable	charcoal	0.01g
3074-1-C-4	Unit 1, Q C, L 4 (40-45 cm)	Cheno-Am	Chenopod/Amaranth seed	<0.01g
		Cheno-Am	Chenopod/Amaranth embryo	<0.01g
		Suaeda	wada seed	<0.01g
		Scirpus	bulrush seed	<0.01g
		Chrysothamnus	rabbitbrush seed	<0.01g
		Artemesia	sagebrush charcoal	<0.01g
		Cercocarpus	mt. mahogany charcoal	0.02g
		Sarcobatus	greasewood charcoal	0.03g
3074-1-C-5	Unit 1, Q C, L5 (50-55 cm)	Cheno-Am	Chenopod/Amaranth seed	<0.01g
		Cheno-Am	Chenopod/Amaranth embryo	<0.01g
		Suaeda	wada seed	<0.01g
		Scirpus	bulrush	<0.01g
		Artemesia	sagebrush charcoal	<0.01g
		Atriplex	saltbush charcoal	<0.01g
		Chrysothamnus	rabbitbrush charcoal	<0.01g
		Sarcobatus	greasewood charcoal	0.01g
3074-1-C-6	Unit 1, Q C, L 6 (62-65 cm)	Cheno-Am	Chenopod/Amaranth seed	<0.01g
		Cheno-Am	Chenopod/Amaranth embryo	<0.01g
		Suaeda	wada seed	<0.01g
		Scirpus	bulrush seed	<0.01g
		Typha	cattail seed	<0.01g
		Artemesia	sagebrush charcoal	0.03g
		Atriplex	saltbush charcoal	<0.01g
		Chrysothamnus	rabbitbrush charcoal	<0.01g
		Sarcobatus	greasewood charcoal	0.04g
		Unidentifiable	charcoal	0.04g
3074-1-C-6	Unit 1, Q C, L6 (63-68 cm)	Cheno-Am	Chenopod/Amaranth seed	<0.01g
		Cheno-Am	Chenopod/Amaranth embryo	<0.01g
		Suaeda	wada seed	<0.01g
		Scirpus	bulrush seed	<0.01g
		Typha	cattail seed	<0.01g
		Artemesia	sagebrush charcoal	0.04g
		Atriplex	saltbush charcoal	0.01g
		Chrysothamnus	rabbitbrush charcoal	0.01g
3074-2-C-5	Unit 2, Q C, L 5 (50-60 cm)	Cheno-Am	Chenopod/Amaranth seed	<0.01g
	Post hole	Cheno-Am	Chenopod/Amaranth embryo	<0.01g
		Suaeda	wada seed	<0.01g
		Scirpus	bulrush seed	<0.01g
		Typha	cattail seed	<0.01g
		Artemesia	sagebrush charcoal	<0.01g
		Chrysothamnus	rabbitbrush charcoal	<0.01g
		Juniperus	juniper charcoal	<0.01g
		Sarcobatus	greasewood charcoal	<0.01g

Table 8.16. Charcoal analysis results from Laurie's site (35HA3074).

Sample no.	Provenience	Species	Common name	Weight
3074-1-A-5	Unit 1, QA, L5	Artemesia	sagebrush	0.01g
		Atriplex	saltbush	<0.01g
		Chenopodiaceae	chenpods	0.01g
3074-1-A-8	Unit 1, QA, L8	Artemesia	sagebrush	0.08g
3074-1-C-5	Unit 1, QC, L5	Artemesia	sagebrush	0.16g
		Sarcobatus	greasewood	0.25g
3074-1-C-6	Unit 1, QC, L6	Artemesia	sagebrush	0.1g
		Atriplex	saltbush	<0.01g
		Sarcobatus	greasewood	0.32g
3074-1-C-6-1a	Unit 1, QC, L6	Unidentifiable		0.09g
3074-1-C-7	Unit 1, QC, L7	Artemesia	sagebrush	0.02g
		Chrysothamnus	rabbitbrush	0.01g
		Sarcobatus	greasewood	0.43g
3074-1-C-8	Unit 1, QC, L8	Sarcobatus	greasewood	0.30g
3074-1-F2	Unit 1, Feature2	Artemesia	sagebrush	0.01g
		Sarcobatus	greasewood	0.09g
3074-2-A-6	Unit 2, QA, L6	Artemesia	sagebrush	0.04g
		Atriplex	saltbush	<0.01g
		Sarcobatus	greasewood	0.04g
		Juniperus	juniper	<0.01g
3074-2-A-7	Unit 2, QA, L7	Artemesia	sagebrush	0.04g
		Atriplex	saltbush	0.11g
		Sarcobatus	greasewood	0.04g
	Chenopodiaceae	chenopods	0.07g	
		Salix	willow	0.15g
		Juniperus	juniper	0.08g
3074-2-A-8	Unit 2, QA, L8	Artemesia	sagebrush	0.15g
		Atriplex	saltbush	0.15g
	Sarcobatus	greasewood	0.09g	
	Cercocarpus	mt mahogany	0.16g	
	Juniperus	juniper	0.01g	
3074-2-A-F1	Unit 2, QA, Feature 1	Artemesia	sagebrush	0.01g
		Atriplex	saltbush	0.01g
3074-2-A-F1-1a	Unit 2, QA, Feature 1	Artemesia	sagebrush	<0.01g
		Atriplex	saltbush	<0.01g
		Cercocarpus	mt.mahogany	<0.01g
		Juniperus	juniper	<0.01g
3074-2-A-8-1a	Unit 2, QA, L8	Artemesia	sagebrush	<0.01g
3074-2-A-9(floor)	Unit 2, QA, L9 floor	Artemesia	sagebrush	0.19g
3074-2-C-4	Unit 2, QC, L4	Artemesia	sagebrush	0.16g
		Chrysothamnus	rabbitbrush	0.01g
		Sarcobatus	greasewood	0.01g
		Cercocarpus	mt. mahogany	<0.01g
		Juniperus	juniper	<0.01g
3074-2-C-4-1a	Unit 2, QC, L4	Cercocarpus	mt. mahogany	0.11g
3074-2-C-4-1b	Unit 2, QC, L4	Chrysothamnus	rabbitbrush	0.01g
3074-2-C-4-1c	Unit 2, QC, L4	Chrysothamnus	rabbitbrush	0.07g

Faunal Remains

Faunal remains recovered from Laurie's site were identified by the author. The specimens were generally very small fragments of small mammals fish, and birds including muskrat, jackrabbit, Tui chub, sucker, and waterfowl. Large mammals such as deer and antelope were also represented, although much of the highly fragmented large mammal bone was unidentifiable to species. Other species noted in the assemblage included bobcat, beaver, badger, and raccoon. Few of the bones were unfused at Laurie's site, suggesting that the site was not inhabited during the peak birthing season during the late spring and summer months when immature animals would have been available in abundance. Unfortunately, all of the files related to the faunal analysis have been lost, so this summary will have to suffice until the faunal remains can be re-analyzed and reported elsewhere.

Summary

It was anticipated that the information available from house pit villages adjacent to Malheur Lake would be useful for considering Whiting's descriptions of activities there:

> "Around the first of September the families began to turn south to the vicinity of Malheur Lake and Saddle Butte. Everyone wanted to be on hand when the *wada* (Sueda depress var. erecta Wats) ripened. This was one of the staple seeds and was picked in large quantities for winter consumption. Probably the largest number of people came together at this time and there were many festivities, including circle dances and games of all kinds. Other seeds were gathered at the same time or a little later: *su.nu* – saltbush, *tomomi* (unidentified), *i'ape* (Chenopodium), and *wata* (Chenopodium Album L.). From the lakes many people went to Crow Camp to pick chokecherries, which were made into cakes and sun dried for winter. At this time there were also communal antelope and rabbit drives.
>
> By the first of November the families started to collect their cached foods and to move into their winter camps. Sites were selected which had a spring or some other source of water, a good supply of wood, and where it was known that there was not likely to be a heavy snowfall. Most of the camps were at the foot of hills or in protected regions near the lakes. Here tule mat houses were set up. (During the summer sagebrush enclosures were the only types of structures used.[Whiting 1950:19])"

Based on Whiting's description, Laurie's site, at least under current environmental conditions, does not seem suitable as a winter village location. There is an absence of good water and firewood sources nearby, and the unprotected site would have stood exposed to the brunt of passing winter storms. The nearby Headquarters site would have been much better suited to a winter occupation, having all of the requirements identified above. Laurie's site *could* have been a likely location for wada collection in the fall considering its placement adjacent to the fluctuating shoreline of Malheur Lake. Other seed plants noted at the site include salt bush, chenopods-amaranths, Great Basin wild rye and Indian rice grass. In any case, artifacts recovered from the site should provide clues to the time and intensity of occupation.

A total of 6.8 cubic meters of fill was excavated at Laurie's site over the course of two seasons, resulting in the recovery of 5074 artifacts per cubic meter. The site is located approximately a quarter-mile from the existing shoreline of Malheur Lake. The 1979 drought shoreline would have been one half mile west of the site, and water rose approximately nine feet to envelop all but the highest portion of the site during the mid-1980s flooding. The site may not have been a suitable location for habitation during periods of highest effective moisture because of its vulnerability to flooding.

House Pit 1was AMS dated to 1890±40 BP (Unit 2, Quad A, Level 7). Unit SP-1 was AMS dated to 1770±50 BP (Level 4). House Pit 2 returned an AMS date of 1580±40 BP (Unit 1, Quad C, Level 9). These dates indicate that people occupied the location a number of times over a 400 year span. A fourth date of 140±40 BP, from House Pit 2 (Unit 1, Quad C, Level 5) seems out of place because the charcoal was collected just two levels above the 1580 BP date. It may be indicative of displaced charcoal associated with rodent or badger activity. It is also possible that a much later occupation occurred in the house pit, and digging associated with that period of use resulted in the close association of older and newer charcoal.

The cultural deposits in each of the house pits can reach depths between 60 to 100 cm, and may reflect a series of occupations, though evidence for this is somewhat limited by the effects of bioturbation. House Pit 2 produced clear evidence of a bimodal distribution in both debitage and bone, but the unfortunate radiocarbon date of 140±40 BP was produced from Level 5 of the unit, thwarting efforts to determine the range of use within the house pit. Stratigraphic complexity was generally limited to a single, broad, dark brown sandy silt cultural layer situated over yellowish sterile silty sands that indicate lakebed deposits. I was not able to subdivide the cultural layer into multiple components with confidence, due to presumed bioturbation and the apparent homogeneity of the silty deposits.

A total of 41 projectile points was recovered at Laurie's site, 36 of which are temporally diagnostic. The points include 11 Rose Spring (28 %), eight Eastgate (20 %), one Rosegate (2 %), five Elko Eared (12 %), three Elko Corner-notched (7 %), two Elko Series (5 %), two Northern Side-notched (5 %), one Contracting Stem (2 %) two stemmed points (5%), and one Malheur Stemmed (2 %). All but two of the points were made of obsidian that originated from sources to the north and east of the site and indicate a strong relationship exists between Laurie's site and the uplands to the north of Harney Valley.

Biifaces were the most abundant tool category at Laurie's site, accounting for 34% of the assemblage. Utilized flakes, at 10% were fewer than projectile points at 20%, followed by ground stone at 17%, cores at 4%, bone tools at 4%, and drills and awls at 2%. Beads constituted 5% of the assemblage and one abrader, graver, and stone ball were collected. The diversity of tools, especially the inclusion of bone tools, drills, and abraders, along with well-formed ground stone fragments, suggests that the site may have hosted occupational episodes that were more prolonged in duration than other temporary camps included in this report except the Broken Arrow and Hoyt sites.

Faunal remains recovered from Laurie's site included small fragments of small mammals fish, and birds including muskrat, jackrabbit, Tui chub, sucker, and waterfowl. Large mammals such as deer and antelope were also represented, although much of the highly fragmented large mammal bone was unidentifiable to species. Other species noted in the assemblage included bobcat, beaver, badger, and raccoon. Few unfused animal bones are present at the site, indcating that it was probably not occupaied during the peak birthing months of spring and early summer

The botanical remains identified in the charcoal samples included chenopods, greasewood, juniper, mountain mahogany, rabbitbrush, sagebrush, saltbush, and willow; a total of eight varieties. Economically important seeds included bluegrass, buckwheat, bulrush, cattails, chenopod/amaranths, greasewood, rabbitbrush, and wada.

Laurie's site is considered to be a residential base camp, probably inhabited in the late summer and fall months. Although cultural deposits at the site are deep and rich, the site lacks stratigraphic complexity consistent with multiple long term occupations and it would not have been a favorable location during perilous winter weather, or at times when water levels had the potential of increasing. The site would have been a suitable choice during warmer months, when multiple logistical forays could have been mounted for the procurement of seeds and marshland resources in the lowlands, and fruits, berries, and large game in the uplands. Activities occurring in this manner would have positioned the inhabitants for large and small mammal game drives, and for the collection of wada when the seeds finally ripened.

CHAPTER IX
BROKEN ARROW SITE (35HA3075)

The Broken Arrow site is located on the southeast edge of Malheur Lake, across an embayment to the east of the Headquarters site and approximately ¼ mile southwest of Laurie's site. The legal location for the site is Township 26 South (South of Malheur Lake), Range 32 East, Section 27 (N ½, SE ¼, NE ¼ and SE ¼, SE ¼, NE 1/4). The site is located on Bureau of Land Management property approximately one-quarter mile from the present-day shoreline, and adjacent to the Malheur National Wildlife Refuge (Figure 9.1). The Donner und Blitzen River empties into Malheur Lake near the Headquarters site, and Black Butte dominates the skyline approximately two miles to the east. Broken Arrow and Laurie's site are so close to each other that they share many characteristics in terms of regional setting, but the land forms they occupy are considerably different. The Broken Arrow site occupies an outcrop of basalt, a low peninsula that has a dune feature of aeolian and lacustine sediments covering it. The land form rises two feet higher than Laurie's site. This small change in topography is significant in such a broad basin, where a considerable volume of water is needed to raise lake levels as little as an inch. Standing at the top of the peninsula, one can look to the south and pick out a series of low shorelines marking significant rises in lake levels, including the 1980s flood event that almost inundated Laurie's site and rose to the edge of Broken Arrow (Figure 9.2).

Site reconnaissance was conducted by Laurie Thompson, Kelly Edmondson, Dianne Ness and Dan Braden on March 25, 2001. At that time, they were aware that the site was of interest to artifact collectors and the elevated land form was a high probability location for encountering an archaeological site. The surface of the site was covered with saltgrass, sedges, Great Basin wild rye, sagebrush and greasewood. One circular depression was filled with Great Basin wild rye, in sharp contrast to the surrounding sagebrush and greasewood.

Cultural materials covered a 300 meter (northwest to southeast) by 120 meter (southwest to northeast) area and consisted of obsidian and CCS debitage, several circular depressions, flaked tools, ground stone, fire-cracked rock, charcoal, and burned bone fragments (Thompson 2001). Diagnostic projectile points collected on the surface included Rose Spring (8), Elko

Figure 9.1. Broken Arrow site (35HA3075) showing Unit 2 in the foreground and Unit 3 beyond. View is to the northwest.

Series (5), Humboldt (1), Malheur Stemmed (1), and stemmed (1) varieties. Additional points were surface-collected throughout the project, and they will be discussed below.

The Broken Arrow site is located at an elevation of 4106 feet. The 36,000 square meter site was surrounded to the west by the extensive flooding that occurred in the 1980s, which reached a maximum elevation of 4102 feet. Once the waters receded, a dense growth of grasses and forbs emerged in the margin between the current lake shore and the greasewood and sagebrush-covered peninsula. Drift lumber from residences and farm buildings dismantled by the flood demarcates the shoreline (Figure 9.2 and 9.3). The drought-reduced shoreline of 1975 is nine feet lower (at 4093 feet) and currently a quarter-mile beyond the present-day lake shore

Preliminary archaeological testing at Broken Arrow occurred from May 14 to May 18, 2001. The testing strategy was to determine if cultural deposits were present in a possible house pit depression, then work northward in ten meter increments to the top of the peninsula. Scott Thomas, of the Burns District Bureau of Land Management, and Dianne Ness, a volunteer, assisted in the excavation of eight 50x50 cm test probes that began on the flat well south of the peninsula and continued up slope to the summit. The area in between has a rich array of artifacts

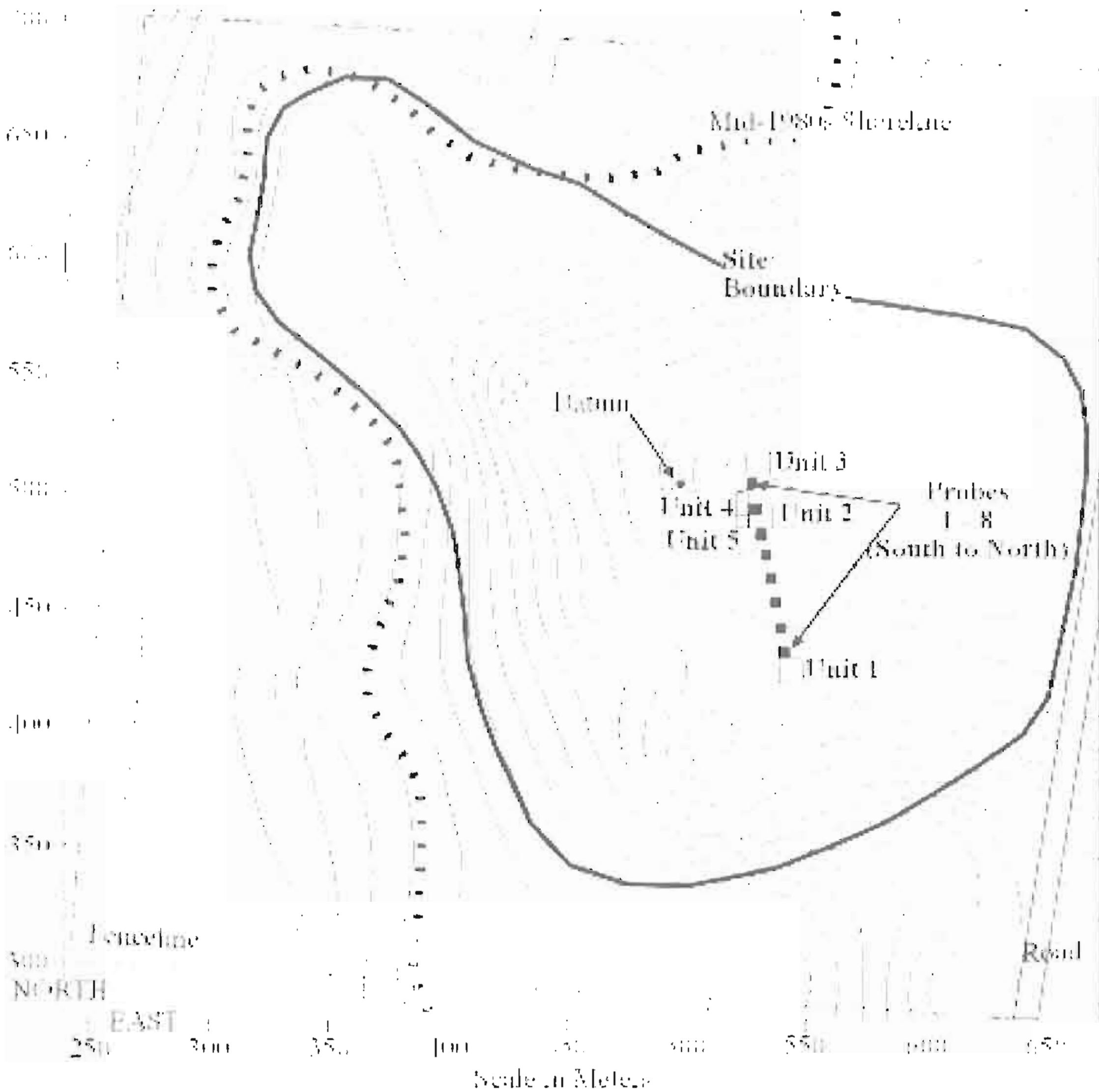


Figure 9.2. Broken Arrow topography and locations of excavation units.

exposed on the surface, including projectile point tips, drill fragments, highly polished metate fragments, manos, large biface fragments and basalt choppers. If the depression did not turn out to be a house pit, we still felt confident that the testing would result in the identification of one or more concentrations of artifacts that would shed light on the nature of human activities at the Broken Arrow site.

Probe 1 was established at the south end of the transect within the ryegrass-choked depression. The probe was excavated on the north side of the depression, offset from the center to preserve the majority of the deposit for field school excavations. Bone (n=54) and debitage (n=102) was found throughout the deposits and a utilized flake, one Cottonwood Triangular point, and two projectile point preforms were collected from the first five excavation levels. The utilized flake and one perform came from Level 1, the Cottonwood Triangular and second preform came from Level 5 (Table 9.1). Probe 2 produced little cultural material and Probe 3 was sterile. Wet weather prompted a move to higher ground to escape the sticky clay sediments, so Probes 7 and 8 were excavated after the completion of probes 2 and 3. Located on top of the peninsula, Probe 7 produced 172 pieces of debitage, 215 bone fragments and two biface fragments. Probe 8, ten meters north, contained 388 flakes and 286 pieces of bone, a bone tool fragment, a biface fragment and an edge-modified flake. Continuing bad weather cut the testing phase short and probes 4, 5, and 6 were not excavated.

Table 9.1 Results of Broken Arrow (35HA3075) Preliminary Testing, May 2001.

				Broken Arrow		
Level	P1	P2	P3	P7	P8	Total
				Debitage		
1	32	5	-	17	83	
2	15	-	-	28	76	
3	13	-	-	39	119	
4	8	-	-	25	83	
5	13	-	-	32	*27	
6	15	-	-	31	-	
7	6	-	-	-	-	
	102	5	-	172	388	667
				Bone		
1	32	-	-	14	20	
2	1	2	-	13	8	
3	1	-	-	43	42	
4	10	-	-	36	99	
5	6	-	-	39	93	
6	2	-	-	70	*24	
7	2	-	-	-		-
	54	2	-	215	286	563

* includes levels 5, 6, and 7--mixing due to badger activity

				Other tools		
1	pref, utfl	-	-	bif	bif	
2	-	-	-	-	bonetool	
3	-	-	-	-	unif	
4	-	-	-	-	-	
5	CT,pref	-	-	-	-	
6	-	-	-	bif	-	
7	-	-	-	-	-	9

pref=preform, utfl=utilized flake, CT=Cottonwood Triangular
bif=biface, unif=uniface

The University of Oregon Archaeological Field School testing project at Broken Arrow occurred from June 28 through July 14, 2001, with additional work at the site sporadically through August 2 when the field school ended. More work was carried out with the assistance of personnel from the Burns District Bureau of Land Management from July 2 through July 11, 2002. The field school excavations consisted of three 2x2 meter units situated in locations where preliminary testing indicated high concentrations of cultural material. Unit 1 was located just south of Probe 1, Unit 2 incorporated Probe 7 as its northwest corner, and Unit 3 was placed north of Probe 8. In 2002, Scott Thomas, Laurie Thompson, Diane Browning and Dan Braden of the Burns District Bureau of Land Management excavated units 4 and 5, located directly west of Unit 2 to explore the possibility of a house floor initially identified in the 2001 excavations.

Excavation Strategies

Testing

Archaeological testing of the Broken Arrow site occurred over the course of two years, utilizing the efforts of both students and federal agency personnel. Test excavations utilizing 50x50 cm shovel probes were used to identify high concentrations of cultural material within the site, then 2x2 meter units were excavated over or adjacent to the most productive probes. The test probes targeted an area where a wide variety of cultural material was scattered across the surface, more so than in other areas, and where the landforms suggested that long term deposition might have occurred. It became apparent after the excavation of probes 1, 7, and 8 that the field school efforts would be best utilized nearby. It was anticipated that the information available from large sites adjacent to Malheur Lake with possible evidence of pit house structures would be vital for considering Whiting's descriptions of activities there (see Chapter 8, pp. 367-368):

Based on Whiting's description, neither Broken Arrow or Laurie's site seem particularly suitable as winter village locations, at least under current environmental conditions. There is an absence of good water and firewood sources nearby, and the unprotected site would have stood exposed to the full force of passing winter storms. Other nearby locations such as the Headquarters site across the bay would have offered better shelter from storms, firewood, and water. Broken Arrow is a good location for the acquisition of marsh and lake resources. Seed plants noted at the site include salt bush, chenopods-amaranths, Great Basin wild rye, and Indian rice grass. Wada would be expected along the fluctuating shoreline, and bulrush and cattail occupy the shallow lake margins. The largest colony of muskrats in Malheur Lake occupies the area nearby, and muskrats would have also been an important resource (Carla Burnside, personal communication 2001).

Excavation Units

During the course of the excavations, an arbitrary datum was established on top of the peninsula for mapping purposes. Using a Topcon GTS-203 transit, coordinates for the datum were set at 500 N/ 500 E, with an arbitrary datum of 100 meters. The individual excavation units were tied into the grid system, but they are identified only by numeric designations here. Individual elevation datums were shot in for the excavation units and vertical control was maintained by level lines attached to datum stakes. The units were excavated in 10 cm levels excepth when strata associated with cultural features was encountered, at which time the cultural material was excavated separately. A single site datum provided adequate coverage for recording the site, but the distance between the Broken Arrow site and Laurie's site proved too great for tying the two together with the total station.

As in the case of the other sites here reported, the basic unit of excavation was the 2x2 meter square, divided into 1x1 meter units oriented towards magnetic north. Quad A was always to the northwest, Quad B to the northeast, Quad C to the southwest, and Quad D to the southeast. Paperwork for each level included drawings, artifact counts, the location of *in situ* artifacts and various physical features on a plan map, and written descriptions of sediment types. The excavators worked with great care to insure that chronologically diagnostic artifacts and other formed tools, features, utilized flakes and noteworthy bone fragments were recorded *in situ* as often as possible. Drawings were made of selected stratigraphic profiles and photographs were taken of representative walls in some excavation units. *In situ* artifacts and potential features were photographed. Fill was removed in 10 cm increments and passed through 1/8 inch mesh hardware cloth. Debitage, bone, and other artifacts were retrieved during the screening process, counted, and added to the level record. A total of 11.8 cubic meters of fill was excavated, resulting in the recovery of 60,946 artifacts, or 5,165 per cubic meter.

Analytic Components

Two AMS dates were assayed on charcoal from the Broken Arrow site, both obtained from an area where a hearth and wickiup floor were investigated through the excavation of Units 2, 4 and 5 (Table 9.2). A hearth, designated Feature 1, was identified in Unit 2 in association with an abundance of fire-cracked rock, splintered and burned bone, numerous Elko and Rosegate projectile points, beads, and various other tools. Subsequent excavation in adjacent Units 4 and 5 the following year led to the identification of a compacted clay floor upon which numerous cultural materials had accumulated (Figures 9.5 and 9.10). A date of 1810±40 BP (Beta-167134) came from Unit 2, Quad A, Level 7, associated with a hearth feature (Feature 1). Artifacts recorded at the same level included a Rose Spring, an Elko Eared point, two drills, a foliate point, a biface, and a variety of ground stone and basalt fragments that had been incorporated into a hearth circle. A second date of 2030±40 BP (Beta-214674) came from Level 10 of Unit 4, Quad B, associated with a surface that is believed to be the floor of wickiup. The floor deposits were clayey and compacted, and most of the artifacts were found in the sediments above the floor. They included Elko Eared, Rose Spring points and the other kinds of artifacts seen in Unit 2, but in lesser numbers because Unit 4 is away from the Feature 1 hearth, where most artifacts were concentrated.

Table 9.2. Radiocarbon dates from the Broken Arrow site.

Sample no.	Beta ID	Provenience	Radiocarbon age	Cal. At intercept	Method
3075-2-A-7-10	Beta 167134	Unit 2, QA, L7	1810±40 BP	1720 Cal BP	AMS
3075-4-B-8	Beta 214674	Unit 4, QB, L8	2030±40 BP	1990 Cal BP	AMS

Unit 1

Unit 1 was excavated in the ryegrass-filled depression believed to be a house pit Figures 9.2 and 9.3). The unit was established south of Probe 1, from which a Cottonwood Triangular point and two preforms were recovered in the first five levels of excavation. Unit 1 was a 2x2 meter square and Probe 1 was located approximately 10 cm north of its northwest corner. The entire unit was excavated to a depth of 70 cm, then work continued in Quad A to a depth of one meter. Ryegrass roots were dense in the first 40 cm and removing them proved to be time consuming. The sediments were hard to distinguish in the upper 40 cm due to the roots. Below the root zone, sediments were composed of fine aeolian silts and clays and tannish-brown in color. Very few small pebbles (<2%) were present in the upper deposits, increasing to approximately 5% after 40 cm. Clays, noted as a minor constituent in the upper deposits, became dense between 30 to 40 cm (just below the root zone) and increased steadily in density thereafter. The sediments in level 7 became speckled with bisque and small pieces of charcoal, which increased with depth. By level 9, clays were becoming less prominent. The fill was crumbly and easily broken into smaller pieces, no longer shearing off in curls when scraped with a trowel. The unit was positioned to be well within the confines of the depression initially perceived as a possible house pit and close enough to the probe to intercept any feature that may have been struck by the probe.

Artifacts recovered in Unit 1 included 15 diagnostic projectile points, 10 point fragments, six biface fragments, four beads, two bone tools, 25 utilized flakes, one core, 15 ground stone fragments, 6809 pieces of debitage and 4835 pieces of bone (Figure 9.4). Charcoal was collected below Level 2 and fire-cracked rock was recorded. Projectile points included six Rose Spring, one Eastgate, six Elko Series, one Humboldt, and one that is unclassifiable. The points were concentrated in levels 4 through 6, averaging four per level. Beads included two non-diagnostic broken clam shell discs (Largaespada 2002) and one tubular bone specimen. In

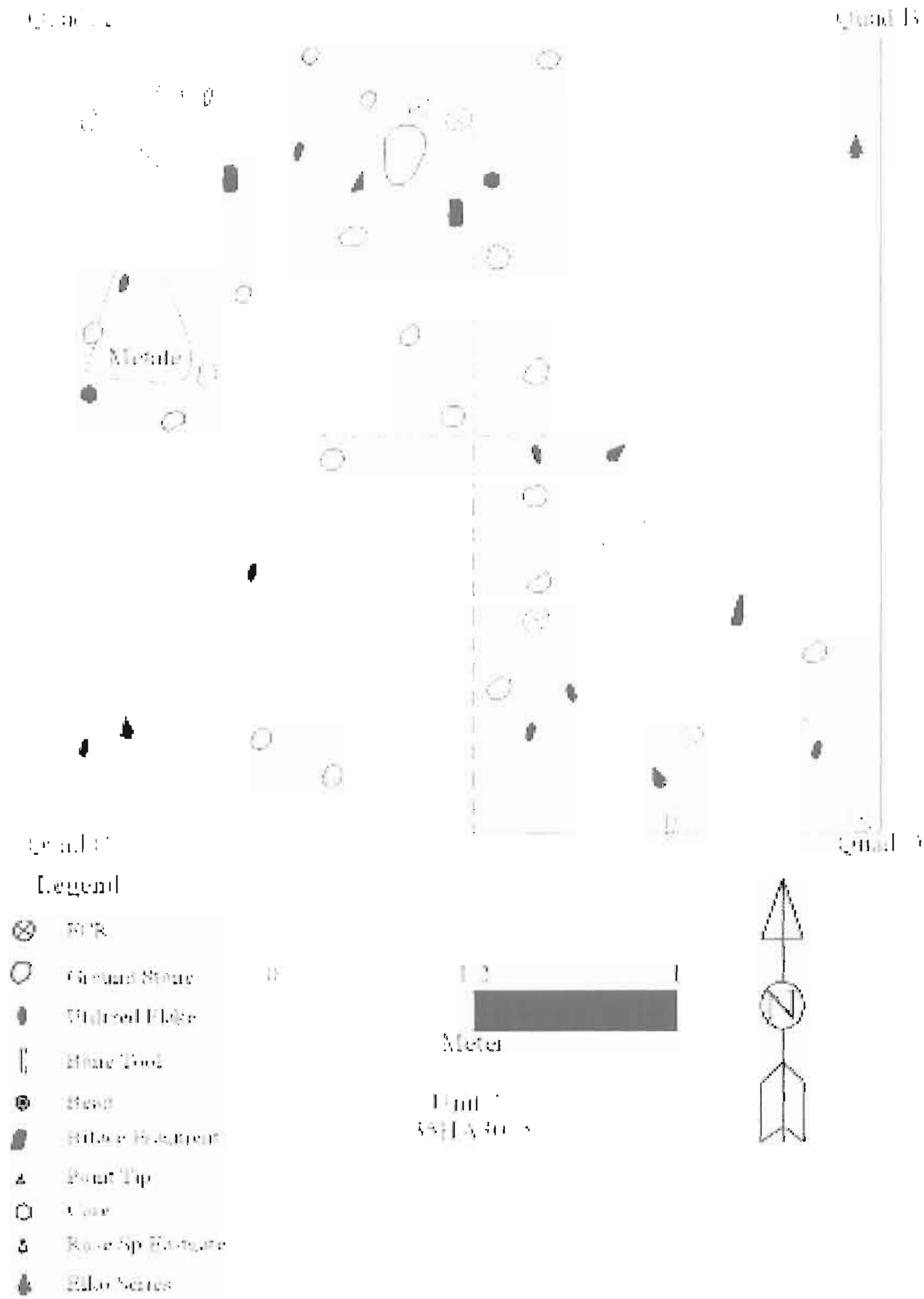


Figure 9.3 Broken Arrow Unit 1, showing locations of in situ artifacts

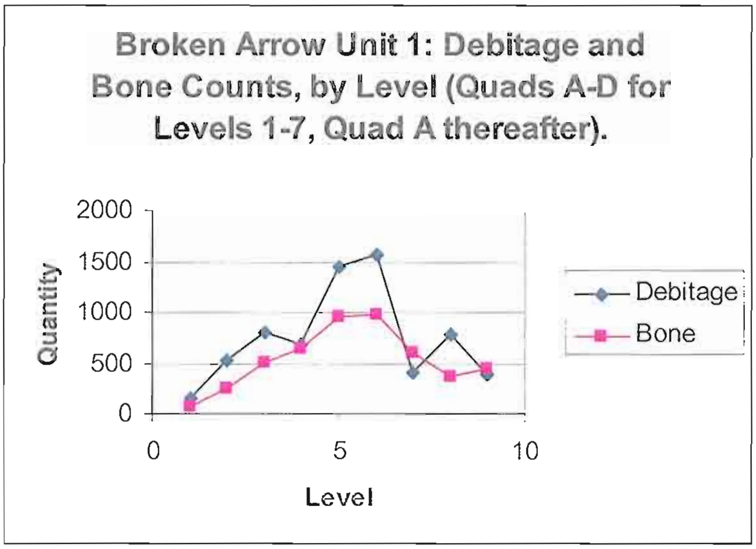


Figure 9.4. Broken Arrow Unit 1 debitage and bone counts, by level.

general, artifact counts increased sharply in Level 3 and continued to increase with depth. The dense root mass, which dominated the upper levels of the deposits, should be taken into consideration with regard to mixing and altering of sediments. It is noteworthy that Rose Spring points were collected from the first two levels alone, and ground stone is not present until Level 3. Charcoal was uncommon throughout the excavation but enough was recovered to allow species identification. Helzer (2002) identified both greasewood and sagebrush charcoal in Unit 1, both of which are still common at the site.

A 20 cm (8 inch) bucket auger excavation was utilized in Quad A to evaluate the sediments beyond a depth of one meter and discontinued at 1.3 meters. It showed that a tannish-brown sandy silt transitional zone identified in both Laurie's site and Broken Arrow during the preliminary testing was not present in Unit 1. Instead, clays which were probably deposited through previous high lake stands began to increase again and continued to a depth of 1.3 meters. With the exception of one bone fragment, cultural materials were not present in the underlying sediments and it appeared likely that they declined rapidly beyond a depth of one meter. A sudden transition from cultural to sterile sediments was noted in the other Broken Arrow units, though it was not as well evaluated in Unit 1 due to time limitations.

Unit 2

Unit 2 was established after the excavation of Probe 7 yielded compelling evidence of a possible hearth feature (Figure 9.5). The probe, located at the high point of the peninsula, was excavated into uniform brownish-gray sands and silts with almost no gravels or pebbles. Debitage and bone counts were high throughout the excavation, but bone counts increased significantly in Level 3. Small mammal bones were common in the first four levels, and large mammal bones increased in abundance by Level 5 (Figure 9.6). Thin laminations of charcoal staining were evident by the bottom of Level 2, and the fill took on an increasingly marbled appearance with depth. Near the bottom of Level 5, a dense layer of charcoal fragments and fire-cracked rock began to emerge. The probe was sealed at that point to protect the deposits until the field school excavations convened. No temporally diagnostic artifacts were present but two biface fragments were collected, one each in levels 1 and 6.

Unit 2 consisted of a 2x2 meter square in which all four quadrants were dug to 80 cm. Work was then discontinued in Quad D to provide an access point in and out of the unit as the other quads were excavated further. The unit was terminated at 1.1 meters due to time constraints. Formed tools found just below the surface included a complete CCS biface and an Elko Corner-notched point, and artifacts continued to be found steadily through the deposits (Table 9.3). Fire-cracked rock was found in abundance along with Elko Series, Rose Spring, foliate, and Northern Side-notched points; bifaces; drills; beads; cores; ground stone, including metates, manos, and abraders; edge-modified flakes; and bone tools. Other artifacts included 8537 flakes of debitage and 10,955 pieces of bone.

Elko and Rose Spring points were co-occurred throughout the deposits, along with others. Elko Corner-notched were recovered in levels 1, 2, 4, and 9; Elko Eared points in levels 1, 6, and 8; Rose Spring points in levels 2, 6, and 10; a Northern Side-notched point was collected in Level 7, and foliate points in Level 5 and 7 for a total of 14 points. The presence of Elko and Rose Spring points in association is a common occurrence at Harney Valley sites, and it is clear from the integrity of the hearth feature and the relationship of the projectile points to it that the two were being used concurrently at Unit 2. The foliate points may be finished projectiles or preforms. Although some overlap is expected between the Elko Series and Northern Side-notched points, the Northern Side-notched point is out of place with the Rose

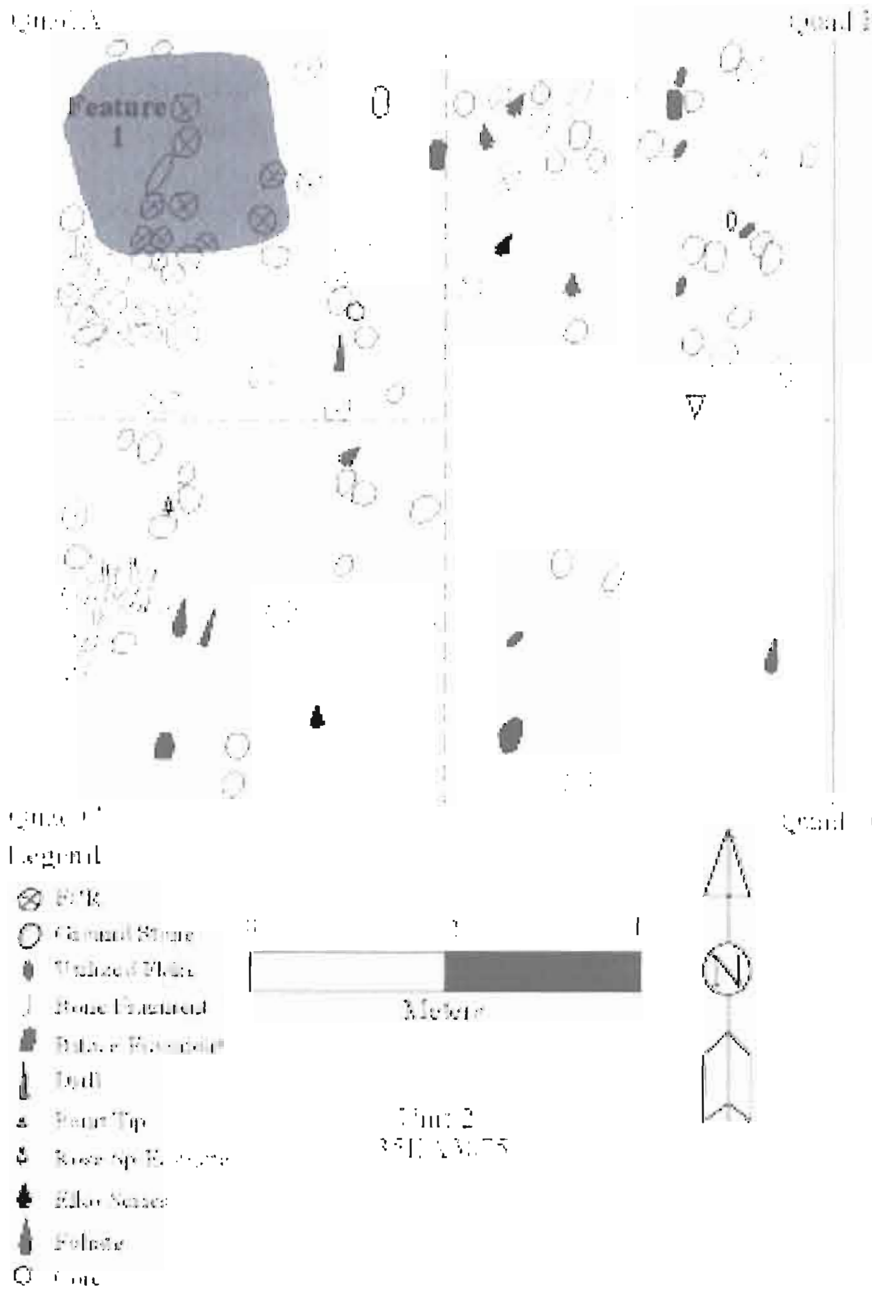


Figure 9.5. Broken Arrow Unit 2, showing locations of in situ artifacts and features.

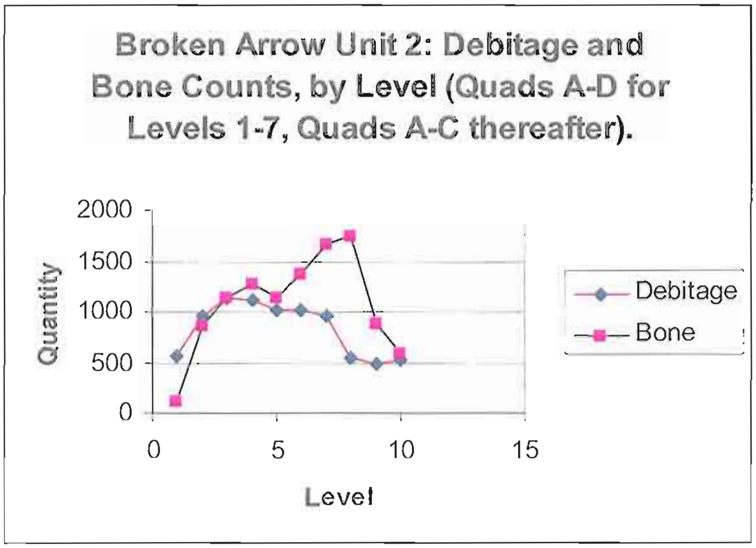


Figure 9.6. Debitage and bone counts for Unit 2, by level.
The Feature 1 hearth developed in Level 7.

Spring points and the ca. 1800 BP hearth, by a minimum of 2,000 years (Oetting 1994). Considering the typological range of projectile points scattered across the surface of the Broken Arrow site (see the projectile point section, below), the deposition of the Northern Side-notched point could have been an isolated occurrence.

The concentration of fire-cracked rock, charcoal, and bone fragments that were initially observed in Probe 7 emerged as a fire hearth, designated as Feature 1, in Level 6 of Quad A (between 65 to 90 cm). The Feature 1 hearth deposits were situated in the northwest corner of Quad A, and a concentration of fire-cracked rock, charcoal, splintered large mammal bone fragments and smaller bones, and tools were scattered in an arc surrounding it. It appears that our excavation caught most, if not all, of the hearth, and approximately one quarter of the activity area around it, assuming that people utilized the entire circumference of the hearth. During excavation, the light brown sandy silts began to darken with charcoal staining beginning in Level 4. The sediments continued to darken and charcoal became more concentrated over the next two levels approaching the hearth. By Level 7, the excavators noted the Feature 1 hearth, bands of charcoal staining, concentrations of charcoal, and dark brown clayey, greasy soil. By the bottom of Level 8 at approximately 90 cm, the Feature 1 hearth was completely removed except for errant fragments of fire-cracked rock. Cultural materials were still being collected in high numbers, but a decline in formed tools became apparent and ground stone fragments, debitage, and bone became the primary materials recovered.

The artifact counts remained strong, but declined to a small degree by Level 12 (120-130 cm). A layer of tannish-brown sediments became apparent at the bottom of the level and artifact counts began to drop at this contact zone. Previous work during the preliminary testing phase helped to identify this contact zone as a transition between cultural and sterile layers of sediment. With time constraints becoming an issue for work at Broken Arrow, we decided to discontinue hand excavation in Unit 2 and utilize a 20 cm (8 inch) bucket auger to explore the underlying deposits of Quad A. Augering to a depth of 2.1 meters, it became apparent that the cultural deposits dissipated quickly after Level 13, with only four pieces of debitage and ten pieces of bone recovered in 80 cm.

Unit 3

Unit 3 was excavated 10.5 meters north of Unit 2, and just north of Probe 8 (Figure 9.7). Small flecks of charcoal were present after Level 1 and continued throughout the excavation, but the dark charcoal-stained laminations seen in Probe 7 were absent. The probe was excavated to 70 cm, but levels 5 through 7 were heavily disturbed by overnight badger activity and they were removed as one unit. Artifact counts were remarkably high for a 50x50 cm probe and included 388 pieces of debitage (primarily small pressure flakes), 286 pieces of bone, a biface fragment, a uniface, and a polished piece of bone.

All four quads of Unit 3 were excavated to a depth of 70 cm, then Quad B alone was excavated to a depth of one meter. Work continued in Quad B with a 20 cm (8 inch) bucket auger to a depth of 1.6 meters. Cultural materials were recovered to a depth of 1.4 meters in Quad B, followed by 20 cm of sterile deposits (Figure 9.8).

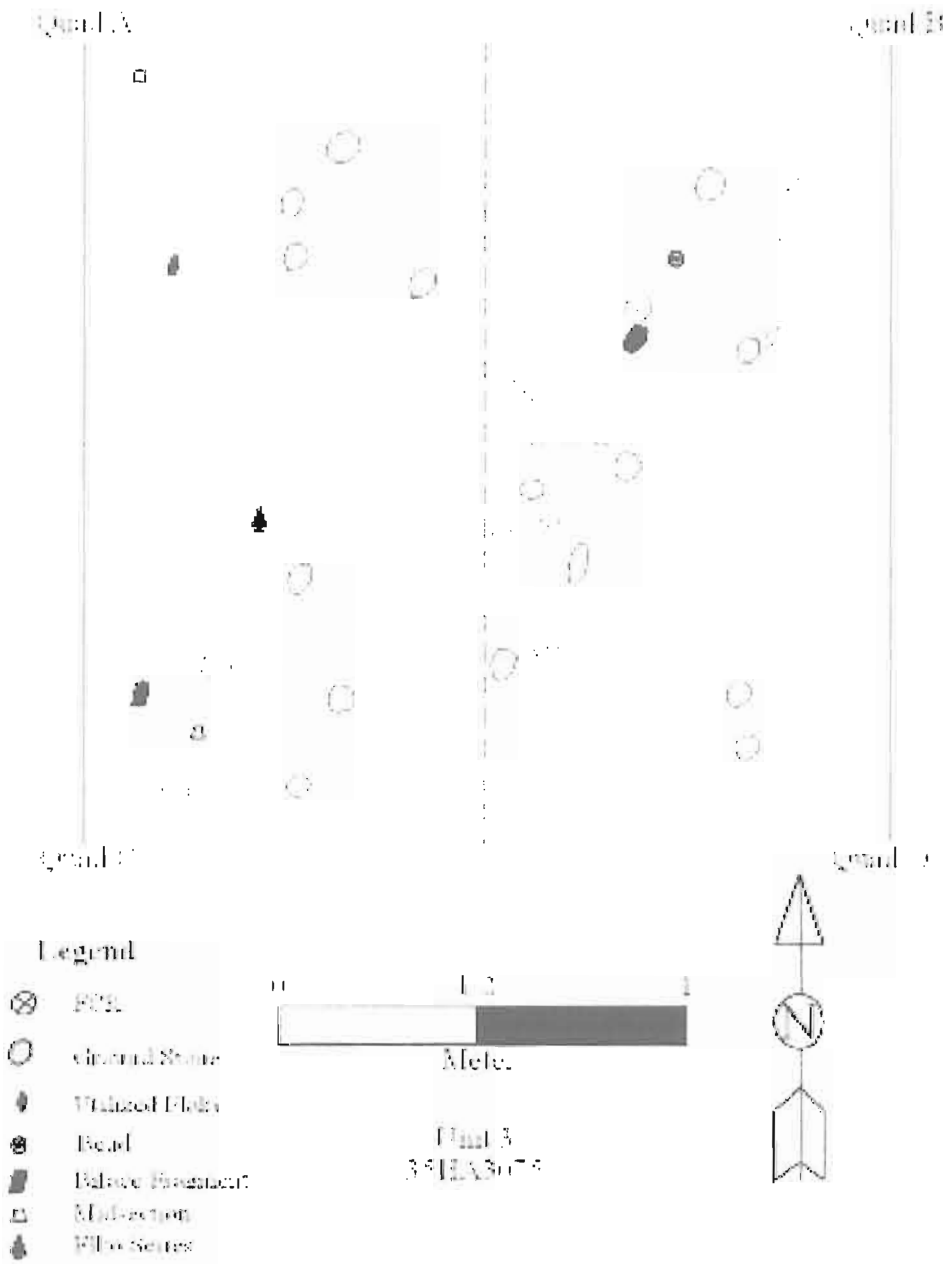


Figure 9.7. Broken Arrow Unit 3. showing the locations of in situ artifacts.

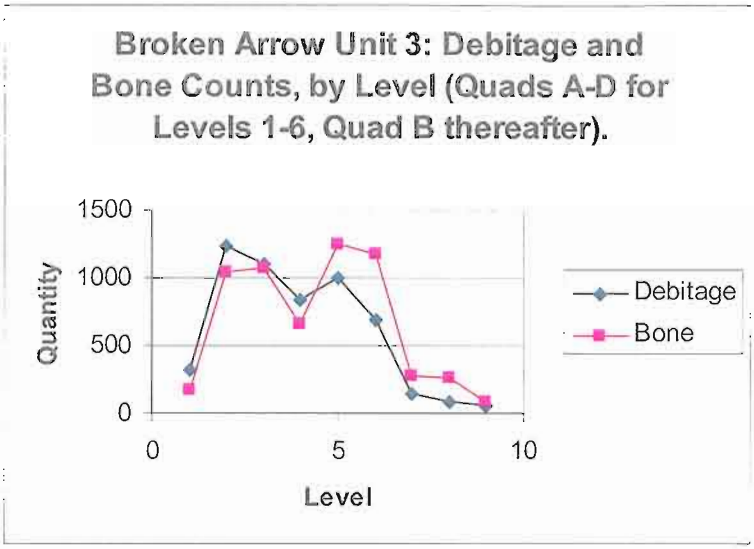


Figure 9.8. Debitage and bone counts for Unit 3, by level.

Excavations at Unit 3 yielded six projectile points, including one Elko Corner-notched, one Elko Series, one Rose Spring, one Rosegate (unidentifiable to either Rose Spring or Eastgate), one Pinstem, and one point that is unclassifiable. Also collected were bifaces, drills, beads, edge-modified flakes, ground stone, and ochre, along with 5,472 pieces of debitage and 5,384 bone fragments.. The Unit 3 excavations, while rich in cultural materials, did not contain distinguishable cultural features. The debitage and bone counts do reflect the possibility of a bimodal distribution of artifacts with peaks in Level 2 and again in Level 5 for both materials (Figure 9.8), based on artifact quantities. Five projectile points were found in levels 2 through 5, and another in Level 8. The sharp decline seen after Level 6 is due to the cessation of excavations in Quads A,C, and D.

Sediments consisted of medium brown sandy silts, with small amounts of fine subangular gravels and occasional angular pebbles of vesicular basalt. These sediments continued throughout the excavation. The tannish-brown sterile sediments were only found during augering.

Units 4 and 5

The 2001 excavations at Unit 2 led to the identification of the Feature 1 hearth and associated cultural materials surrounding it in a broad arc. The richness and variety of the cultural deposits suggested that the Feature 1 hearth belonged in a structure of some kind, most likely a wickiup, but evidence of structural elements or compacted floor deposits was lacking. It was decided that additional work would be required at the Feature 1 hearth locality in an attempt to identify the nature of the occupation surface with better clarity. We returned in 2002 with Bureau of Land Management personnel and established Units 4 and 5, positioned to explore an area of potential cultural deposition surrounding the hearth to the west (Figures 9.9 and 9.10). Unit 4 was a 1x2 meter excavation identified as Quads B and D of an unrealized 2x2. Unit 5, 1x1 meter in size, was designated as Quad B of a 2x2 meter unit. Unit elevations were based on the datum established for Unit 2 in 2001.

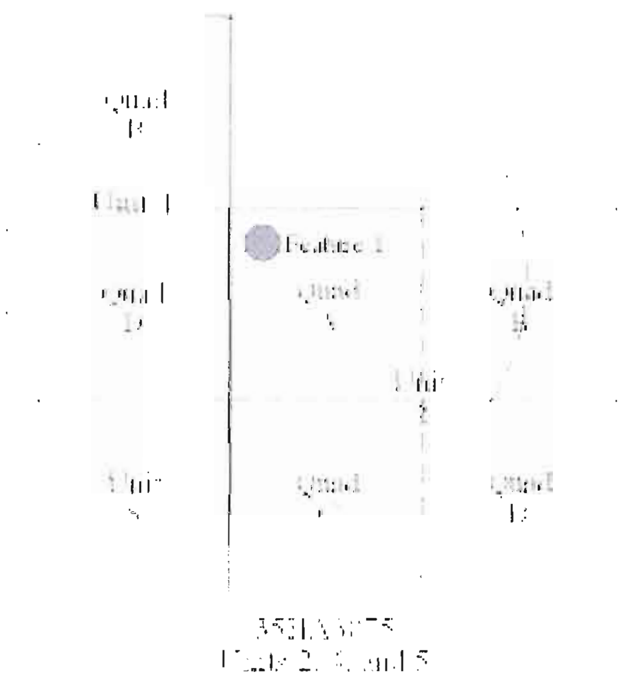


Figure 9.9. Broken Arrow: Positions of Units 2, 4 and 5, circle indicates area of potential cultural deposition within the wickiup.

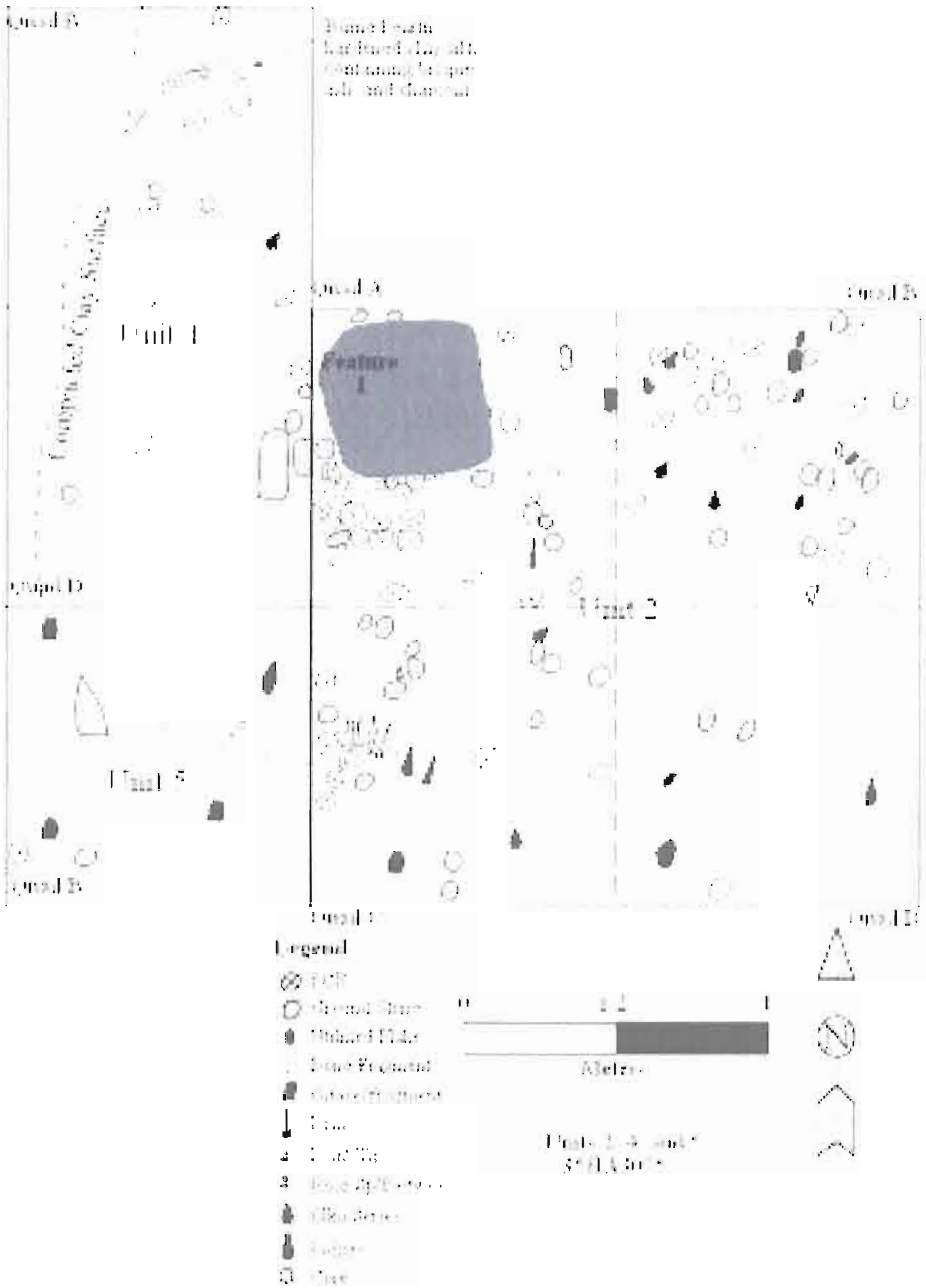


Figure 9.10. Broken Arrow: Units 2, 4, and 5, showing the locations of in situ artifacts, the compacted clay surface, and the burned earth concentration.

Excavations at the two units led to the recovery of seven projectile points, including four from Unit 4 and three from Unit 5. The Unit 4 points consisted of four Elko Eared, three Eastgate, one Humboldt, and one Rose Spring, collected in levels 4 through 7. The Unit 5 points included two Elko Eared, an Eastgate, one unclassifiable point fragment, and one Rose Spring from levels 1 through 8. Most artifacts in Units 4 and 5 were similar to those in Unit 2, consisting of ground stone fragments, fire-cracked rock, debitage and bone, edge-modified flakes, cores, and biface fragments. Drills were recovered in Unit 4, Level 3 of Quad D and in Level 4 of Unit 5. Two shell beads were found in Unit 4, Quad B, Level 4; and three in Unit 5, including two shell beads in Level 1, one shell bead in Level 2, and an unusual bone bead (or pendant) in Level 4 (Figure 9.20). Charcoal staining became evident in Level 5 of both units and large mammal bones, one with cut marks, started to appear in the same level. The sediments remained similar, dark brown sandy silts with charcoal staining, until Level 7, when a hard-packed surface consisting of yellowish silty sands and clays began to appear. The surface was a transitional zone between the cultural surface above and the sterile aeolian and lacustrine- deposited materials below. Just below the transitional zone, a layer of yellowish clay several centimeters thick is present that identifies either a prepared house floor or an avenue where foot traffic around the Feature 1 hearth (Figures 9.5 and 9.10) either compacted clay-rich sediments or drew the clays out of the surrounding matrix, creating a harder surface in the process. The layer is situated between 85 and 103 cm in elevation and undulates, with numerous small depressions and hummocks. The overlying cultural sediments were removed from the yellow clay layer, but no artifacts were hidden in the depressions, as they were at Laurie's site. Beyond the clay surface was a layer of sterile tannish-brown sediments of an unknown depth.

In Quad B of Level 7, a portion of the clay surface had been heat altered, creating a roughly crescent-shaped oxidized and discolored surface of bisque, ash, and charcoal. The area around it is hard-packed and several mano and fire-cracked rock fragments were found in association. Obvious hearth constituents were absent, aside from those materials that were trapped in the bisque itself; no lenses containing charcoal, ash, or burned animal bones were accumulated adjacent to the bisque surface.

The utility of excavating Units 4 and 5 was proven by the discovery of the compacted clay surface, which provides context for the Feature 1 hearth and the rich accumulation of artifacts surrounding it. The surface appears to indicate a structural floor that was either deliberately prepared with a clay lining or perhaps compacted by foot traffic. No evidence of structural supports was encountered during the excavation, so determining the physical nature of the super structure itself is not possible.

Features

Although a number of individual artifacts were mapped in situ and their dispersal in the individual excavation units has been well documented (Table 9.3), there were only two associations of artifacts at the Broken Arrow site that were identified as distinct features. They included the hearth designated as Feature 1 and the compacted clay surface known as Feature 2. Both were found in the excavation block consisting of Units 2, 4, and 5, and they are described in detail in the unit excavation descriptions above. Additional attention will be paid to dimensions and sediment profiles in the feature descriptions below.

Feature 1

A large hearth, designated as Feature 1, covered the northwest corner of Unit 2 beginning in the bottom of Level 6 (Figures 9.9 and 9.10). The hearth was first apparent at a depth of 65-70 cm, and continued through Level 8 to a depth of almost 90 cm. The feature was surrounded by a scatter of ground stone fragments, fire-cracked rock fragments and an abundance of splintered large mammal bone. The shape of the hearth could not be defined because of the high quantities of camp rock around it and the permeation of the hearth charcoal outward into the surrounding loose sediments. While the primary concentration of charcoal covered an area between 50 to 60 cm in diameter, primarily in Quad A, the associated ground stone, fire-cracked rock, and bone fragments extended over an area that was 150 to 200 cm wide, covering much of Unit 2. An AMS date of 1810±40 BP was returned on a charcoal sample (Specimen 3074-2-A-7) taken directly from the interior of the hearth. The sample wood was identified as willow by Dr. Marge Helzer, paleobotanist at the University of Oregon.

The sediments surrounding the hearth were described in the excavator's note as "dark brown, clayey, and greasy, with bands of charcoal stains." In general, the sediments were largely sandy silts with few, to no pebbles. A few small, angular to subangular pebbles were present in the area of the hearth, as was the dense concentration of camp rock. Clays were noted around the feature, but an actual layer of clay suggestive of a lined house floor was not evident. Substantial quantities of cultural material, other than the items mentioned previously, included debitage, small fragments of small mammal bone, diagnostic projectile points, edge-modified flakes, and a wide variety of specialized tools such as drills, bone awls, and abraders, and decorative items like beads, were found in close association with the hearth.

Feature 2

A compacted clay surface was encountered in Units 4 and 5 during the 2002 excavations (Figure 9.10). The surface extended westward from the approximate midpoint of the east wall of Unit 5, curved sharply northward through Quads B and D of Unit 4 with a width of 60 to 90 cm, and continued beyond the Unit 4 excavations for an unknown distance. As is shown in Figure 9.10, the clay surface is a portion of a wickiup floor that is approximately 2.5 meters in length by 60 to 90 cm in width, with the Feature 1 hearth near it's center. The Feature 2 floor surface appears to be roughly oval in shape. Taking the area east of the Feature 2 floor, including the Feature 1 hearth and the surrounding artifact concentration into consideration, it appears that the wickiup was approximately three meters in diameter with a centrally located hearth.

The Unit 4 and 5 excavations produced clear evidence of the feature, which was not apparent during the excavation of Unit 2 the previous year. Large quantities of charcoal and refuse deposited during the use of the Feature 1 hearth may have altered the underlying floor to the point where the clays, though noted as a constituent in the sediments during the excavation of Unit 2, were not as coherent in the vicinity of the hearth as they are further from it. It may be possible that clays already existing in native sediments were separated out of those sediments during the course of activities at the dwelling, particularly foot traffic, but the surface has the appearance of one that has been prepared to some degree. Cultural materials that were found in abundance on and above the surface dissipated as excavations surpassed the floor deposits. Concentrations of debitage, bone and formed tools decreased sharply in the Feature 2 floor sediments. A crescent-shaped area of burned earth and charcoal was found in Quad B of Unit 4, between 30 to 50 cm south of the north wall (Figure 9.9). No deposits were evident to indicate the original purpose of the fire-altered area.

The Feature 2 floor first became evident in Level 8 of Unit 5, at a depth of between 80 to 90 cm, and the deposits continued into Unit 4 at the same elevation. Sediments around the feature consisted of the yellowish to tannish silty sands that characterize sterile deposits in both the Laurie's and Broken Arrow sites. The Feature 2 floor consisted of hard-packed dark brown silty sands in the upper deposit where contact between the feature and overlying cultural deposits occurred. The underside of the floor was bounded by a thin layer of yellowish silty sand with some sub-angular to angular pebbles, then a pronounced increase in clay at the contact zone with the sterile deposits. The deposits ranged between 10 and 15 cm in thickness, and the floor surface, once cleared of the overlying cultural deposits, was found to be undulating.

An AMS date of 2030±40 BP was assayed on sagebrush charcoal recovered directly from the upper portion of the floor deposits in Level 8 of Unit 4, Quad B. The sample was identified by Dr. Marge Helzer, a paleobotanist with the University of Oregon.

Table 9.3. Summary of artifacts from the Broken Arrow site, by quadrant.

Level	Debitage	Bone	Proj Pts	Pt Frags	bifaces	Drills	Beads	Bone Tls	Util Fl	Cores	GS	Ochre	Charcoal
Unit 1, Quads A–D													
1A	24	-	-	-	-	-	-	-	-	-	-	-	-
1B	58	1	RS	-	-	-	-	-	-	-	-	-	-
1C	15	4	-	-	-	-	-	-	-	-	-	-	-
1D	68	70	-	-	-	-	-	-	-	-	-	-	-
2A	125	46	-	1T.1B	-	-	-	-	-	-	-	-	-
2B	130	100	RS	-	1	-	-	-	-	-	-	-	X
2C	75	24	-	-	1	-	-	-	1	-	-	-	X
2D	209	84	-	-	-	-	-	-	2	-	-	-	X
3A	178	98	-	-	-	-	-	-	-	-	1	-	-
3B	63	39	-	-	1T	-	-	-	1	-	1	-	-
3C	348	229	-	-	-	-	-	-	1	-	-	-	-
3D	207	140	-	-	-	-	-	-	2	-	2	-	X
4A	227	200	-	1T	-	-	-	-	1	-	1	-	-
4B	133	127	RS	-	-	-	-	-	-	-	-	-	-
4C	148	141	ECN	1T	-	-	-	-	2	-	1	-	-
4D	169	184	ECN	-	-	-	-	-	-	-	1	-	-
5A	668	129	-	1T	-	-	-	-	-	-	2	-	-
5B	311	164	EE	-	-	-	-	-	-	-	1	-	-
5C	223	409	-	-	-	-	-	-	2	-	1	-	-
5D	249	249	HUM,ECN	-	-	-	1bone	1	2	-	-	-	-
6A	370	119	RS	-	-	-	2	1	1	-	2	-	-
6B	602	195	UNK	-	-	-	-	-	-	1	-	-	-
6C	268	307	EE	-	-	-	-	-	1	-	-	-	-
6D	338	367	-	-	-	-	1	-	2	-	-	-	-
7A	421	609	EE,RS	1T,3B	-	-	-	-	5	-	1	-	-
8A	792	370	RS	1T	-	-	-	-	-	-	1	-	X
9A	390	448	EG	-	2	-	-	-	2	-	-	-	X
Total	6,809	4,853											

Table 9.3 (continued). Summary of artifacts from the Broken Arrow site, by quadrant.

Level	Debitage	Bone	Proj Pts	Pt Frags	Bifaces	Drills	Beads	Bone Tls	Util. Fl	Cores	GS	Ochre	Charcoal
Unit 2, Quads A–D													
1A	109	23	-	-	1	-	-	knife	-	-	-	-	-
1B	149	23	ECN	-	-	-	-	-	-	-	-	-	-
1C	190	43	-	-	-	-	-	-	-	-	-	-	-
1D	115	29	-	-	-	-	-	-	-	-	-	-	-
2A	136	104	-	-	-	-	-	-	-	-	-	-	-
2B	350	213	RS,ELKO	-	-	-	1	-	-	-	-	-	-
2C	222	194	-	-	1	-	-	-	-	-	1	-	X
2D	258	358	-	-	1	-	-	-	-	-	-	-	X
3A	176	115	-	-	-	-	-	-	-	-	-	-	X
3B	300	386	-	-	-	-	-	-	-	1	-	-	X
3C	267	311	-	-	-	-	-	-	-	-	-	-	X
3D	390	331	-	-	-	-	-	-	-	-	-	-	-
4A	292	310	-	1B	-	-	1	-	-	-	1	-	X
4B	180	568	ECN	-	-	-	-	-	-	-	-	-	-
4C	324	362	-	-	-	-	-	-	-	-	1	-	-
4D	312	40	-	-	-	-	-	-	-	-	1	-	-
5A	202	219	-	1T	-	-	1	1	-	-	-	-	X
5B	272	296	-	-	-	-	1	-	-	-	2	-	-
5C	275	305	-	-	-	-	1	1	-	-	1	-	-
5D	267	310	-	1T	-	-	-	-	-	-	3	-	-
6A	159	294	-	-	-	-	-	-	-	-	2	-	X
6B	317	380	RS,EE	-	-	-	-	-	-	1	1	-	X
6C	223	371	-	-	1T	-	1	-	-	-	1	-	X
6D	330	324	-	1T	1	-	-	-	-	-	-	-	X
7B	371	720	-	-	-	-	-	-	1	-	3	-	X
7C	269	337	-	-	-	1	-	-	-	-	1	-	X
7D	123	165	-	-	-	-	-	-	1	-	-	-	X
8A	144	934	-	-	1	-	-	-	-	-	-	-	X
8B	203	388	-	-	2	-	-	-	2	-	6	-	X
8C	206	416	ELKO	-	-	-	1	-	-	-	3	-	X
9A	125	303	-	-	-	-	-	-	-	-	1	-	X
9B	304	345	ECN	-	1	-	-	1	2	-	1	-	X
9C	67	229	-	-	2	-	-	-	1	-	4	-	X
10A	232	317	-	-	-	-	-	-	-	-	-	-	X
10B	148	171	RS	-	-	-	-	-	1	-	3	-	X
10C	140	95	-	-	-	-	-	-	1	-	3	-	X
11/12A	190	333	-	-	-	-	-	-	-	1	6	-	X
	8,537	10,955											

Table 9.3 (continued). Summary of artifacts from the Broken Arrow site, by quadrant.

Level	Debitage	Bone	Proj Pts	Pt Frags	Bifaces	Drills	Beads	Bone Tls	Util Fl	Cores	GS	Ochre	Charcoal
Unit 3, Quads A–D													
1A	93	40	-	-	-	-	-	-	-	-	-	-	-
1B	95	54	-	-	-	-	2	-	-	-	-	-	-
1C	101	29	-	-	1T	-	-	-	-	-	-	-	-
1D	97	51	-	-	-	-	-	-	-	-	-	-	-
2A	281	272	-	-	1M	-	1	-	-	-	-	-	X
2B	306	217	ELKO	-	-	-	-	-	-	-	-	-	-
2C	299	259	-	-	1M	-	-	-	-	-	2	-	X
2D	354	297	-	-	-	-	-	-	-	-	2	-	X
3A	178	176	-	-	-	-	-	-	-	-	3	-	X
3B	280	277	RS,1?	-	-	-	1	-	-	-	-	-	X
3C	329	348	RS	-	-	-	-	-	-	-	1	-	X
3D	311	274	-	-	-	-	-	-	-	-	-	-	X
4A	165	215	-	-	2T,1?	-	-	-	-	-	3	-	X
4B	195	239	-	-	-	-	1	-	-	-	-	-	X
4C	233	21	ELKO	-	-	-	-	-	-	-	-	-	X
4D	249	193	-	-	-	-	-	-	-	-	2	X	X
5A	221	227	-	-	-	-	-	-	2	-	-	-	X
5B	245	406	-	-	-	1	-	-	1	-	-	-	X
5C	224	362	-	-	-	-	-	-	-	-	-	X	X
5D	305	255	-	-	1	-	-	-	-	-	1	-	X
6A	233	323	-	-	1	-	-	-	1	-	-	-	X
6B	179	298	-	1T,1?	-	-	-	-	-	-	2	-	X
6C	156	254	-	1T	-	-	-	-	-	-	-	-	X
6D	119	297	-	-	1T,1?	-	-	-	-	-	3	-	X
7B	144	280	-	-	-	-	-	-	-	-	-	X	X
8B	88	261	ECN	-	-	-	-	-	-	-	1	X	X
9B	52	91	-	-	-	-	-	-	1	-	-	-	X
	5,532	6,016											

Table 9.3 (continued). Summary of artifacts from the Broken Arrow site, by quadrant.

Level	Debitage	Bone	Proj Pt	Pt Frags	Bifaces	Drills	Beads	Bone Tls	Util Fl	Cores	GS	Ochre	Charcoal
Unit 4, Quads B and D													
1B	97	16	-	-	-	-	-	-	-	-	-	-	-
1D	115	53	-	-	-	-	-	-	-	-	-	-	X
2B	176	158	-	1T	-	-	-	-	-	-	-	-	X
2D	225	295	-	1T, 1BARB	1B	-	-	-	-	-	-	-	X
3B	635	377	-	1M	-	-	-	-	-	-	-	-	X
3D	-	413	-	1T	-	1	-	1	-	-	1	-	X
4B	356	259	2 EG, 1 HUM	-	-	-	3	-	-	-	-	-	X
4D	377	390	EG	1T	1?	-	-	-	-	-	-	-	X
5B	414	436	-	1T	2B, 1M	-	-	-	-	-	-	-	X
5D	657	648	-	-	-	-	1	-	-	1	-	-	X
6B	606	703	2 EE	1 BARB	-	-	-	-	-	-	-	-	X
6D	501	670	EE, RS	-	-	-	-	-	-	-	1	-	X
7B	345	419	EE	-	-	-	-	-	-	-	1	-	X
7D	425	530	-	-	1E	-	-	-	-	-	-	-	X
8B	146	78	-	-	-	-	-	-	-	-	-	-	X
8D	100	92	-	-	-	-	-	-	-	-	-	-	X
	5,173	5,537											
Unit 5, Quad													
B1	88	22	EG	-	-	-	3	-	-	1	-	-	-
B2	434	431	-	-	-	-	1	-	-	-	-	-	-
B3	467	581	-	-	-	-	-	-	-	-	-	-	X
B4	490	506	RS, UNK	1M	PRE	1	-	1	-	-	2	-	X
B5	649	740	-	1B, 1M	2B	-	-	-	-	-	1	-	X
B6	650	801	-	-	-	-	-	-	-	-	-	-	X
B7	455	539	-	1E	-	-	-	-	-	-	-	-	X
B8	200	177	2 EE	1T, 1M	1E	-	-	-	-	-	-	-	X
B9	-	-	-	1KNIFE	1E	-	-	-	-	-	-	-	X
B10	-	-	-	-	-	-	-	-	-	1	-	-	X
	3,433	3,797											

Artifact Assemblage

Chipped Stone Tools

Projectile Points

A total of 82 points was collected at the Broken Arrow site, including 50 from the excavation units and 32 that were isolated finds. The majority of points are manufactured from obsidian (n=76, or 93%), six are made of CCS (7%), and there are no basalt points. The projectile points have been classified according to the system established by Thomas (1981) for the Monitor Valley in central Nevada and Heizer and Hester (1978) for the Great Basin at large. The temporal range of the points is wide (Figure 9.11), ranging from the historic contact period to the early Holocene. Points include one Cottonwood Triangular (1%) nineteen Rose Spring (23%), nine Eastgate (12%), one Rosegate (1%), two Malheur Stemmed (3%), sixteen Elko Corner-notched (20%), seventeen Elko Eared (21%), three Elko Series (4%), two Humboldt (3%), one Northern Side-notched (1%), one Great Basin Stemmed point base (1%), one Pinstem (1%), one leaf-shaped preform and two foliate points (3%), and five that are unclassifiable (6%).

Conspicuous by their absence are Desert Side-notched points. In fact, the absence of these points suggests that the point identified as a Cottonwood Triangular, coeval with Desert Side-notched, may actually be a triangular preform with attributes similar to a Cottonwood Series point. Also missing from the Broken Arrow site are Gatecliff Series points, including Gatecliff Split Stem and Contracting Stem varieties. Oetting (1994) identifies a temporal range of 5,000 to 2,200 BP for the Gatecliff Series. Use of the points ceased approximately 1,200 years before Elko Series points fell out of use. Only one Northern Side-notched point was collected at the Broken Arrow site.

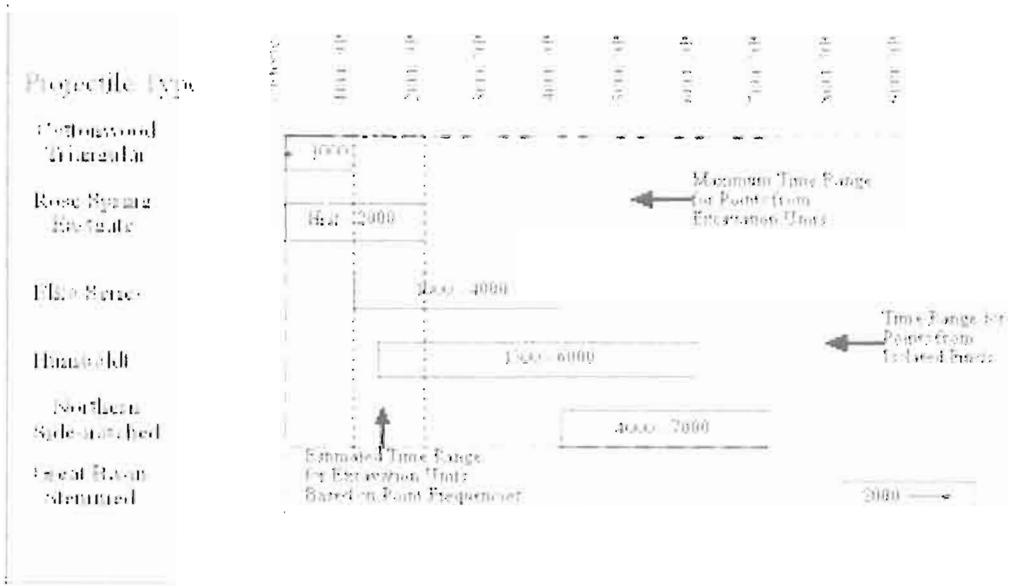


Figure 9.11. Broken Arrow: Temporal distributions of diagnostic projectile point types found at Broken Arrow, after Oetting (1994).

The points collected as isolates have a much broader range of use than those found in the excavations (Figure 9.11). Cottonwood Triangular points were used from 1,000 BP to the historic contact period and Great Basin Stemmed points were utilized between 11,000 to 8,000 BP (Oetting 1994:44). Points found within Units 1 through 5 consisted primarily of twelve Rose Spring (24%), five Eastgate (10%), one Rosegate (2%), twenty-two Elko Series (44%), one Cottonwood Triangular (2%), one Pinstem (2%), three unclassifiable (6%), two foliate points and a leaf-shaped preform (6%), and one Northern Side-notched point (2%). Given the radiocarbon dates between ca. 1,800 to 2,000 BP, the high frequencies of Rose Spring, Eastgate, and Elko points, and the absence of Gatecliff Series and Desert Side-notched points, it is clear that the excavated portion of the Broken Arrow site was occupied between roughly 1,000 to 2000 BP, but the landform on which the site is located has been used intermittently for 8,000 years, at least.

Rose Spring and Eastgate, (or "Rosegate" Points). Rosegate is a derivative term incorporating points previously identified as Rose Spring (Lanning 1963) and Eastgate (Heizer and Baumhoff 1961) into a single classification based on the frequent co-occurrence of these points in many sites. Thomas (1981:19) lumped the Rose Spring (Lanning 1963) and Eastgate (Heizer and

Baumhoff 1961) point types together under one classification, but the two types are clearly dissimilar in both form and distribution, and in this report, Rose Spring and Eastgate are analyzed separately. Rose Spring points are small corner-notched points that commonly have expanding stems, while Eastgate points are basally notched on a triangular or slightly rounded preform, producing barbs or tangs that are even with the base. The term "Rosegate" will be reserved for those points where breakage or retouching limits the ability to discern differences between the two varieties. According to Thomas (1981:19) Rosegate points have a basal width of 10 mm or less, a proximal shoulder angle between 90° and 130°, and a neck width less than or equal to [basal width plus 0.5 mm.]. Twenty-nine points identifiable as Rose Spring (n=19, or 23%), Eastgate (n=9, or 11%) or Rosegate (n=1, or 1 %) were collected from the Broken Arrow site. Included were five Rose Spring, and one Eastgate recovered in Unit 1; four Rose Spring and one Eastgate recovered from Unit 2; one Rose Spring and one Rosegate recovered from Unit 3, one Rose Spring and three Eastgate in Unit 4, and one each of Rose Spring and Eastgate points in Unit 5. Seven Rose Springs and four Eastgates were collected as isolates (Tables 9.4 and 9.5, Figure 9.12)

Rose Spring points were recovered from all of the units and in most excavation levels. Fewer were found in Units 4 and 5, but the two units were considerably smaller than Units 1, 2, or 3. It is interesting to note that Unit 1 had more Rose Spring points and as many Eastgate points as Unit 2, despite the dense concentration of artifacts surrounding the Feature 1 hearth. This pattern held true for all types of projectile points except Northern Side-notched; Unit 1 had as many or more points than Unit 2, and no discernable feature was identified there. The picture changes when Units 4 and 5 are added, particularly with regard to Eastgate points.

Eastgate points were concentrated in the upper levels of Units 1, 4, and 5, with none found deeper than Level 5 (50-60 cm). One was found in Unit 1, three in Unit 4 and one in Unit 5. The point is reiterated here because it is noteworthy that four Eastgate points were recovered from Units 4 and 5, and none from the Unit 2 excavation, indicating that the points represent a localized deposition at the perimeter of the Feature 1 hearth. As was true at Laurie's site, Eastgate points account of 40% of the arrow points recovered from the excavation units.

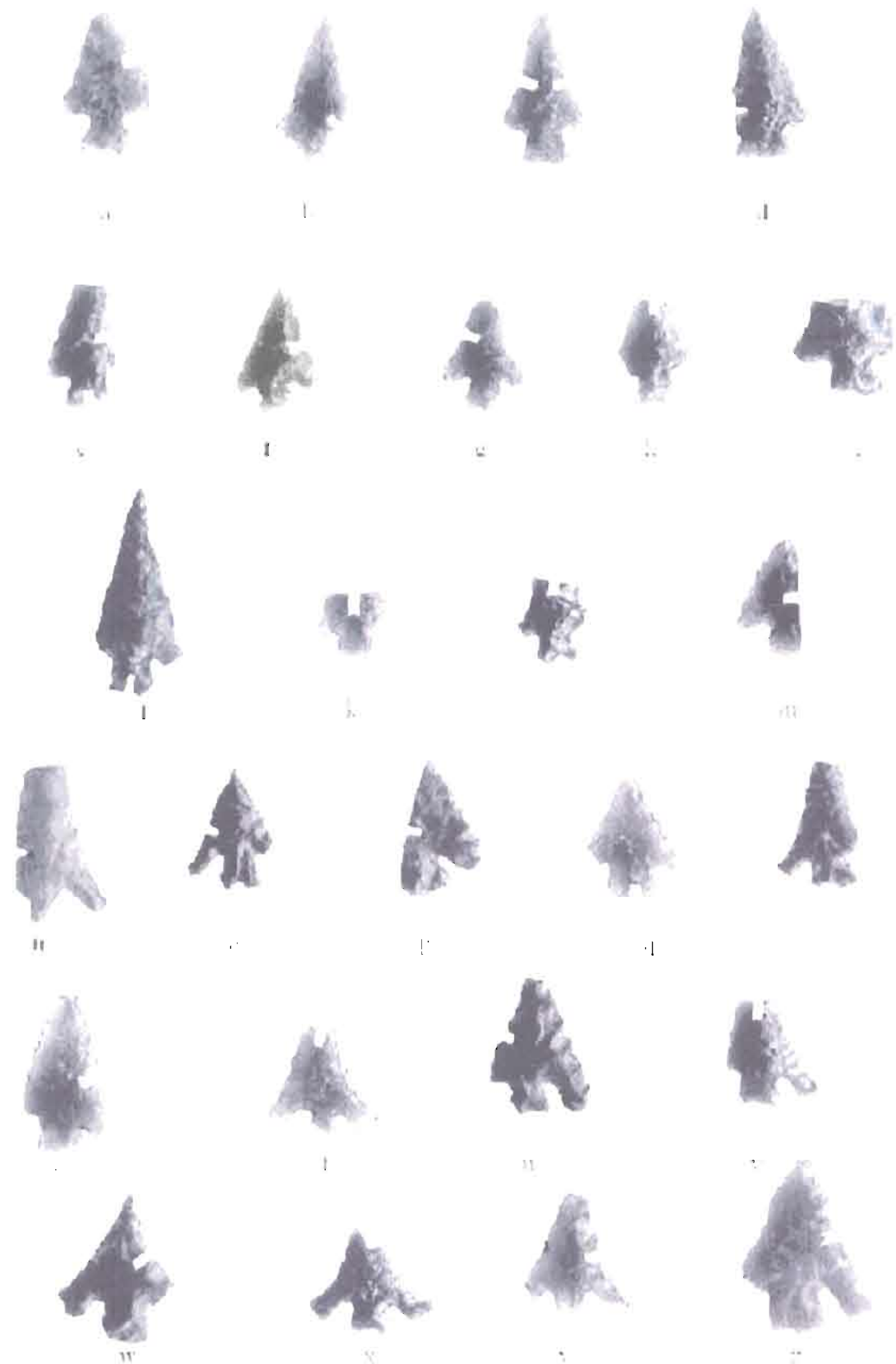
The degree of variability was similar for both point styles. Most had expanding stems but a few had relatively straight stems. The stems terminated with a variety of basal elements, including some of each that were concave, convex, flat, and bifurcated. The size range was considerable for both Rose Spring and Eastgate points, All of the points were manufactured from obsidian.

Of those that were geochemically sourced, Rose Spring points originated from six obsidian sources which included Indian Creek and Indian Creek "B", Double O , Tule Springs, Venator, Eldorado, and Whitewater Ridge. All but the Double O source are located to the north and east of the site. Hydration measurements ranged from 1.2 to 3.9 microns, with a mean of 2.3 microns for 16 measureable specimens. Most of the hydration measurements were grouped between 2.1 and 2.8 microns and the range of measurements differed little between the points collected on the surface and those from the excavations.

Eastgate points came from five sources, including Venator, Indian Creek and Indian Creek "B", Double O, and Whitewater Ridge. The range of hydration measurements is similar to those of Rose Spring points, between 1.2 to 3.3 microns, with a mean of 2.2 microns for ten specimens. One Eastgate point (Specimen 3075-4-B-4a) has two hydration rims of 2.3 and 4.2 microns, presumably due to the manufacture of the point from a curated flake. Only the 2.3 micron rim was used in establishing the mean that is reported above. Eastgate points collected from the surface have a broader range of measurements than those from the excavation units but this is most likely a quirk of sampling, considering that all other point types showed little variation between the measurements for surface artifacts and those collected from the excavations.

Figure 9.12. Broken Arrow projectile points: Rose Spring (a-m);Pinstem (n); Eastgate (o-z); shown actual size.

a. 01-3075-2-B-2-1	b. 01-3075-1-B-1-1	c. 01-3075-2-B-6-1	d. 01-3075-1-B-2-1
e. 02-3075-iso-31	f. 01-3075-2-C-7-1	g. 02-3075-iso-32a	h. 02-3075-iso-32b
i. 02-3075-iso-34	j. 02-3075-5-B-4b	k. 01-3075-1-A-7-2	l. 01-3075-iso-5
m. 01-3075-iso-1	n. 01-3075-3-B-3-1	o. 01-3075-2-B-10-1	p. 01-3075-iso-29
q. 01-3075-3-C-3-1	r. 02-3075-4-D-6-2	s. 01-3075-iso-24	t. 01-3075-5-B-1e
u. 01-3075-iso-8	v. 01-3075-1-A-9-1	w. 02-3075-4-B-4a	x. 02-3075-4-B-4b
y. 01-3075-iso-9	z. o2-3075-4-D-5		



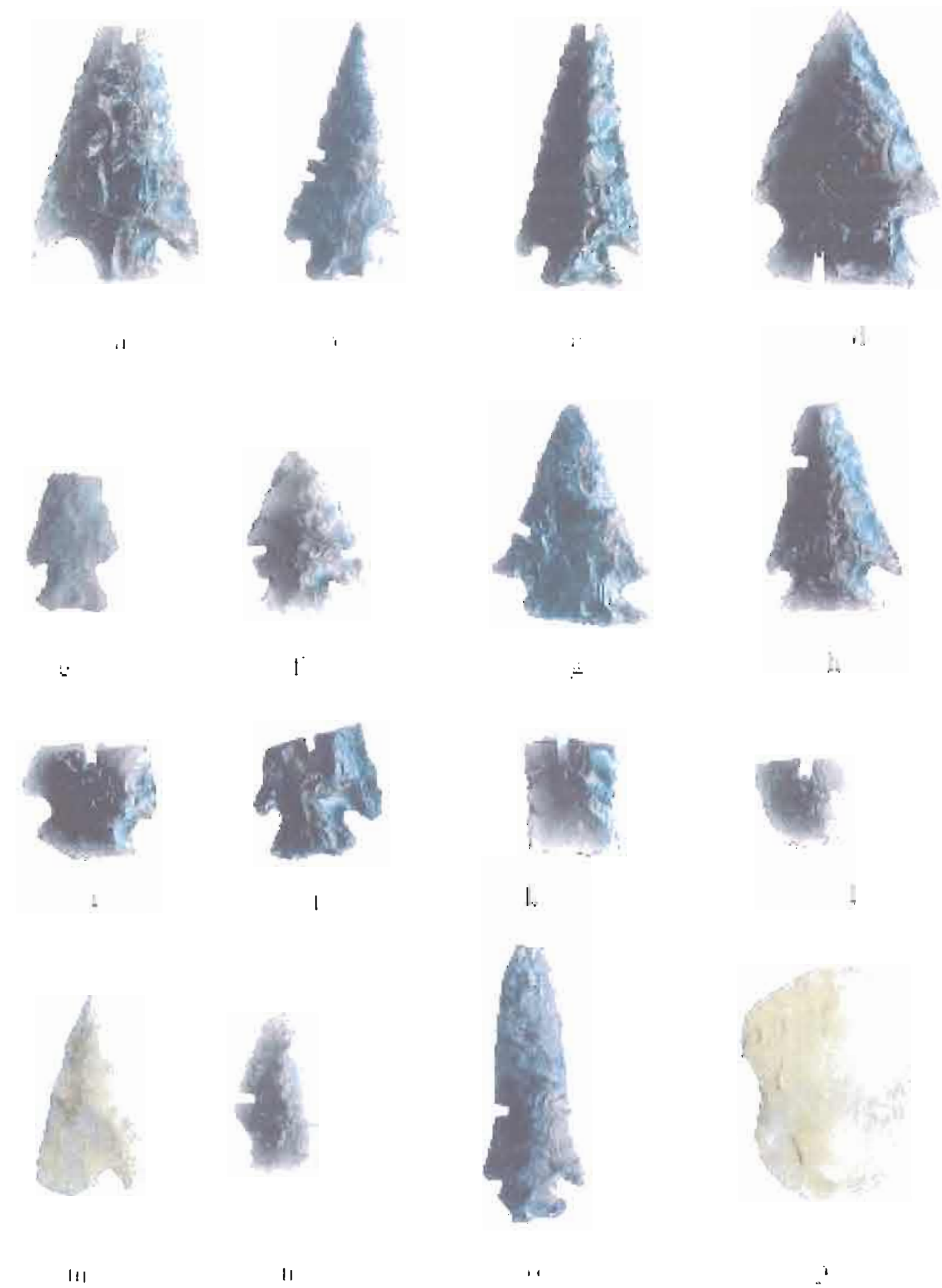


Figure 9.13. Broken Arrow projectile points and hafted tools: Elko Corner-notched, (a-j); Humboldt, (k); foliate, (l); unclassifiable, (m); Cottonwood Triangular (n); Dr, [Dumond and Minor 1983:171](o); Hafted scraper,(p); shown actual size.

a. 01-3075-1-D-4-1	b. 01-3075-1-D-5-2	c. 01-3075-2-B-1-1	d. 01-3075-3-B-2-1
e. 02-3075-iso-6	f. 01-3075-2-B-2-2	g. 01-3075-iso-28	h. 01-3075-iso-10
i. 01-iso-3	j. 01-3075-2-B-4-1	k. 3075-02-4-B-4-2	l. 01-3075-2-C-7-3
m. 01-3075-3-B-8-1	n. 01-3075-P1-5(1)	o. 01-3075-iso-16	q. 01-3075-2-D-2

Figure 9.14. Broken Arrow projectile points: Elko Eared, (a-n); Northern Side-notched, (o); Malheur Stemmed, (p-q); Great Basin Stemmed (t); shown actual size.

a. 02-3075-5-B-8-2	b. 01-3075-1-B-5-1	c. 01-3075-1-D-3-1	d. 01-3075-1-C-6-1
e. 01-3075-2-B-9-1	f. 01-3075-2-D-1-1	g. 01-3075-iso-7	h. 01-3075-iso-19
i. 02-3075-4-B-6b	j. 01-3075-iso-15	k. 02-3075-5-B-8	l. 02-3075-iso-33
m. 02-3075-4-B-7	n. 01-3075-4-B-6a	o. 01-3075-2-C-7-2	p. 01-3075-iso-13
q. 02-3075-iso-35	r. 01-3075-iso-21		

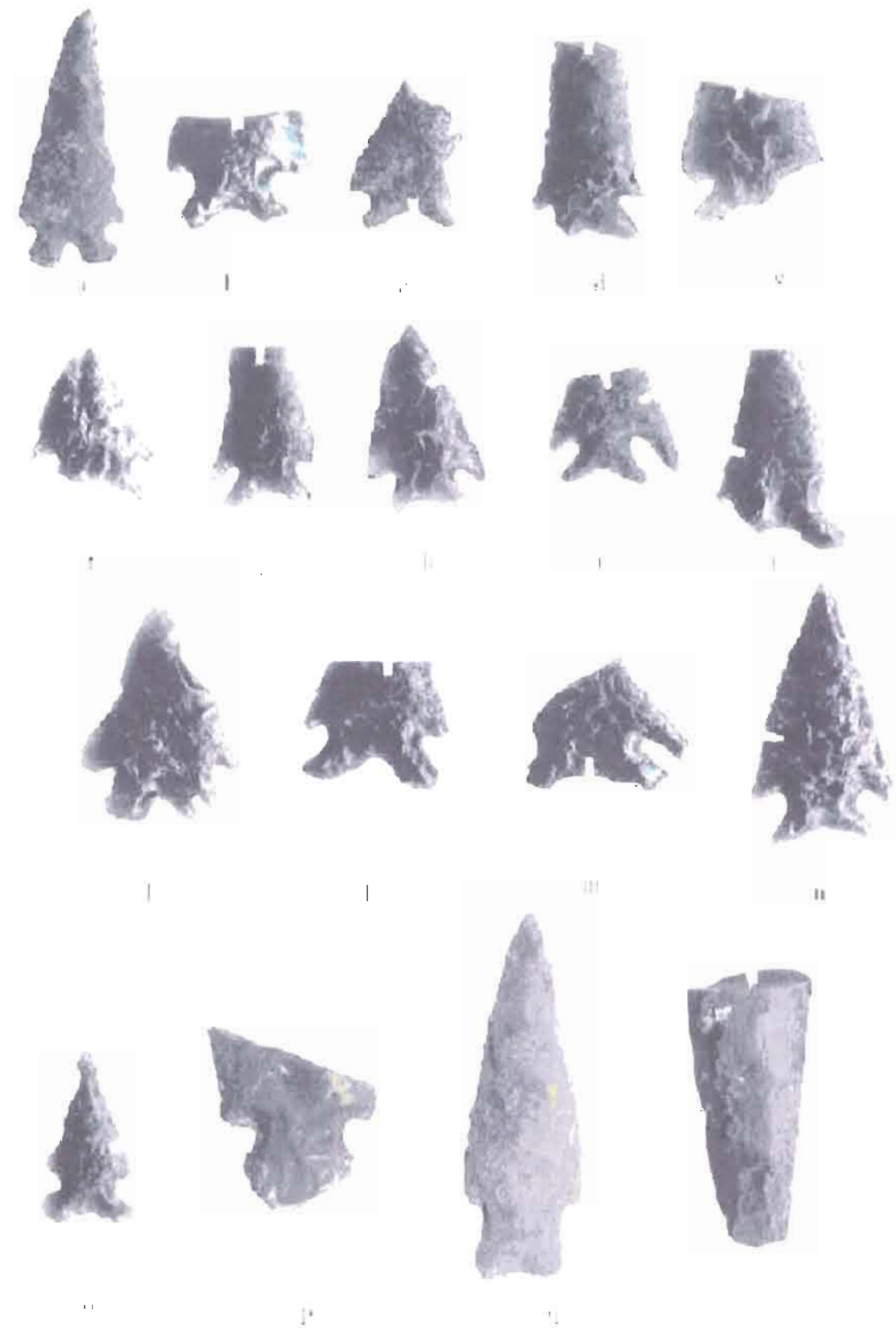


Table 9.4. Metric attributes of Broken Arrow site projectile points from excavation units , in mm.

Artifact	Type	L (mm)	W	Th	Neck W	Wt.(g)	Material
3075-P1-1	leaf	38.8	17.3	7.3	-	5.1	ccs
3075-P1-5(1)	CT	24.1	12.8*	3.05	-	0.8	obs
3075-P1-5(2)	preform	46.35	32.65	5.8	-	9.5	ccs
3075-1-A-6-1	RS	28.4	11.5*	2.85	5.75	0.9	obs
3075-1-A-7-1	EE	30.7	17.1*	4.6	12.7	1.8	obs
3075-1-A-7-2	RS	10.7*	12.6*	2.25	5.15	0.2	obs
3075-1-A-8	RS	6.1*	8.7*	2.2	3.5	0.13	obs
3075-1-A-9-1	EG	16.6*	15.3*	3.5	5.7	0.6	obs
3075-1-B-1-1	RS	24.3	14.1*	2.7	5.75	0.5	obs
3075-1-B-2-1	RS	24.6	12.1*	3.55	7.85	0.9	obs
3075-1-B-5-1	EE	18.1*	24.8	5.7	13.25	2.6	obs
3075-1-B-6	UNK	20.8*	18.0*	4.5	11.1	1.6	obs
3075-1-C-4-1	ECN	19.9*	21.65	3.55	15.0	1.4	obs
3075-1-C-6-1	EE	33.0*	19.25	5.35	11.3	3.1	obs
3075-1-D-3-1	ECN	24.5	21.3*	4.55	13.0	1.9	obs
3075-1-D-4-1	ECN	38.1	24.95	5.35	11.2	4.0	obs
3075-1-D-5-1	HUM	70.45	19.9	6.2	-	7.8	obs
3075-1-D-5-2	ECN	38.75	17.4	4.3	9.75	2.0	obs
3075-2-B-1-1	ECN	38.7*	19.75	4.65	8.45	2.7	obs
3075-2-B-2-1	RS	22.15	14.5*	2.9	5.5	0.7	obs
3075-2-B-2-2	ECN	24.1	18.8*	4.1	8.45	1.4	obs
3075-2-B-4-1	ECN	19.2*	19.6	5.05	8.8	1.6	obs
3075-2-B-6-1	RS	25.05	13.5	2.8	5.35	0.6	obs
3075-2-B-6-2	EE	29.0	19.85	4.7	12.25	1.7	obs
3075-2-B-9-1	ECN	23.3*	24.1*	4.7	-	2.4	obs
3075-2-B-10-1	RS	18.5	15.0*	2.9	4.6	0.4	obs
3075-2-C-7-1	RS	20.2	13.7	3.4	4.4	0.6	obs
3075-2-C-7-2	NSN	29.15	16.15	4.1	8.9	1.3	obs
3075-2-C-7-3	leaf	12.9*	16.1	3.2	-	0.7	obs
3075-2-C-8-1	EE	12.9*	23.6*	5.5	13.5	1.5	obs
3075-2-D-1-1	EE	26.2*	21.6	4.5	12.4	1.7	obs
3075-3-B-2-1	ECN	41.25	28.55	6.8	17.85	6.7	obs
3075-3-B-3-1	PS	24.5*	15.5*	4.2	5.3	1.3	obs
3075-3-B-8-1	UNK	29.45	16.3	3.0	10.0*	1.2	ccs
3075-3-C-3-1	RS	20.7*	17.4*	3.4	7.7	0.69	obs
3075-3-C-4-1	Elko	34.3*	18.7*	4.1	10.7	2.14	obs
3075-3-D-5-3	RG	10.9*	13.7	2.6	-	0.27	obs
3075-02-4-B-4a	EG	22.5	18.7*	3.1	7.0		obs
3075-02-4-B-4b	EG	17.4*	20.0	5.5	2.8		obs
3075-02-4-B-4c	HUM	16.7*	14.0*	5.0	-		obs
3075-02-4-D-5a	EG	22.3	18.0*	3.0	6.0		obs
3075-02-4-B-6a	EE	44.4	25.3	5.2	12.1		obs
3075-02-4-B-7	EE	20.4*	26.7*	4.5	17.7		obs
3075-4-D-6	EE	7.1*	22.6*	3.1	17.2	0.53	obs
3075-4-D-6(2)	RS	19.2	14.0	3.2	5.5	0.56	obs
3075-02-4-B-6b	EE	19.4*	22.6	4.4	9.1	1.39	obs
3075-02-5-B-1	EG	16.6*	17.5	4.2	3.4		obs
3075-02-5-B-4a	UNK	23.4*	17.4	6.2	-		obs
3075-02-5-B-4b	RS	32.8	14.6	2.9	6.5	0.94	obs
3075-02-5-B-8	EE	38.8	28.4	6.0	16.7	3.82	obs
3075-02-5-B-8(2)	EE	43.6	18.2	5.9	11.3	3.53	ccs

* = broken

Table 9.5. Metric attributes of Broken Arrow site projectile points found as isolates, in mm.

Artifact	Type	L (mm)	W	Th	Neck W	Wt.(g)	Material
3075-iso-1	RS	20.05	20.1*	2.7	12.4	0.4	obs
3075-iso-2 -	-	-	2.0	-	-	-	obs
3075-iso-3	ECN	16.7*	20.35	5.05	11.9	1.8	obs
3075-iso-4	EE	16.9*	25.8*	4.8	16.0	2.1	obs
3075-iso-5	RS	13.9*	11.9*	3.2	4.55	0.4	obs
3075-iso-6	ECN	20.0*	14.0	3.05	6.7	0.8	obs
3075-iso-7	EE	26.3*	18.9*	4.55	9.05	1.9	obs
3075-iso-8	EG	21.3	16.3*	3.55	5.5	0.9	obs
3075-iso-9	EG	19.7*	17.2*	2.75	4.4	0.6	obs
3075-iso-10	ECN	30.8*	20.3	4.55	11.0	2.2	obs
3075-iso-11	UNK	33.7*	19.8	6.35	-	3.0	obs
3075-iso-12	Elko	18.7*	12.2*	3.7	-	1.1	obs
3075-iso-13	MS	28.9*	27.0*	7.6	14.65	6.0	ccs
3075-iso-14	ECN	17.8*	18.8*	4.8	10.8	1.9	obs
3075-iso-15	EE	34.2*	20.1*	4.75	14.2	2.8	obs
3075-iso-16	Dr	40.5*	15.7	3.6	8.3	1.9	obs
3075-iso-17	RS	17.4*	11.3*	2.8	4.0	0.5	obs
3075-iso-18	EE	11.8*	17.1*	4.4	4.5	1.0	obs
3075-iso-19	ECN	31.2	20.45	5.15	9.85	2.2	obs
3075-iso-21	stem	47.6*	21.6*	7.6	-	7.6	obs
3075-iso-22	ECN	43.4	20.45	5.1	10.95	2.9	obs
3075-iso-24	EG	25.2*	17.6*	3.8	6.2	1.0	obs
3075-iso-28	ECN	32.4	24.1	4.1	14.25	2.4	obs
3075-iso-29	EG	21.5*	13.7*	3.1	-	0.6	obs
3075-iso-30	Elko	24.9*	22.8	3.95	9.1	1.7	obs
3075-iso-31	RS	19.1*	11.3*	3.1	5.9		obs
3075-02-iso-32a	RS	17.0*	14.0*	2.6	5.0	0.38	obs
3075-02-iso-32b	RS	16.8	11.4*	3.2	5.4	0.49	obs
3075-02-iso-33	EE	21.0*	24.9	5.8	15.9	2.58	obs
3075-02-iso-34	RS	14.6*	16.7	4.5	6.4	1.04	obs
3075-02-iso-35	Mal. St.	62.0	21.2	6.1	13.4	7.11	ccs

* = broken

Elko Series Points. Thirty-six Elko series points (44%) were collected from Broken Arrow, including 17 Elko Eared, 16 Elko Corner-notched points, and 3 fragmented points that can only be attributed to the Elko series (Tables 9.4 and 9.5, Figures.9.13 and 9.14). Elko points have an expected basal width of 10 mm or more, and a proximal shoulder angle between 110° and 150° (Thomas 1981:20-21). Three Elko Eared and four Elko Corner-notched points were collected from both Unit 1 and Unit 2, one Elko Corner-notched and one Elko Series point came from Unit 3, four Elko Eared points were found in Unit 4 and two in Unit 5.

Elko Eared points are large, corner-notched points with a deeply indented base that, in conjunction with the corner-notching, form "ears" for hafting purposes. The basal indentation ratio should be less than or equal to 0.93 (Thomas 1981:21). Elko Corner-notched points are included in the Elko Series and morphologically similar to Elko Eared points, but lack the deep basal indentation that produces the eared appearance, with a basal indentation ratio exceeding 0.93 (Thomas 1981:21). The widest portion of either point is just forward of the base. Both types are coeval.

Like those at Laurie's site, Broken Arrow Elko points display a considerable range in both size and form but most are fairly robust, with broad, lenticular cross-sections. Many have breakage patterns consistent with impact damage. Elko points originate from 11 obsidian sources, and the greatest variation is among the Elko Eared specimens, originating from seven sources. They include three from Indian Creek and two from Indian Creek "B", three from Venator, one from Dog Hill, two from Burns, one from Beatys Butte to the southwest, and one from Whitewater Ridge, originating near Seneca. Two Elko Corner-notched points came from Indian Creek, six from Tule Spring, five from Venator, and one apiece from Double O, Wolf Creek, and Whitewater Ridge. Elko Series points included one each from Indian Creek, Tule Spring, Venator, and Buck Springs. Two clear distinctions were apparent: the high number of Elko Corner-notched points from Tule Springs but the absence of this source in the Elko Eared specimens, and the manufacture of Elko Eared points from Dog Hill and neighboring Burns obsidian, while no Elko Corner-notched points were made of this obsidian.

Obsidian hydration measurements vary considerably for both types of Elko points. The range for Elko Corner-notched points is between 1.5 to 6.4 microns, with a mean of 3.1 microns for 15 specimens. Elko Eared points range from 1.4 to 5.7 microns, and the mean is 3.1 microns for 13 specimens. Some variation was observed when sourcing and hydration information for Elko points was considered for each excavation block. In Unit 1, the mean for all seven Elko points is 3.2 microns and the origins of the obsidian sources are all to the north and east. For Units 2, 4, and 5 combined, the mean of the hydration measurements is 2.8 microns and the sources are primarily northern and eastern with one Double O artifact from west of Harney Lake. Only two Elko points were gathered from Unit 3 for a mean of 2.5, and the two sources were from the north and east

Northern Side-notched. Large side-notched projectile points have been identified by various regional appellations or morphological attributes in the northern Great Basin and southern Columbia Plateau. Specimen 3075-2-C-7-2, recovered from Level 7 of Unit 2, fits the Northern Side-notched classification established by Heizer and Hester (1978) for the Great Basin, having a straight to concave base and notches that are deep and perpendicular to the long axis (Figure 9.14). The typological designation of this point is somewhat troubling because of the substantial degree of resharpening to which it has been subjected. The point could also be an Elko Eared that has been retouched, lending the appearance of side notching as the body of the artifact was modified. Oetting (1994) places Northern Side-notched points between 7,000 to 4,000 years in age in the northern Great Basin. Chronologically, the point is out of place in the ca. 2,000 year-old house pit by about 2,000 years. The point has a hydration rind of 3.9 microns and it originates from the Burns obsidian source, to the northwest.

Pinstem. A single point collected in Unit 3, Quad B, Level 3 can be attributed to the Pinstem series, described by Dumond and Minor as "...characterized by a straight stem that is virtually round in cross-section. The points are contemporary with Rose Spring and Eastgate points and Dumond and Minor (1983:162) associate Pinstem points with the Quinton phase (1000 BP to historic contact) at the Wildcat Canyon site, on the John Day River near its confluence with the Columbia.

Specimen 3075-3-B-3-1 (Figure 7.11) was found in Level 3 of Quad B, Unit 3. The point was recovered in association with Rose Spring, Elko, and Eastgate points. Elko points were utilized until approximately 1000 BP, so it is probable that the Pinstem was deposited at the early end of its time range. The point is manufactured from obsidian originating at the Venator source to the east, and it lacks a measureable hydration reading.

Malheur Stemmed. One complete point (3075-iso-35) and one point base (3075-iso-13) are consistent with Oetting's (!990) guidelines for designation as Malheur Stemmed points (Figure 9.14). Twenty-eight of these points were collected during the post-1980s flood surveys of Malheur Lake and were first described by Oetting (1990:139-144) as lanceolate points with distinctive expanding stems. The length of the basal element is short in comparison with the blade and the stem expands toward the base (Oetting 1990:140). Neck widths range between 7.9 and 19.3 mm. Although some attributes of these points are suggestive of Great Basin Stemmed and other large point types, Oetting (1990:144) noted that most Malheur Stemmed points were found on sites dominated by Rosegate points.

Like the Malheur Lake points described by Oetting (1990), the Broken Arrow site points have distinct expanding stems and shoulders. Specimen 3075-iso-13 has a neck width of 14.65 mm and 3075-iso-35 has a neck width of 13.4 mm, both in keeping with Oetting's (1990:140) dimensional range. Both of the points were collected as isolates and both are manufactured of CCS. Malheur Stemmed points have not been recovered in a radiocarbon-dateable context to date, though 3075-iso-35 was collected six meters south of Unit 5 and it may be associated with the occupation there. The presence of these points at late sites has already been made apparent (Oetting 1990:144) The points also fit the Side Notched 4 category in the Columbia Plateau typology described by Dumond and Minor (1983:171).

Stemmed. One artifact can be classified as a Stemmed point in the tradition of the Western or Great Basin Stemmed series of points dating to the early Holocene (Willig et al. 1988). Specimen 01-3075-iso-21 (Figure 9.14) is a stemmed base manufactured from Venator obsidian. It was found as an isolate.

The lanceolate point has a long, tapering stem leading to a slightly convex bas e, and the artifact exhibits considerable wear that is probably the result of weathering. The edges of the stem appear to be ground, but erosional process may have also had something to do with this alteration. The artifact was submitted for obsidian hydration and was found to have an unreadable hydration rind.

Another artifact has the appearance of a stemmed point, but is believed to be a middle to late Holocene knife. Specimen 02-3075-5-D-9 is a large obsidian biface with weak shoulders offsetting a tapered base. The biface lacks edge grinding of the basal element and it was recovered from the ca. 2000 BP floor deposits in Unit 5, Level 9. The object is made of Dog Hill obsidian and it has a hydration measurement of 4.6 microns.

Humboldt Series. These points are described as "...unnotched, lanceolate, concave-base projectile points of variable size...," by Thomas (1981:17). Two Humboldt Series point fragments were recovered from the Broken Arrow excavations, one in level 5 of Quad D, Unit 1 (3075-1-D-5-1),and the second in Level 4, Quad B, of Unit 4 (3075-02-4-B-4c [Figure 9.13]). The Unit 1 point is a large specimen with a slightly concave base, which originates from the Tule Spring obsidian source. The hydration band is 4.6 microns in width; only ten other projectile points at Broken Arrow have hydration readings exceeding four microns. The Unit 4 Humboldt has a base that appears almost flat, although a slight concavity can be discerned upon closer examination. The point is made of Wolf Creek obsidian and it has a hydration reading of 2.5 microns.

Unknown. Four artifacts recovered from Broken Arrow are clearly projectile points, but lack the diagnostic attributes that would make them typologically classifiable. They include specimens 3075-1-B-6, 3075-3-B-8-1, 3075-02-5-B-4a, and 3075-iso-11. All are Stage 5 bifaces and they were clearly designed for hafting, but they are either resharpened fragments of broken points utilized expediently, or they are points that were simply manufactured without attention to characteristic hafting elements or common design touches.

At least one "unknown" point came from each excavation block and one was collected as an isolate. Specimen 3075-iso-11, the isolate, appears to be a reworked waste flake that is somewhat amorphously shaped but has a small projection for hafting purposes. The artifact has a hydration reading of 4.5 microns and it is manufactured from Whitewater Ridge obsidian. Specimen 3075-1-B-6-1 is believed to be part of a large projectile point base that was modified into a projectile point and either broken during the process or during use. The Unit 3 point, 3075-3-B-8-1, is a small, foliate point akin to Thomas' (1981:16) Cottonwood Leaf-shaped points with a flat base. Obsidian sourcing and hydration analysis was conducted on the artifact but the results are not available at this time. Specimen 3075-5-B-4a is an obsidian base with a broad, lenticular cross-section. It may be the basal element of a heavy projectile point or possibly a drill or awl base. The artifact came from the Venator obsidian source and it has a hydration measurement of 2.0 microns.

Shaped Bifaces

This treatment uses the multi-stage biface classification system employed by Jenkins and Connolly (1990) at the Indian Grade Spring site in the Stinkingwater Mountains near Buchanan. Stage 1-5 bifaces are discussed here (Table 9.6). Stage 5 bifaces are generally classified as projectile points, and all diagnostic point fragments have been treated separately in a previous portion of the text. Few of the Broken Arrow site bifaces are complete, and those which are broken are considered in terms of a generalized leaf-shaped biface morphology. With this template in mind, tips are pointed and are thought to be the distal end of the artifact. Bases usually have rounded or slightly convex squared ends and are thought to be the proximal portion of the artifact. Midsections are frequently tapered to some degree, but can be straight-sided. Certainly not all bifaces have rounded bases, pointed tips, and show clear signs of tapering, but it seems most utilitarian for descriptive purposes to emphasize the shape of a common artifact form when only fragments exist. The function of the bifaces can only be implied, but they often served multiple purposes ranging from cutting implements to cores for the manufacture of projectile points and other tools.

A total of 125 biface fragments was recovered from the Broken Arrow site, all but one (3075-iso-1) from the excavations. They include two Stage 1, eighteen Stage 2, fourteen Stage 3, thirteen Stage 4, and seventy-eight Stage 5 bifaces (Table 9.6, Figures 9.15 and 9.16). Obsidian tools account for 106 of the 124 bifaces (85%) and 9 are made of CCS and ten of basalt. The

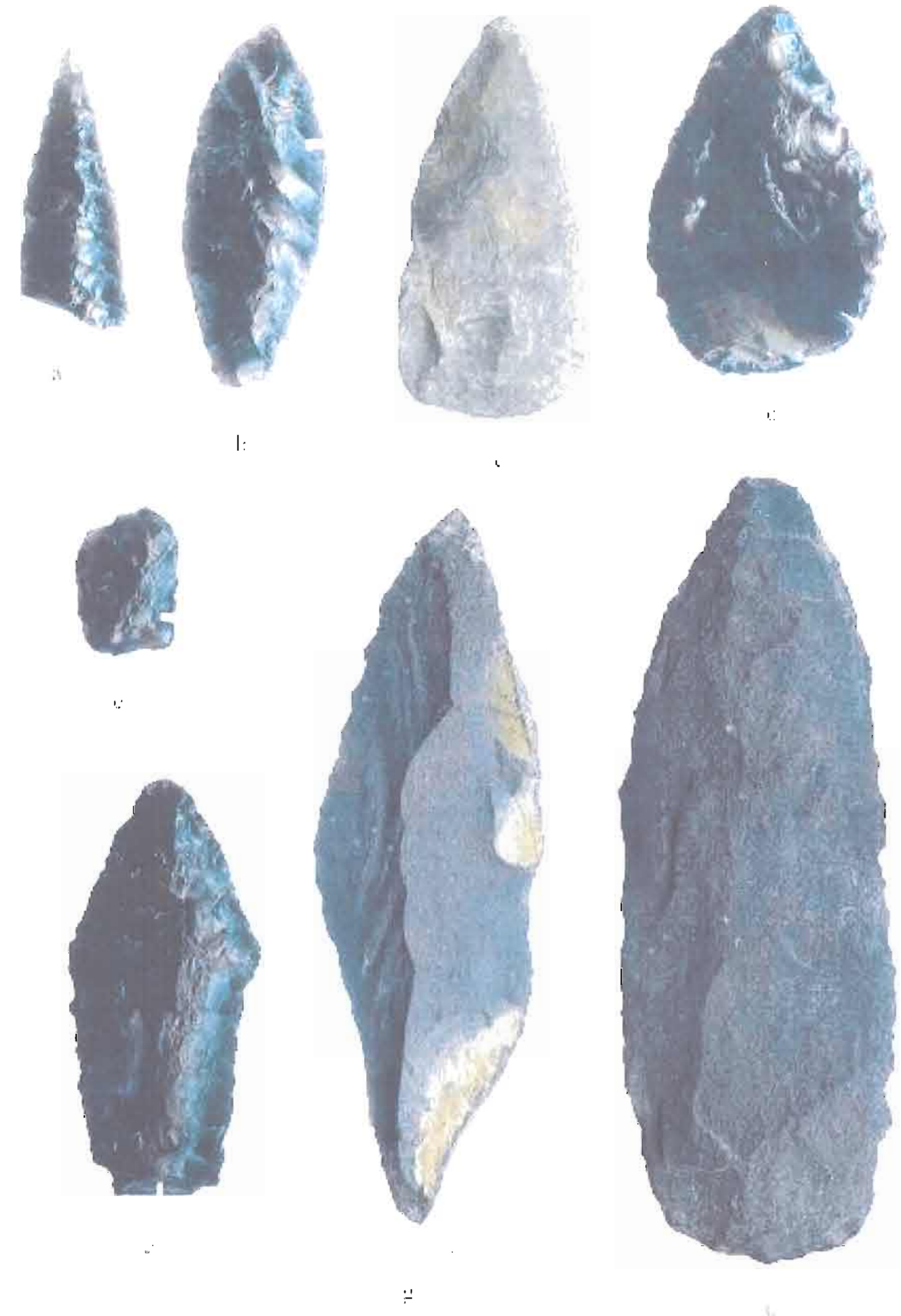


Figure 9.15. Broken Arrow bifaces, shown actual size.
a. 01-3075-3-C-6-1 b. 01-3075-2-D-5-1 c. 01-3075-2-A-1-1 d. 02-3075-4-D-6
e. 02-3075-iso-6 f. 02-3075-5-D-9 g. 02-3075-5-B-5 h. 02-3075-4-D-5b

Stage 5 artifacts consist almost entirely of projectile point fragments, of which 32 are tips (41%), 10 are midsections (13%), 12 are barbs (15%), 9 arebase fragments (11%), 8 are edge fragments (10%), 2 are tangs (3%), 2 are unidentifiable fragments (3%) and 3 are complete, but nondiagnostic bifaces (4%).

The only two Stage 1 bifaces found at Broken Arrow were collected in Unit 5, a 1x1 meter unit. Although more variation occurred when sample sizes were smaller, the frequency of the various biface stages remained fairly consistent from unit to unit across the site. Stage 5 bifaces composed between 58% to 65% in any unit, Stage 2 bifaces were generally the second most common, with frequencies ranging between 7% to 20%, and Stage 3 and 4 bifaces generally occurred in similar frequencies. When Units 2, 4, and 5 totals are combined, the frequencies of the biface stages in the three dispersed excavation blocks (Unit 1; Units 2,4,and 5; and Unit 3) are very similar. The high frequency of Stage 2 bifaces may be due to their utility as bifacial cores, easily carried from the quarry to the lakeside site and capable of serving multiple purposes.

Stage 1 bifaces. These bifaces have thick cross-sections and large, unpatterned flake scars. They exhibit only the most rudimentary development, with rounded or thick lenticular shapes and cross-sections. The flaking pattern reflects use of the hard hammer percussion technique, and the edges of these tools can be very sinuous. Two of the bifaces recovered from Unit 5 excavations reflected Stage 1 reduction. One base fragment made of red CCS was collected in Quad B, Level 5 (02-5-B-5[3]), associated with one Stage 2 and two Stage 5 bifaces. An obsidian Stage 1 base fragment was collected from the Level 9 floor deposits.

Stage 2 bifaces. Bifacial thinning is continued on these artifacts through the removal of contiguous hard hammer percussion flakes. The removal of the flakes results in the development of an artifact, which, although still crudely shaped, has a more pronounced form than stage 1 artifacts. Stage 2 bifaces are considered to be quarry blanks. Seventeen artifacts fit this classification. Four were collected from Unit 1, five from Unit 2 and Unit 3, one from Unit 4 and

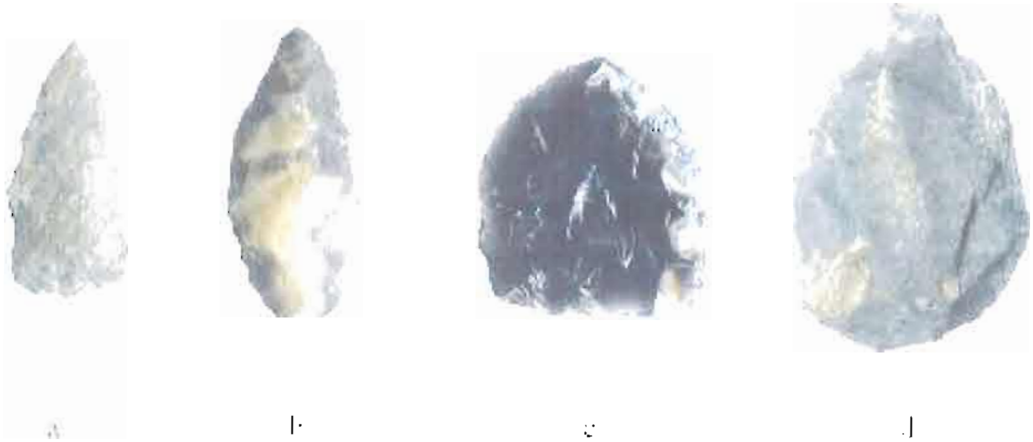


Figure 9.16. Additional bifaces from the Broken Arrow site, shown actual size.
a. 01-3075-1-A-9-2 b. 01-3075-P1-1 c. 02-3075-2-A-1 d. 01-3075-P1-5-2

two from Unit 5. Two of the Unit 1 bifaces were made of basalt and the other two were obsidian; the Unit 2 artifacts included one of basalt, one CCS, and three of obsidian; the Unit 3 tools consisted of four of obsidian and one of CCS; and all but one of the artifacts in Units 4 and 5 are obsidian. The exception is a large basalt bifacial core (02-3075-4-D-5b) which has also been utilized as a knife (Figure 7.14). The artifact was geochemically sourced to explore a possible relationship between it and the basalt tools of the RJ site (35HA3013). The Unit 4 knife is not related, and the geochemical source is provisionally identified as Unknown Basalt 1. Stage 2 and Stage 5 artifacts exhibit the greatest variety in tool stone, a fitting relationship if the former was being transported to the site for manufacture of the latter.

Stage 3 bifaces A total of 14 bifaces and fragments fit this classification, 11 of which are obsidian, two are CCS, and one is basalt. These bifaces exhibit little evidence of pressure flaking and have the slightly sinuous edges characteristic of large percussion flake scars created by the initial stages of bifacial reduction. The entire artifact surface has been modified through the removal of flakes which can reach the middle of the artifact. It is at this stage that major thinning of the artifact occurs, often leading to breakage. A majority of the Stage 3 tools (n=12, or 86%) are broken and include edges, midsections and bases. Stage 3 artifacts often exhibit fine pressure flaking along some edges, with varying degrees of percussion flaking along other edges and across the body of the artifact.

Table 9.6. Metric attributes of Broken Arrow site bifaces and fragments, in mm and grams.

Artifact	Type	L	W	Th	Wt	Notes
01-1-A-1-1	St. 5	7.3	6.1	1.9	0.06	obs proj pt barb
01-1-A-2-1	St. 5	8.8	6.2	1.4	0.05	obs proj pt barb
01-1-A-2-1	St. 5	10.3	9.0	2.2	0.15	obs proj pt frag
01-1-A-2-2	St. 4	21.2	9.0	5.3	2.2	obs square base preform
01-1-A-4-2	St. 5	11.9	8.9	2.4	0.22	bas proj pt midsection
01-1-A-5-1	St. 5	11.8	7.0	1.9	0.14	obs proj pt tip, small pt
01-1-A-7	St. 5	4.0	3.0	1.1	0.01	obs proj pt tip
01-1-A-7-4	St. 2	22.3	24.4	7.5	3.81	obs rounded base quarry blank
01-1-A-7-6	St. 5	8.6	9.6	2.8	0.16	obs proj pt tip
01-1-A-7-11	St. 4	14.9	28.2	5.3	2.07	obs rounded base
01-1-A-8-1	St. 4	25.8	16.4	5.8	1.66	obs tip frag
01-1-A-9-2	St. 5	33.1	15.9	4.0	1.84	complete beige ccs preform
01-1-A-9-8	St. 2	54.4	43.0	26.9	45.22	bas pointed base of lg bifacial core
01-1-A-9	St. 5	7.7	8.2	2.2	0.12	obs proj pt barb
01-1-B-2	St. 4	28.4	31.2	5.8	5.1	obs triangular base
01-1-B-3-1	St. 5	7.2	7.6	2.2	0.05	bas proj pt tip
01-1-B-4-1	St. 5	9.0	3.9	1.3	0.03	obs proj pt tip, small pt
01-1-B-5	St. 5	7.1	7.9	2.5	0.10	obs proj pt tip
01-1-B-5(2)	St. 5	5.0	4.5	1.9	0.12	obs proj pt barb, small pt
01-1-B-6	St. 5	4.5	3.4	1.3	0.01	red obs proj pt tip
01-1-B-6-1	St. 5	11.4	7.2	2.0	0.11	obs proj pt tip, small pt
01-1-C-4	St. 2	16.0	31.5	8.3	4.82	obs edge frag
01-1-C-4-2	St. 5	7.2	5.0	1.7	0.05	obs proj pt tip
01-1-C-6	St. 3	32.7	9.3	9.3	2.05	obs edge frag
01-1-C-6(2)	St. 5	4.3	3.5	1.9	0.01	obs proj pt barb
01-1-C-6-1a	St. 5	8.9	12.9	3.8	0.38	obs rounded base frag, small biface
01-1-C-7	St. 3	54.7	35.6	9.0	16.29	beige ccs rounded base
01-1-C-8	St. 3	30.5	43.4	7.4	10.79	bas pointed base
01-1-D-3	St. 2	11.8	18.4	6.6	1.3	bas rounded base frag
01-1-D-5	St. 5	10.1	7.0	3.3	0.27	obs proj pt barb
01-2-A-1-1	St. 3	67.0	31.8	7.9	16.91	brown ccs preform, complete
01-2-A-3	St. 5	12.5	7.5	3.9	0.32	obs proj pt edge frag
01-2-A-3(2)	St. 5	9.2	12.6	3.5	0.39	obs proj pt edge frag
01-2-A-4-1	St. 2	29.2	45.2	9.4	15.85	bas rounded base frag
01-2-A-5-1	St. 5	21.0	9.5	3.9	0.54	obs proj pt tip, large pt
01-2-A-5-4	St. 2	18.3	28.4	6.7	2.34	obs pointed base
01-2-A-6	St. 5	5.7	8.1	2.9	0.09	obs proj pt barb
01-2-A-6(2)	St. 5	4.7	4.4	1.7	0.01	obs proj pt tip
01-2-A-7-1	St. 5	18.7	14.5	2.6	0.58	obs proj pt tip, large pt
01-2-A-7-6	St. 5	4.3	6.0	1.4	0.04	obs proj pt midsection, small pt
01-2-A-8-1	St. 3	23.3	37.9	6.9	5.75	obs rounded base frag
01-2-B-1	St. 5	6.5	4.2	1.6	0.02	obs proj pt tip
01-2-B-2	St. 5	6.9	10.02	2.5	0.15	obs proj pt tip
01-2-B-3	St. 3	21.8	19.3	8.7	2.19	bas rounded base frag
01-2-B-4	St. 5	19.7	4.7	3.8	0.43	white ccs edge frag
01-2-B-4(2)	St. 5	6.4	10.0	2.6	0.14	obs proj pt base frag
01-2-B-4(3)	St. 5	11.0	3.7	2.5	0.04	obs proj pt tip, small pt
01-2-B-4(4)	St. 5	4.8	4.7	1.7	0.04	obs proj pt tip, small pt
01-2-B-7-1	St. 5	22.6	16.6	3.7	1.06	obs proj pt tip, lg pt
01-2-B-8	St. 5	8.5	7.1	2.5	0.12	obs proj pt barb
01-2-B-8-1	St. 4	41.4	36.1	9.4	14.77	obs midsection of large knife
01-2-B-8-2	St. 5	13.8	18.2	5.3	0.93	obs edge frag
01-2-B-9-2	St. 4	17.8	23.6	5.9	3.2	obs midsection

Table 9.6 (continued). Metric attributes of Broken Arrow site bifaces and fragments, in mm and grams.

Artifact	Type	L	W	Th	Wt	Notes
01-2-C-2	St. 5	8.5	8.0	2.5	0.09	obs proj pt barb
01-2-C-2(2)	St. 3	8.2	6.1	3.6	0.39	obs edge frag
01-2-C-2-1	St. 5	22.6	13.5	5.2	1.81	bas rounded base, poss proj pt
01-2-C-3	St. 5	23.6	28.4	7.5	5.49	white/gray chert square base
01-2-C-3(2)	St. 5	7.9	5.0	2.4	0.08	obs proj pt tang
01-2-C-4-2	St. 5	8.3	9.5	2.6	0.15	obs proj pt tip, lg pt
01-2-C-4-2(2)	St. 5	16.2	19.0	4.7	1.62	obs edge frag, probably lg proj pt
01-2-C-5	St. 4	15.1	22.2	4.3	1.69	obs square base preform frag
01-2-C-6	St. 5	7.2	7.1	4.0	0.20	obs edge frag
01-2-C-6-1	St. 5	7.4	6.0	2.1	0.06	obs proj pt tip
01-2-C-8-5	St. 4	21.2	27.5	6.4	4.3	obs square preform base
01-2-C-9	St. 5	7.6	11.4	4.5	0.41	obs edge frag
01-2-C-9-1	St. 3	19.7	21.0	4.5	2.03	obs edge frag
01-2-C-9-2	St. 2	36.2	36.0	8.7	11.3	orange ccs rounded base
01-2-D-3	St. 5	6.5	8.0	2.5	0.09	obs proj pt tip
01-2-D-3-1	St. 2	23.0	16.1	6.3	2.06	obs edge frag
01-2-D-3(2)	St. 4	8.5	8.8	6.5	2.53	bas rounded base
01-2-D-4-2	St. 5	10.0	12.2	3.1	0.34	obs proj pt base frag
01-2-D-5-2	St. 4	16.4	17.8	4.4	1.08	obs porj pt midsection, large pt
01-2-D-5-1	St. 5	60.85	23.4	8.4	11.6	obsidian foliate biface
01-2-D-6-1	St. 5	8.2	7.4	1.9	0.08	obs proj pt tip
01-2-D-6-2	St. 2	60.0	23.5	5.5	9.53	obs rnd base, ¾ of quarry blank
01-3-A-2-1	St. 5	31.3	17.6	6.2	3.53	obs proj pt midsection, large pt
01-3-A-4	St. 2	24.3	42.2	9.7	7.84	obs midsection, near base
01-3-A-4-1	St. 3	40.5	26.9	9.8	10.43	obs midsection, med-sized biface
01-3-A-4-2	St. 5	27.0	17.8	4.9	2.08	obs tip frag
01-3-A-6-1	St. 5	12.2	13.9	3.3	0.72	obs proj pt midsection, large pt
01-3-B-2-2	St. 5	6.9	6.4	2,4	0.09	obs proj pt barb
01-3-B-2-2(2)	St. 4	15.6	14.8	7.1	1.21	obs edge frag
01-3-B-3	St. 5	8.8	7.0	3.6	0.24	obs proj pt or drill midsection
01-3-B-3-2	St. 5	9.7	10.0	2.8	0.28	obs proj pt midsection
01-3-B-6-1	St. 5	18.6	15.2	5.0	1.03	obs proj pt midsection
01-3-B-6-2	St. 4	29.6	27.1	7.8	4.76	obs edge frag
01-3-B-9-4	St. 2	21.3	39.0	13.4	7.68	white translucent ccs rounded base
01-3-C-1-1	St. 5	8.0	5.7	2.8	0.9	obs proj pt tip
01-3-C-2-1	St. 2	49.4	28.2	9.7	16.33	lg obs knife midsection
01-3-C-4	St. 5	11.2	11.4	4.1	0.49	obs square base frag
01-3-C-5	St. 5	5.0	4.0	1.5	0.04	obs proj pt tang
01-3-C-6-1	St. 5	47.1	18.3	6.8	4.64	obs proj pt frag, large pt
01-3-D-3	St. 2	12.1	25.8	7.6	1.79	obs base frag
01-3-D-3(2)	St. 3	7.4	8.5	6.9	0.72	obs edge frag
01-3-D-3(3)	St. 5	4.2	6.5	1.8	0.05	obs proj pt base frag, small pt
01-3-D-5-1	St. 2	33.0	34.4	7.1	8.13	obs lg tip frag
01-3-D-6-1	St. 5	24.5	21.4	3.9	1.76	obs lg tip frag
01-3-D-6-2	St. 5	14.8	14.4	3.2	0.55	obs proj pt tip, lg pt
01-iso-1	St. 5	16.1	7.3	2.0	0.19	obs proj pt tip

Table 9.6 (continued). Metric attributes of Broken Arrow site bifaces and fragments, in mm and grams.

Artifact	Type	L	W	Th	Wt	Notes
02-4-B-2	St. 5	18.2	5.8	1.8	0.14	obs proj pt tip
02-4-B-3	St. 5	20.4	17.2	6.8	1.81	obs midsection
02-4-B-5	St. 2	21.0	30.4	8.7	4.3	obs rounded base frag
02-4-B-5(2)	St. 5	10.4	6.5	2.6	0.01	obs proj pt tip, small pt
02-4-B-5(3)	St. 3	12.9	26.2	4.7	1.73	obs midsection
02-4-B-5(4)	St. 4	25.2	20.7	6.4	2.69	beige ccs square base
02-4-B-6	St. 5	6.0	7.3	2.8	0.09	obs proj pt barb
02-4-D-2	St. 3	28.6	17.0	5.3	3.22	obs rounded base and edge frag
02-4-D-2(2)	St. 5	10.7	6.9	2.2	0.12	obs proj pt tip
02-4-D-2(3)	St. 5	6.9	3.7	1.8	0.05	obs proj pt barb
02-4-D-3	St. 5	5.3	5.1	2.2	0.05	obs proj pt tip
02-4-D-4	St. 5	17.5	8.8	3.3	0.36	obs proj pt tip
02-4-D-5b	St. 2	-	-	-	-	lost before measurement
02-4-D-7	St. 3	29.8	28.9	6.3	6.27	obs edge frag
02-5-B-4	St. 3	35.9	16.7	4.6	3.0	obs preform frag,
02-5-B-4(2)	St. 5	17.0	3.8	4.0	0.74	obs proj pt midsection, lg pt
02-5-B-5	St. 5	8.1	13.7	4.4	0.37	obs proj pt base frag
02-5-B-5(2)	St. 2	35.9	37.6	8.3	11.73	obs rounded base edge frag
02-5-B-5(3)	St. 1	22.1	55.9	16.4	19.61	red ccs rounded base frag
02-5-B-5(4)	St. 5	27.7	16.4	5.5	2.60	obs midsection
02-5-B-7	St. 5	10.3	15.0	6.2	0.66	obs edge frag
02-5-B-8	St. 5	12.8	10.0	2.8	0.31	obs proj pt midsection, lg pt
02-5-B-8(2)	St. 5	17.2	10.7	2.4	0.41	obs proj pt tip, lg pt
02-5-B-8(3)	St. 2	22.6	31.2	8.4	5.43	obs edge frag
02-5-B-9	St. 1	25.5	28.3	9.6	6.38	obs pointed base frag
02-5-B-9	St. 5	69.7*	31.9	8.8	18.98	obs knife , broken base

Stage 3 bifaces were collected from all of the units including three from Unit 1, five from Unit 2, two from Unit 3, three from Unit 4 and one from Unit 5. Most appear to be knife fragments rather than bifacial cores, and two were brought to the site as preforms to be made into other tools (specimens 01-2-A-1-1 [Figure 9.15]and 02-5-B-4). The tools are scattered through the deposits enveloping the Feature 1 hearth and Feature 2 compacted clay surface. Those found in association with the two features consist of small fragments. Stage 3 bifaces are concentrated in the lower levels of Unit 1 (levels 6 through 8) and in the upper levels of Unit 3 (levels 3 and 4). None of the Stage 3 artifacts were submitted for obsidian sourcing and hydration studies.

Stage 4 bifaces. The continuation of percussion and pressure flaking techniques after Stage 3 results in bifaces with a more "finished" appearance than Stage 3 tools. Pressure flakes can reach the midline of the artifact or beyond, and frequently eliminate the large percussion flake scars from earlier reduction. Edges are strengthened by the removal of pressure flakes which increase the edge angle. Thirteen Stage 4 artifacts were collected from the Broken Arrow site, including seven bases, one tip, two edge fragments, and three midsections. The Stage 4 bifaces from the Broken Arrow site also included a fragment from a large projectile point (01-2-D-5-2) and a preform (01-2-C-8-5). The majority of the bifaces were collected from the lower deposits (Level 5 and below) in Units 2, 4 and 5, and several (01-2-C-8-5, a square preform base of CCS; 01-2-B-8-1, an obsidian knife midsection; and 01-2-B-9-2, a midsection of obsidian) are associated with the Feature 1 hearth.

Projectile Point Fragments (Stage 5)

Most of the Stage 5 bifaces and fragments recovered from the Broken Arrow site were probably from arrow and dart points. The projectile points discussed earlier are Stage 5 bifaces that have diagnostic attributes. This section deals primarily with fragments (Table 9.6). The numerous broken fragments probably resulted during manufacturing or resharpening of tools. Of the 78 artifacts, only two were complete, including a large, foliate biface (01-2-D-5-1[Figure 9.15]) and a small CCS triangular preform (01-1-A-9-2[Figure 9.16]). A shouldered knife, 02-5-D-9, is missing a portion of the base (Figure 9.14).

Most of the Stage 5 fragments (n=63, or 81%) were recovered from Levels 1 through 6 in all of the excavation units. Most of the fragments were tips (n=32, or 41%), followed by barbs (n=12, or 15%), midsections (n=11, or 14%), edge fragments (n=8, or 10%), tangs (n=2, or 3%), unidentifiable fragments (n=2, or 3%) and bases (n=8, or 10%). Edge fragments were only found in the three excavation units associated with the Feature 1 hearth and Feature 2 compacted clay surface (Units 2, 4, and 5). The Unit 4 and 5 artifacts may be under-represented to some degree because lithic mass analysis was not conducted on debitage from the two units. Many of the small tool fragments from Units 1, 2, and 3 were encountered during close analysis of the debitage.

The large, shouldered knife and the foliate biface mentioned previously were submitted for obsidian sourcing and hydration analysis. The knife, Specimen 02-5-D-9, originated from the Dog Hill source near Burns and produced a hydration reading of 4.6 microns. Both the Dog Hill and Burns sources are fast hydrators (Appendix #), so the relatively large hydration band is not necessarily indicative of an early occupation at the site.

The foliate biface, 01-2-D-5-1, was made of tool stone from the Venator obsidian source, to the east. The hydration reading is 4.6 microns.

Drills or Awls

The eight drills included six recovered from the excavations at Units 2, 4 and 5 and two that were isolated finds. There is considerable variety among the eight specimens and some appear to have been utilized as hafted tools while others were probably hand held (Figure 9.17, Table 9.7). One specimen (01-3075-iso-23) is made of basalt, two (01-3075-iso 20 and 02-3075-iso-4) are made of obsidian, and the other five are CCS.

Three of the drills are relatively straight-stemmed. Artifact 01-3075-2-C-7-4 is a complete awl, made of CCS, with considerable wear apparent on the tip. The basalt awl, 01-3075-iso-23, is also complete and has a narrow base that tapers distally towards the tip. The third specimen, 01-3075-3-B-5-1, is a large CCS awl that appears to be broken at midpoint. The basal element expands slightly and has two shallow notches on opposing sides that may either be for hafting or for gaining better purchase during heavy-duty activities.

Two broad-based drills also appear to have been hand-held tools. Specimen 01-3075-2-A-7-2 is manufactured of CCS and missing a small portion of the tip, but is otherwise complete. Specimen 02-3075-4-D-3 is missing part of the base and tip, but it is quite similar to the previously mentioned artifact. It has "potlids" at various places which may be evidence that the tool stone was heat-treated prior to manufacture.

Two drills were clearly designed for hafting. Specimen 02-3075-5-B-4 is an obsidian tool that is very similar to a white CCS drill surface-collected at the Hoyt site, and found with some regularity at long term campsites throughout the Northern Great Basin. The other obsidian drill, Specimen 3075-iso-20 was collected as an isolate and may have been fashioned from a concave-based projectile point. The artifact was submitted for obsidian sourcing and hydration and was found to originate from Indian Creek obsidian, with a hydration measurement of 6.6 microns. One other artifact (3075-iso 28), an Elko Corner-notched point also made of Indian Creek obsidian, had a measurement of 6.4 microns. The two are the only artifacts found at Broken Arrow with hydration rims exceeding six microns, and they may both relate to a single occupation event.

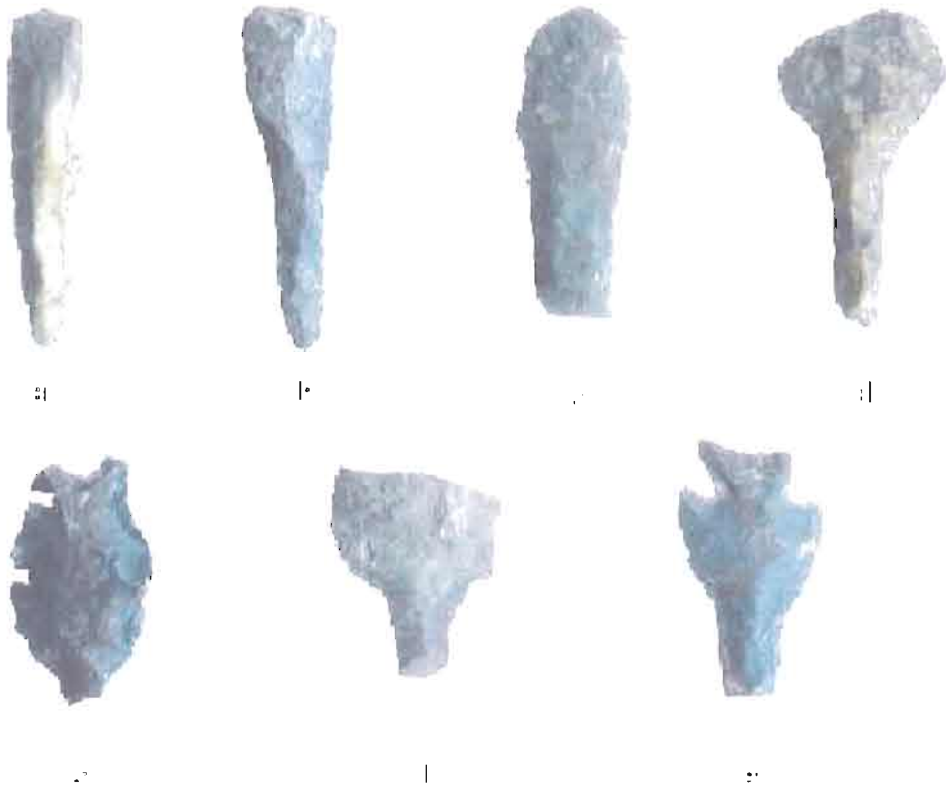


Figure 9.17. Broken Arrow site: Selected drills and awls, shown actual size.

a. 01-3075-2-C-7-4 b. 01-3075-iso-23 c. 02-3075-3-B-5-1 d. 01-3075-2-A-7-2
e. 3075-iso-20 f. 02-3075-4-D-3 g. 02-3075-5-B-4

The recovery of several styles of drills and awls in association with the two cultural features suggests that activities occurring at the location were varied and probably time-consuming, and required long duration occupations. These are the kinds of tools that would be expected where clothing, basketry, and woodworking activities might be occurring, not the common fare of tool kits found at short term sites associated with highly mobile populations in search of seasonally available resources.

Table 9.7. Metric attributes of drills from the Broken Arrow site.

Artifact	Type	L	W	Th	Wt	Notes
01-2-A-1-2	ccs	8.6	7.9	4.3	0.31	green ccs midsection of drill shaft
01-2-A-7-2	ccs	41.2	22.4	8.3	5.3	brown ccs hand-held drill, complete save for small portion of base
01-2-B-5-1	ccs	41.0*	15.6	6.2	4.69	gray ccs hafted drill, broken approx at midpoint
01-2-C-7-4	ccs	44.9	10.05	7.4	3.07	gray hand held drill or awl, complete
02-5-B-4	obs	33.9*	19.6	4.8	2.52	hafted drill on an proj pt base, tip missing
02-4-D-3	ccs	27.2*	22.5	8.3	4.53	gray ccs hand held drill, tip and part of base missing
01-iso-20	obs	31.3*	19.3	7.0	3.87	hafted drill utilizing an "eared" base, tip missing
01-iso-23	bas	45.7	13.0	6.2	3.43	complete hand held drill or awl

Edge-modified Flakes

A total of 39 edge-modified flakes was collected at the Broken Arrow site (Table 9.8). Those artifacts meeting the classification of an edge-modified flake must exhibit regular, patterned, flaking on at least one edge that is clearly intentional, excluding the possibility that flaking has resulted from trampling or other agents of edge-damage. As was the case for the projectile point fragments above, many of the artifacts identified as edge-modified were discovered during debitage analysis after the flakes had been thoroughly cleaned. The lack of such artifacts from Units 4 and 5 may be directly attributable to this factor.

Most edge-modified flakes were less than five cm long and four cm wide. Unit 1 contained 11 edge-modified flakes distributed between levels 2 through 7. Unit 2 contained 19, which were scattered through all levels except 3 and 4. Level 6 had the most, with a total of four, but a noticeable increase occurs near the cultural features.. Unit 3 produced eight in levels 2 through 7, and one came from the bottom of Unit 5.

Table 9.8. Metric attributes of Broken Arrow site utilized flakes.

Artifact	Type	L	W	Th	Wt	Notes
01-1-A-2	bas	26.5	17.1	6.3	2.95	rectangular, one unifacial edge
01-1-A-7	bas	38.3	25.6	6.6	6.6	rectangular, unifacial edges on three of four sides
01-1-B-4	bas	31.0	2.8	2.9	2.62	polygonal, small curved unifacial edge
01-1-B-5	obs	21.0	12.2	3.7	0.73	rectangular, unifacial edge on one long side
01-1-C-2	obs	15.9	10.8	3.4	0.70	rectangular, single unifacial edge
01-1-D-2	ccs	28.9	10.2	3.6	1.04	rectangular, unifacial inset curved edge
01-1-D-5-5	bas	54.3	43.2	10.0	24.82	large basalt thinning flake, steep-edged unifacial serrated cutting edge
01-1-D-5-6	bas	32.8	13.0	3.3	1.38	triangular, single crescentic unifacial edge on one long side
01-1-D-6	obs	16.6	13.5	2.3	0.59	triangular, unifacial edge on longest side
01-1-D-6-2	obs	24.5	25.9	5.2	2.35	polygonal bifacial scraper
01-1-D-6-3	obs	29.6	13.5	4.7	2.15	polygonal steep-edged unifacial scraper
01-2-A-6	obs	28.5	20.4	5.0	3.06	polygonal, single unifacial crescentic edge
01-2-A-7	obs	11.1	11.4	2.8	0.41	square, with unifacial edge on one side
01-2-A-8	obs	16.9	18.0	3.3	0.88	polygonal, unifacial edge on three of four sides
01-2-A-9	obs	24.1	24.3	4.2	2.27	rectangular, inset unifacial edge
01-2-A-10	obs	12.1	19.1	3.7	0.78	polygonal, unifacial crescentic edge
01-2-A-10(2)	obs	16.3	20.6	8.2	2.3	triangular unifacial convex edge
01-2-B-1	obs	15.0	18.0	3.3	1.22	square end scraper, unifacial
01-2-B-5	obs	21.5	17.8	4.2	1.56	triangular flake, two unifacial opposing edges, one curved
01-2-B-6	obs	21.5	17.5	5.3	1.65	polygonal, unifacial edge on two sides, longest has inset crescentic scraper at midpoint
01-2-B-7	obs	29.5	13.0	4.3	1.2	rectangular, two unifacial edges on opposing sides of long axes
01-2-B-8	obs	24.2	15.7	4.0	1.81	rectangular, unifacial edge with inset crescentic edge at midpoint
01-2-B-9-3	obs	22.2	24,5	10.05	5.58	steep-edged unifacial scraper crafted from small spent core
01-2-C-2	bas	38.5	24.2	4.6	4.04	polygonal, unifacial edge
01-2-C-6	obs	15.5	9.5	2.3	0.38	triangular, unifacial edge on long side
01-2-C-10	obs	15.9	16.4	3.2	0.75	rectangular, one unifacial crescentic edge
01-2-D-1	obs	33.1	15.6	3.8	2.45	rectangular flake, unifacial edge on one long side
3075-2-D-2	ccs	35.3	27.4	8.9	9.01	ccs
01-2-D-5	obs	13.0	21.0	2.0	0.45	polygonal, single unifacial edge
01-2-D-6	ccs	0.9	12.9	1.7	0.19	polygonal, unifacial crescentic Edge

Table 9.8 (continued). Metric attributes of Broken Arrow site utilized flakes.

Artifact	Type	L	W	Th	Wt	Notes
01-3-B-2	obs	20.4	17.7	4.0	1.2	polygonal flake, unifacial edges on one corner
01-3-B-3	obs	17.8	6.8	1.6	.023	small rectangular flake, edges on opposite ends, unifacial
01-3-B-5	obs	27.2	19.3	4.7	1.93	rectangular, two unifacial crescentic scrapers on same end
01-3-B-5-2	obs	42.5	23.7	2.7	3.92	triangular, single bifacial edge on end
01-3-B-7	obs	50.3	32.4	6.9	9.49	polygonal flake, curved unifacial edge on one end
01-3-B-7(2)	obs	40.8	16.1	5.0	2.39	polygonal flake, one unifacial edge on long side
01-3-C-3	obs	32.0	22.3	5.5	3.43	oval, unifacial edge on one long side
01-3-D-3	ccs	12.8	8.0	1.9	0.17	triangular, unifacial crescentic inset edge
01-5-B-10	bas	52.4	20.8	4.2	4.24	long polygonal flake, one unifacial edge

Of the 39 edge-modified flakes, 28 were obsidian, seven were basalt, and four were CCS. Most were expediently manufactured, but a few were scrapers capable of performing a variety of tasks related to woodworking or the modification of other durable materials. These include Specimen 01-1-D-6-3, a steep-edged unifacial scraper fashioned on a polygonal flake, 01-2-B-1, a unifacial end scraper, and 01-2-B-9-3, a steep-edged unifacial scraper that appears to be made from a small, spent core. All are obsidian. Most of the edge-modified flakes were unifacial (n=37, or 95%); two (one each from Units 1 and 3) were bifacial. Twelve of the flakes had curved, but expedient cutting edges, not the carefully prepared crescentic edges expected of spokeshaves.

Cores

Nine cores were collected from the Broken Arrow site, three from Unit 1, one from Unit 3 and five from the Unit 2, 4, and 5 excavations (Table 9.9). Of the nine cores, three are obsidian, four are basalt, and two are CCS. Three of the cores were chunky fragments of tool stone from which multiple flakes were struck, two were large flakes, two were prepared for flake removal, and one

Table 9.9. Metric attributes of Broken Arrow site cores.

Artifact	Type	L	W	Th	Wt	Notes
01-1-A-7	bas	44.1	37.7	24.6	55.33	basalt core, rectangular, flakes struck from four planes
01-1-B-6	ccs	39.5	27.9	17.3	20.77	brown translucent ccs, flakes struck from three planes
01-1-C-5-2	obs	27.7	21.3	12.3	5.89	small, flakes struck from four planes, water worn edges
01-2-B-3	bas	45.8	39.6	16.2	32.7	basalt prepared core, rectangular, flakes struck from four planes, some cortex
01-2-D-2	ccs	35.5	27.8	14.3	16.27	med sized brown ccs flake, multiple flakes removed on all sides
01-3-A-5-1	bas	61.4	37.9	11.9	29.25	basalt, one heavy unifacial serrated edge
02-4-D-5	bas	82.7	60.9	20.0	94.36	large basalt flake, multiple flakes removed on one side
02-5-B-1	obs	40.6	23.9	14.7	13.35	small obs prepared core, multiple flakes struck around the sides
02-5-B-10	obs	38.6	22.9	20.0	16.0	obs nodule frag with cortex, flakes struck from two planes collected in floor fill

was a natural nodule that had been tested for usefulness. Two cores (01-2-B-3 and 02-5-B-1) are prepared, in that they have been shaped by the removal of bulk to create striking planes for maximum flake yield. Both of the prepared cores were found in the Unit 2, 4, and 5 excavations associated with the Feature 1 hearth and the Feature 2 compacted clay surface. The former is basalt, the latter is obsidian. Specimen 02-5-B-10, an obsidian nodule with flakes struck from two planes, was collected in the Feature 2 fill.

Ground Stone

Ground stone tools are those which exhibit shaping or wear by abrasion that is usually associated with the processing of botanical resources, particularly roots, bulbs, and seeds, but can also result from the preparation of faunal resources. Ground stone tools include manos, metates, stone balls, and abrading stones. Few of the 64 pieces of ground stone recovered from the Broken Arrow site are complete (Table 9.10). Much of the material is broken into small

Table 9.10. Metric attributes of Broken Arrow site ground stone.

Artifact	Type	L	W	Th	Wt.	Notes
01-P1-1	mano	40.0	39.1	31.6	61.2	edge frag, bifacial, high degree of finish
01-P7-2	mano	22.3	27.5	36.9	37.08	edge frag, bifacial, edge pecked round
01-P7-5	metate	68.7	60.0	50.0	200+	unifacial thick edge frag, pecked rim
01-P7-5(2)	metate	64.7	40.4	60.3	200+	thick bifacial edge frag, highly finished, pecked rim edges and finished, flat rim
01-P8-1	metate	60.3	39.3	18.4	58.89	thin, plate-like frag with pecked edge
01-P8-2	mano	45.6	31.2	36.6	46.62	bifacial corner frag, edge pecked round
01-P8-3	metate	26.1	25.5	10.6	7.99	bifacial interior frag, thin and plate-like
01-P8-4	metate	42.9	52.8	38.5	63.6	interior frag, unifacial
01-P8-2	unknown	29.7	29.7	36.6	22.63	elongated nodule with small ground surface on one end
01-2-A-4-3	metate	51.2	45.5	10.01	23.23	thin edge frag, slight pecking of the edge, unifacial
01-2-A-6-2	pestle	119.7	79.6	75.4	200+	large end frag, battered end, uses as mano also apparent, triangular in cross section
01-2-A-7-3	metate	58.7	106.1	67.7	200+	bifacial end frag, squared edges and flat sides
01-2-A-7-4	mano	39.5	70.9	41.2	143.64	bifacial end frag, edges pecked round
01-2-A-7-5	metate	21.1	18.9	9.3	6.57	small interior unifacial fragment, thin and plate-like
01-2-A-9-1	pestle	81.8	67.1	61.0	200+	combo mano and pestle end frag, all surfaces highly faceted except end, which is flattened from pounding
01-2-A-11-1	mano	130.7	83.7	81.3	200+	large cobble, roughly triangular in cross section, two side faceted, third unused – muller?
01-2-A-11-2	mano	47.2	62.1	34.5	165.98	bifacial end frag, pecked to wedge-shape, edges pecked round
01-2-A-11-3	metate	33.1	23.8	16.1	14.21	interior frag, unifacial, broken at midline
01-2-A-11-5	metate	34.9	28.2	9.5	7.87	thin plate-like interior frag, bifacial
01-2-B-5-2	metate	72.1	45.5	19.8	99.31	bifacial edge frag, sharp rim edges, rim pecked flat
01-2-B-5-3	metate	30.6	29.4	12.9	22.11	interior unifacial fragment, thin and plate-like
01-2-B-6-4	metate	23.7	23.1	14.0	8.47	interior frag of thin, bifacial slab
01-2-B-7-2	metate	65.8	58.8	43.0	200+	edge frag, unifacial, dished interior, raised rim, edge and base pecked to shape
01-2-B-7-3	metate	30.4	26.6	15.7	17.28	interior frag, unifacial
01-2-B-8.6		25.4	25.1	21.9	20.42	interior frag, bifacial
01-2-B-8-8	mano	16.9	35.6	20.8	16.89	edge frag, unifacial, squared side, rounded corner
01-2-B-8-8	mano	59.2	51.9	19.0	76.34	faceted surface frag, highly finished fine-grained material, broken at midline and only one facet present
01-2-B-8-9	metate	67.5	34.1	51.0	180.62	interior frag of unifacial specimen
01-2-B-10	mano	36.0	17.4	28.4	21.91	mano edge frag, bifacial, edge pecked round
01-2-C-2-2	mano	16.9	50.1	28.2	33.73	bifacial end frag, edge pecked round, broken side highly polished from use as an abrader
01-2-C-4-1	metate	71.6	69.5	25.5	182.53	small bifacial mano frag, one side "dished" as though used for small grinding tasks
01-2-C-5-3	metate	26.0	21.3	19.7	4.54	interior, bifacial, plate-like thin and evenly ground fine-grained material
01-2-C-6-3	mano	83.8	96.4	35.6	200+	approx 2/3 of bifacial, flat faceted specimen, edges pecked round
01-2-C-7-5	mano	91.8	63.1	38.2	200+	broken bifacial mano partially reshaped, one side "dished" from grinding or hammering, edges pecked round
01-2-C-8-3	mano	25.0	46.4	39.8	35.52	end frag, bifacial, edges pecked round
01-2-C-8-4	metate	35.8	33.0	41.4	69.49	interior frag, bifacial
01-2-C-9-5	mano	43.7	32.9	39.5	58.74	bifacial edge frag, edge pecked round
01-2-C-9-7	metate	39.0	39.0	28.0	46.34	bifacial edge frag, untreated edge
01-2-D-4-1	metate	50.7	36.5	15.1	42.57	bifacial corner frag, tuffaceous, one side has impact marks, sharpening or battering marks?

Table 9.10 (continued). Metric attributes of Broken Arrow site ground stone.

Artifact	Type	L	W	Th	Wt.	Notes
01-3-A-3-1	metate	47.2	34.7	13.7	30.91	interior frag of thin, unifacial specimen
01-3-A-3-2	mano	60.8	59.3	55.6	200+	edge frag, large bifacial, roughly pecked edge
01-3-A-4-4	mano	57.4	25.3	34.1	77.1	edge frag, bifacial, highly finished, edge pecked round
01-3-A-4-5	metate	27.4	38.3	15.7	23.96	unifacial interior frag
01-3-A-4-6	metate	47.8	65.5	28.8	78.85	tuffaceous edge frag, unfinished rim, highly finished grinding surface
01-3-B-3-4	metate	15.9	13.0	4.3	1.02	small frag of interior grinding surface
01-3-B-6-3	metate	47.4	56.6	21.3	82.53	thin edge frag, unifacial, unfinished edge
01-3-B-6-4	mano	37.2	30.2	23.5	33.34	bifacial edge frag, edge pecked round
01-3-B-8-2	metate	92.0	88.8	30.3	200+	interior frag of highly faceted, bifacial slab
01-3-C-2-3	mano	72.3	65.5	19.4	108.42	unifacial corner frag, sheared off midline at angle, edge pecked round
01-3-C-3-2	metate	66.0	49.5	64.9	200+	corner frag, unifacial, one edge pecked flat, other unfinished
01-3-C-3-2	mano	52.1	27.8	32.2	62.38	edge frag, pecked edge, unifacial, but split at midline, highly faceted grinding surface
01-3-D-2-1	mano	36.8	45.3	43.9	67.26	mano edge frag, bifacial, edge pecked round
01-3-D-2-2	mano	18.2	34.4	39.4	32.11	partial end frag, bifacial, rough edge prep
01-3-D-4-1	metate	79.3	58.9	19.4	122.03	thin plate-like edge frag, bifacial, curved rim, partially pecked to shape
01-3-D-4-2	metate	35.3	46.7	24.2	47.96	unifacial, edge frag, edge pecked flat, corner sharp
01-3-D-5-2	metate	66.9	49.0	46.4	200+	unifacial edge frag, edge pecked flat with sharp corners
01-3-D-6-3	mano	49.8	47.5	38.7	102.02	bifacial edge frag, finely pecked edges and high polish on facets
01-3-D-6-4	mano	54.7	55.9	30.9	117.46	bifacial edge frag, edge pecked round
02-4-B-7	mano	57.9	50.2	38.5	101.58	bifacial corner frag, edge pecked round, high degree of polish on both faces
02-4-D-3	mano	69.9	31.6	42.8	110.01	bifacial edge frag, edge pecked round
02-4-D-6	mano	50.8	35.8	16.9	47.71	unifacial end frag, split at midline, edge pecked round
02-5-B-4	mano	44.5	33.7	26.7	50.03	bifacial edge frag, edge pecked round
02-5-B-4(2)	mano	29.5	35.4	21.8	26.87	mano frag, unifacial, edge and opposite missing
02-5-B-5	mano	44.0	55.5	44.0	173.46	bifacial edge frag, edges pecked round

fragments, often charred, and probably utilized in a secondary fashion for hearth rocks or cooking stones. The ground stone fragments are primarily from metates (n=32, or 50%), followed by manos (n=30, or 47%), and pestles (n=2, or 3%). In addition to the grinding implements, several abraders were collected, which will be described separately.

Despite their fragmented state, all but one of the artifacts reveal a sufficient number of characteristics to determine they are either manos, metates, or pestles. The manos are generally bifacial edge fragments, somewhat lenticular in cross section with convex grinding surfaces, and they have pecked and rounded edges that are easily distinguished from metate rims. Sixteen of the manos are edge fragments, thirteen are end fragments and the single interior mano fragment has bifacial faceting which aided its identification. Sixteen of the metate specimens are rim fragments. The metate fragments are often thinner than the manos - almost plate-like in some cases - and the edges can be pecked either square or round, but the thinner specimens often have more sharply defined edges. Interior fragments account for 16 of the specimens. Most of the metate fragments have unifacial working surfaces (n=18) which are either concave or flat. The bifacially worked artifacts are a close second, represented by a total of 14. Refitting was not attempted of the mano or metate fragments, so it is unclear whether there are multiple fragments of a few specimens, or many different grinding stones represented. The latter is probably true, because there is such a high density of fragmented specimens scattered across the entire site. Handling of the larger fragments and complete specimens has been kept to a minimum, in case future researchers should wish to submit manos or metates for pollen analysis. In some cases, the artifacts were transferred directly into bags, sealed on site, and have not been handled since.

Two pestle fragments were included among the ground stone artifacts, both of which were recovered in Quad A of Unit 2. Specimen 01-2-A-6-2 is a large end fragment that was apparently used secondarily as a mano. The artifact has a triangular cross section and these surfaces have faceting from use. The end is battered and may have served as a hammer stone. Specimen 01-2-A-9-1, another end fragment, was also utilized as a mano. This specimen is much more polished from use and the end has been flattened from pounding, presumably in a mortar.

Two other ground stone fragments have been reused for other tasks. Specimen 01-2-C-4-1 is a small metate recovered from Level 4, Quad C, of Unit 2, that has been fashioned from a discarded bifacial mano fragment. One side has a shallow basin ground into it from use and the other side retains its original appearance. A similar artifact was found in Level 7 of the same quadrant. Specimen 01-2-C-7-5 is a bifacial mano fragment that has been partially reshaped, including rounding of some broken edges. One side of the artifact has a basin ground into it that may result from use with a mano or from pounding with a pestle or hammer stone.

Almost half of the ground stone objects were found in Unit 2, closely associated with the Feature 1 hearth. Like numerous fragments found at Laurie's site, many of the Broken Arrow artifacts were probably being used as hearth or cooking stones. It is clear that reuse of broken manos and metates was occurring on a regular basis at the site. Some curiosity is inevitable about why we found none of the complete specimens one would expect to see at a site where ground stone is so prominent in the assemblage.

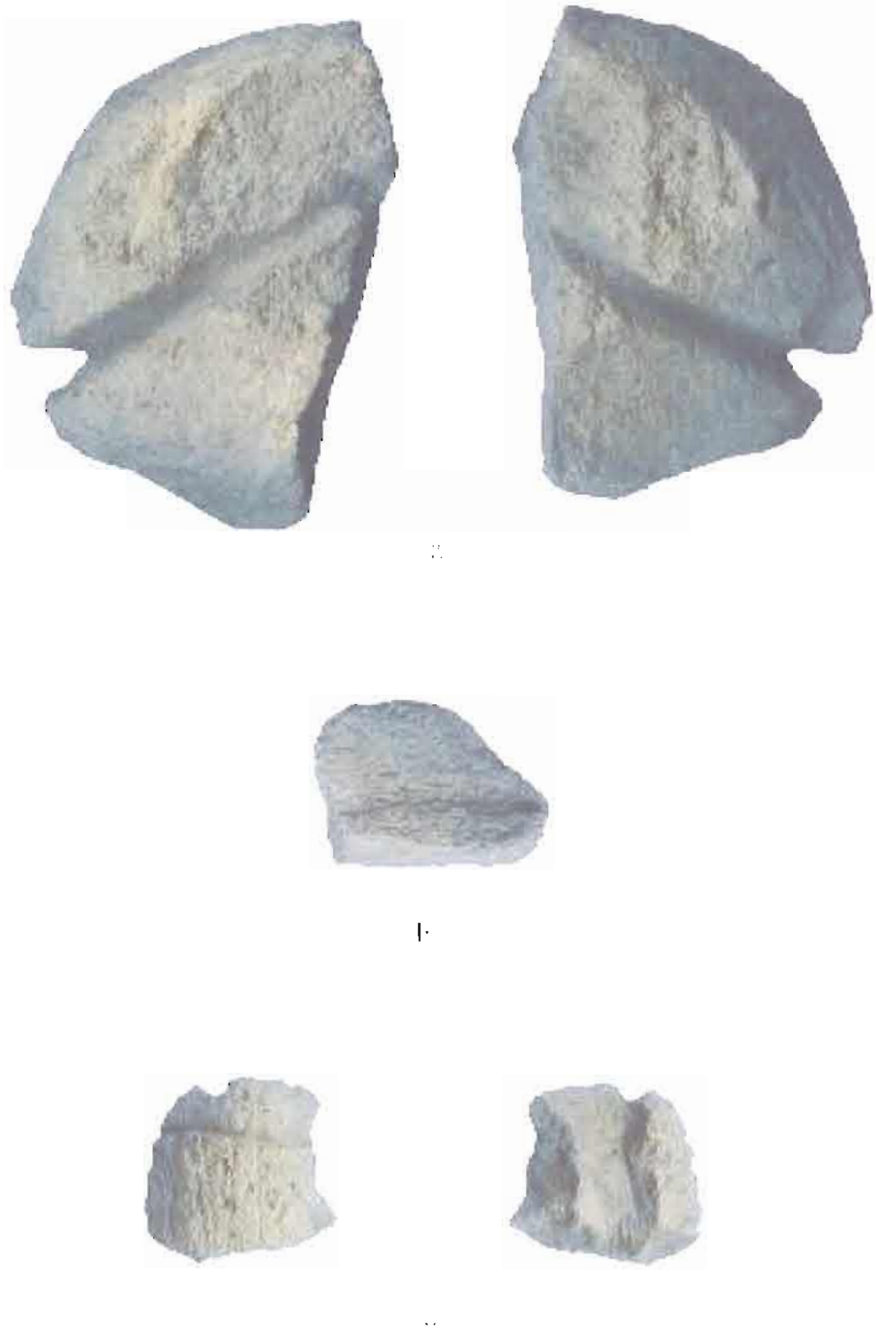


Figure 9.18. Broken Arrow: Abraders (a and b) and decorated pipe fragment (c), shown actual size.
a. 02-3075-4-D-6-1 b. 02-3075-4-D-8 c. 02-3075-5-B-5

Abraders

Two artifacts recovered at the site are abraders, manufactured from porous and abrasive volcanic tuff or pumice (Figure 9.18). Abrading tools were utilized for a variety of tasks involving shaping and polishing of wood and bone tools and the smoothing of arrow and dart shafts, among others. They are found regularly in Harney Valley sites, though generally in small numbers. Specimen 02-3075-4-D-6-1 is a cobble of lightweight pumice, roughly keel-shaped, which has a single deep groove bisecting all but one flat side. Figure 7.16 shows the sides featuring the abrading groove. The groove is not particularly uniform in width and it appears that the objects being shaped are of a smaller diameter than the groove, causing uneven shaping of the channel. Specimen 02-3075-4-D-8 was found in the same quad of Unit 4, but two levels below. It is smaller, made of harder material (volcanic tuff), and has been lightly used, leading to a shallow and uneven groove across the abrading surface. The abraders are another example of the distinction between artifacts on the west side of the Feature 1 and 2 excavation units, as opposed to those south and east, suggesting that a variety of activities were conducted at different areas on the occupation surface.

Figure 9.19. Pipe fragment 02-3075-5-B-5, actual size, with incised decorations highlighted.

Pipe Fragment

A fragment of a decorated pipe was collected from the fifth level of Unit 5 (Figures 9.18 and 9.19). The pipe is manufactured from coarse-grained volcanic tuff. The interior, or bowl, has undergone rough shaping and there is no clear evidence of use, such as darkening or discoloration of the interior from burning. The lack of burning, coupled with the roughly shaped and seemingly unfinished interior, may indicate that the pipe was broken prior to completion. A series of ten longitudinal grooves and a single, deep, transverse grove were etched on the exterior surface of the pipe for decoration (Figure 7.17). The pipe was recovered from the screen and its original location in Unit 5 is unknown.

Other Artifacts

Bone Artifacts

Seven bone artifacts were recovered at the Broken Arrow site, including four tools and three decorative objects (Figure 9.20, Table 9.11). The bone tools include a flaker utilized in lithic reduction activities, a spatulate tip of unknown utility, and two awls that could have been used for a variety of tasks. This is a workmanlike assemblage of tools that would have been needed for the repair and replenishment of hunting gear, clothing and other day-to-day items. One awl (01-3075-2-A-5-3) was probably an expedient tool, fashioned for immediate use. The artifact is simply a small splinter of large mammal bone that was picked up by the fireside and had one already pointed end sharpened lightly to create a fine tip. The specimen has been darkly stained by contact with occupation-stained sediments and possibly heat. The other awl fragment (01-3075-2-B-9-6) consists of a small, finely sharpened tip that is slightly rounded from use. The object has a lenticular cross-section and a symmetry that suggests it originates from a well-crafted bone tool. The flaker (01-3075-2-C-5-2) is the midsection of a large mammal rib, of which both ends have been roughened and rounded by pressure and abrasion, presumably from the pressure flaking of tool stone. The interior (concave) section of the tool has been deeply gouged in two locations from contact with

Figure 9.20. Broken Arrow: Bone tools and decorative objects, shown actual size; spatulate tool, a; awls, b and c; flaker, d; pendant, e; beads, f and g.
a. 02-3075-1-A-6-4 b. 01-3075-2-B-9-6 c. 01-3075-2-A-5-3 d. 01-3075-2-C-5-2
e. 02-3075-5-B-4 f. 02-3075-4-D-3 f. 01-3075-3-D-2

Table 9.11. Metric attributes of Broken Arrow site bone tools, in mm.

Artifact	Type	L	W	Th	Wt.	Notes
01-3075-1-A-6-4	spatulate	21.3	9.2	1.7	0.45	lg mamm. frag, high polish, rounded spatulate end, no rough areas associated with flaking tool stone
01-3075-2-A-5-3	awl	71.5	7.2	3.2	1.47	large mammal bone splinter with sharpened tip, expedient
01-3075-2-B-9-6	awl	9.6	2.8	-	0.05	tip, highly polished, lenticular cross-section
01-3075-2-C-5-2	flaker	104.7	10.5	4.7	3.64	lg mammal rib midsection, curved, roughened ends, gouges on concave (interior) surface
01-3075-3-D-2	bead	6.1	3.5	0.9	0.20	approx. ¼ of one side, one edge beveled, polished
02-3075-4-D-3	bead	7.7	3.4	-	0.40	small mamm. or bird longbone section with beveled ends, highly polished
02-3075-5-B-4	pendant	16.5	5.7	1.8	0.26	polished, lenticular, drilled at broadest end, which is worn and chipped

stone tools. The finish is lightly polished and darkened from extensive handling, but the artifact is otherwise unmodified. The spatulate tool (01-3075-1-A-6-4) is a thin and relatively delicate piece of large mammal cortical bone that has a lobed tip and a high degree of polish. The object is worn smooth along a thin margin at the interior edge of the lobe, indicating light duty, but intensive use. Like the spatulate bone tools at Laurie's site, the thought comes to mind that it could have been utilized in basketry making, although the function it might have served is unclear.

The decorative objects include a teardrop-shaped pendant (02-3075-5-B-4) that has been drilled for suspension on a cord. The bone probably originates from a large mammal and it is entirely cortical. The pendant was ground on both sides to shape, it is highly polished but otherwise undecorated, and it is drilled from only one side. Specimen 01-3075-3-D-2 is a fragment of a bead with a rectangular, symmetrical appearance. It is approximately one-quarter of one side of a tube that has broken lengthwise, and it has a single beveled edge diagnostic of bone tube beads in the northern Great Basin. Another, complete bead (02-3075-4-D-3) is manufactured from a small mammal or bird longbone midsection and has beveled edges at both ends. A portion of one beveled end was broken during use, and there is additional wear on the broken surface indicating that it continued to be worn for some time thereafter. It has a high degree of polish, and it was recovered from the faunal remains during the zooarchaeological analysis.

Most of the bone artifacts were recovered from Units 2, 4 and 5 in association with the cultural features there. The exceptions were the spatulate tool, collected from Unit 1 and the bead fragment, which came from Unit 3.

Beads

The Broken Arrow site produced 26 beads, including 2 bone beads that are discussed in the bone artifiact section above, 19 shell beads, four stone beads, and one that is unidentifiable (Figure 9.21). Only the shell and stone beads are discussed here and in Table 9.12, below. Fifteen of the beads came from the Unit 2, 4 and 5 excavations (63%), four were recovered from Unit 1, and five were found in Unit 3. All but one of the beads came from the first six levels of excavation.

Beads recovered during the 2001 field season were analyzed by Leah Largaespada of the University of Oregon (Largaespada 2001). They were identified utilizing Largaespada's comparative collection, and measurements were taken with the use of an Olympus petrographic microscope mounted to a Sony video monitor equipped with a digital micrometer. Beads collected during the 2002 season were identified by the author utilizing the beads analyzed by Largaespada, and measured with handheld calipers.

The shell beads were manufactured from clam, dentalium, limpet, and *Olivella*. Clam disc beads are the most common, accounting for nine of the 19 shell beads, followed by three Olivella and two *Dentalium*. The *Olivella* beads include several varieties identified by Bennyhoff and Hughes (1987) as having temporal significance. Specimen 01-2-A-5-2, recovered from Quad A, Level 5 of Unit 2, is a Type E1a (Round Thin Lipped) originating from central or southern California. Bennyhoff and Hughes (1987:127-128) consider Type E1a beads to be a marker for early Phase 2 of the Late period in central California and most common around the beginning of the Protohistoric, ca. AD 1500-1600. These beads have been associated with limpet rings, one of which was recovered in Unit 4 and another (possibly) in Unit 3. An *Olivella* Type G3b (Large Ring) was recovered in Level 6 of Quad C, Unit 2 (Specimen 01-2-C-6-2). Bennyhoff and Hughes (1987:132) consider the most common source to be the Marin district of central California, associated with the early phase of the Middle period, from ca. 1000 BP to 750

Table 9.12. Metric attributes of Broken Arrow site beads, in mm.

Artifact	Type	L	W	Th	Drill hole Diam.	Notes
01-1-C-3	shell	9.5	5.7	1.1	2.0*	½ of clam disc, worn edges, irregular shape, mis-start on drill-hole
01-1-A-6-3	shell	5.64	5.64	0.64-0.92	1.5	½ of clam disc, possibly freshwater, grinding on ventral and dorsal to create a smooth, flat bead, some remaining epidermis
01-1-D-5-3	stone	3.82	3.82	0.72	1.58	possibly schist, perfect shape of drill hole suggests historic period manufacture with drill bit
01-1-D-6-1	shell	5.22	5.22	1.14-1.76	1.92	½ of clam disc, probably marine, epidermis remaining on dorsal side
01-2-A-4-2	shell	4.58	4.58	1.22-1.42	1.10	clam disc with epidermal remaining, edges chipped and ground to create a smooth, flat bead, biconically drilled from ventral side with exterior retouch
01-2-A-5-2	shell	5.74	5.68	0.88-1.48	1.24	Olivella thin-lipped (Bennyhoff and Hughes Type E1a), squarish in outline and slightly curved, ground on all sides and edges, conically drilled with exterior retouch
01-2-B-2-3	shell?	5.86	5.86	1.66-1.88	1.08	undiagnostic in terms of chronology, wedge-shaped profile, ground on sides and edge, biconically drilled, analyst unsure if bead is shell or stone.
01-2-C-5-1	unknown	6.2	6.2	0.84	1.54	may be clam or stone, thin relative to other beads, irregular circle, with one flattened side
01-2-C-6-2	shell	9.06	9.06	0.58	2.78	Olivella circular wall bead (Bennyhoff and Hughes Type G3b, large ring), conically drilled from dorsal with exterior retouch, drill hole large and off center, epidermis remaining
01-2-C-8-9	shell	7.2	4.7	0.2	2.5*	Olivella spire-lopped, darkened and polished through wear
01-2-D-6-7	shell	3.16	3.16	0.48	-	small broken section of dentalium
01-3-A-2-2	shell	5.54	5.54	1.25	1.88	clam disc, probably marine, finely ground on edges and sides, drill hole off center and irregular where drill “missed”
01-3-B-1-1	shell	5.28	5.28	1.22-1.48	1.48	clam disc, probably marine, finely ground on all surfaces, drill hole off center, slightly wedge shaped profile , very dense

Table 9.12 (continued). Metric attributes of Broken Arrow site beads, in mm.

Artifact	Type	L	W	Th	Drill hole Diam.	Notes
01-3-B-1-2	shell	5.82	5.82	0.98-1.62	1.7	clam disc, possibly cockle, biconically drilled from ventral side, finely ground on all edges, one indented edge may be trace of hinge, roughly wedge shaped
01-3-B-3-3	shell	6.12	6.12	1.04-1.22	1.84	clam disc, probably marine, finely ground to produce smooth, circular bead, drill hole off center and biconical, wedge shaped profile, original surface probably curved
01-3-B-4-1	shell	5.58	5.58	1.26	2.92	either clam disc or limpet callus, finely ground, sqarish in shape with large drill or natural hole in
02-4-B-4(1)	shell	5.1	3.7	1.4	3.5*	limpet callous, finely ground, with natural aperture
02-4-B-4(2)	stone	7.1	-	1.5	2.2*	biconically drilled, edges ground smooth
02-4-B-4(3)	stone	3.8	-	0.7	1.9*	tiny,sharp edges, uniform drill-hole
02-4-D-5	shell	3.8	4.2	0.7	3.5*	dentalium tube fragment, high polish
02-5-B-1(1)	stone	7.1	6.6	1.8	1.8*	thick, squarish, biconically drilled
02-5-B-1(2)	shell	4.3	-	0.7	1.8*	clam shell?, slight curvature, finely ground
02-5-B-1(3)	shell	7.1	4.5	1.0	1.3*	½ of unknown shell, irregular, biconically drilled
02-5-B-2	shell	8.0	3.5	0.6	3.1*	probably clam disc, ½ of original, distinct curvature

* = measurement taken with hand calipers, others measured with video micrometer.

BP. *Olivella* small spire-lopped beads (Type A1a) such as Specimen 01-2-C-8-9, recovered from Level 8, Quad C, of Unit 2, are most common during the Early period and Phase 1 of the Late period in central California (3000 BP to 1300 BP, and 800 BP to 500 BP, respectively), but can occur at any time (Bennyhoff and Hughes 1987:117-118). Jenkins and Wimmers (1994:112) report Type A1a beads from the Big M and Carlon Village sites in the Fort Rock Basin. At Big M, the beads are associated with dates ranging from 3530 BP to 4910 BP and a date of 1780 BP at Carlon Village. Wingard (2001) recovered both *Olivella* and *Dentalium* beads at Carlon Village, where two primary occupation periods were noted at 1800 BP and 600 BP.

Northern Paiute informants reported that *Olivella* beads were obtained in California, near San Francisco (Park, in Fowler 1989:114). They reported that the shells were picked up at the sea shore and not purchased. It is possible that these same beads were traded northward into Harney Valley following such collecting events.

Figure 9.21. Broken Arrow: Shell and stone beads organized by excavation unit, and one shell fragment, shown actual size:
Unit 1, a-d; Unit 2, e-k; Unit 3, l-p; Unit 4, q-t; Unit 5, u-x.

a. 01-3075-1-A-6-3	b. 01-3075-1-C-3	c. 01-3075-1-D-3	d. 01-3075-1-D-6-1
e. 01-3075-2-A-4-2	f. 01-3075-2-A-5-2	f. 01-3075-2-B-2-3	g. 01-3075-2-C-5-1
h. 01-3075-2-C-6-2	i. 01-3075-2-C-6-2	j. 01-3075-2-D-6-7	k. 01-3075-2-C-8-9
l. 01-3075-3-A-2-2	m. 01-3075-3-B-1-1	n. 01-3075-3-B-1-2	o. 01-3075-3-B-3-3
p. 01-3075-3-B-4-1	q. 02-3075-4-B-4(1)	r. 02-3075-4-B-4(2)	s. 02-3075-4-B-4(3)
t. 02-3075-4-D-5	u. 02-3075-5-B-1(1)	v. 02-3075-5-B-1(2)	w. 02-3075-5-B-1(3)
x. 02-3075-5-B-2	y. 02-3075-4-D-4		

Shell

Although freshwater snail shell was ubiquitous throughout the Broken Arrow site, large shell fragments originating from freshwater bivalves such as mussels (*Margaretifera)* were uncommon. One fragment, Specimen 02-3075-4-D-4, was collected from Level 4, Quad D, of Unit 2 (Figure 7.17). The shell is deteriorated, with portions delaminating into the surrounding deposits, and it is not possible to determine how the specimen may have been utilized.

Lithic Debitage Mass Analysis

Mass analysis utilizes population means including counts and weights of size-graded debitage in a replicable, quantitative manner to examine relationships of debitage in both inter and intra-site contexts (Ahler 1989, Connolly 1999). Flake attributes such as size, weight, quantity, and the presence of cortex vary with each stage of lithic reduction, as early core and biface production yield larger flakes with more cortex than later stage biface reduction and pressure flaking (Connolly and Byram 2001:68). By quantifying chipping waste through the previously mentioned variables, a given site assemblage can be compared to those from other sites, and to an experimental lithic reduction data set established for all five reduction stages (core reduction = Stage 1, biface pressure flaking = Stage 5) collected from the Newberry Volcano obsidian source (Connolly and Byram 2001:69). The mass analysis results should reflect the most dominant lithic reduction activities at a given location and, depending on other factors such as stratigraphic mixing, may allow comparisons between early and late components within a site.

Debitage collections from the Broken Arrow site were processed through a series of nested screens with dimensions of 1" (G1), 1/2" (G2), 1/4" (G3), and 1/8" (G4). The flakes from each size grade were counted, weighed, and examined for the presence of cortex. The results were then compared with those from the other Harney Valley sites, the Bon site in Deschutes County (Connolly and Byram 2001), and with the overall results from the Newberry Crater project (Connolly 1999). This information is presented below in Tables 9.13 and 9.14, and summarized in the final chapter. Here, debitage from Units 1, 2, and 3 is examined.

Connolly (1999) developed a formula for determining stages of lithic reduction activities at archaeological sites based on three variables : Stage = 6.048 – 0.124 (F) – 0.023 (P) – 0.091 (Q), where F is the percent count of G2 over G1 – G4, P is the mean weight of G2 (G2 weight/G2 count) in decigrams, and J is the mean weight of G3 (G3 weight/G3 count) in centigrams. The values produced from the archaeological data were inserted into the formula and the numeric result is an indicator of the relative stage of lithic reduction that occurred at the site, either for the entire site or for components of the site.

Utilizing Connolly's (1999) formula for the aggregate of the three units at the Broken Arrow site resulted in a predicted stage value of 2.62 (Tables 9.13 and 9.14), placing the site below the Bon site (35DS608) in terms of lithic reduction stages, but at a similar reduction stage to other base camps some distance from the tool stone source where activities are not focused on lithic procurement and reduction. The Bon site is a residential base camp located north of Newberry Caldera. Component 34-2, at the Paulina Lake site (35DS34), which functioned as a base camp located within the Newberry Caldera (Connolly 1999, Connolly and Byram 2001:69) has values similar to the three units at the Broken Arrow site, and the value equates well with the Hoyt and Laurie's sites from this study. When the obsidian is examined by unit, the stage values are found to vary to a limited degree. Unit 1 has a stage value of 2.50 and Unit 2 is 2.62, and Unit 3 is 2.68.

Table 9.13. Values for the Broken Arrow site obsidian mass analysis variables, Units 1- 3 combined.

Variable	Computation	Value (%)
A PCTWTG1	55.8/1173.5	4.8
B PCTWTG2	408.4/1173.5	34.8
C PCTWTG3	436.7/1173.5	37.2
D PCTWTG4	272.6/1173.5	23.2
E PCTCTG1	3/10346	0
F PCTCTG2	223/10346	2.2
G PCTCTG3	1454/10346	14.0
H PCTCTG4	8666/10346	83.8
I PCTWT13	55.8/900.9	6.2
J PCTWT23	408.4/900.9	45.3
K PCTWT33	436.7/900.9	48.9
L PCTCT13	3/1680	0.2
M PCTCT23	223/1680	13.3
N PCTCT33	1454/1680	86.5
O MNWT1G	55.8/3	18.6
P MNWT2DG	408.4/223	18.3
Q MNWT3CG	436.7/1454	30.0
R MNWT4CG	2726/8666	3.14

Stage =6.048 - 0.124(F) – 0.023(P) – 0.091(Q)
Stage =6.048 - 0.2728- 0.4209 – 2.73
Stage = 2.62

Table 9.14. Broken Arrow: Lithic debitage mass analysis results for units 1 - 3, individually and combined (obsidian only).

	Grade 1			Grade 2			Grade 3			Grade 4		
	N	Wt	Cortex	N	Wt	Cortex	N	Wt	Cortex	N	Wt	Cortex
Unit												
1	0	0	0	56	93.2	10	344	109.0	14	2082	59.1	5
			N	**Wt**								
Total G1-G4			**2482**	**261.3**								
Total G1-G3			**400**	**202.2**								
Stage = 2.5												
2	1	11.1	1	106	209.4	24	692	203.1	58	4194	136.6	55
			N	**Wt**								
Total G1-G4			**4993**	**560.2**								
Total G1-G3			**799**	**423.6**								
Stage =2.66												
3	2	44.7	2	61	105.8	7	418	124.6	32	2390	76.9	27
			N	**Wt**								
Total G1-G4			**2871**	**352.0**								
Total G1-G3			**481**	**275.1**								
Stage = 2.68												
All	3	55.8	3	223	408.4	41	1454	436.7	104	8666	272.6	87
Units 1 – 4			**N**	**Wt**								
Total G1-G4			**10346**	**1173.5**								
Total G1-G3			**1680**	**900.9**								
Stage = 2.62												

Obsidian Sourcing and Hydration

A total of 97 artifacts recovered from the Broken Arrow site was submitted to Northwest Research Obsidian Studies Laboratory (NROSL) for obsidian sourcing and hydration analysis (Table 9.15, Figure 9.22). The artifacts include 70 projectile points, one biface, two preforms, two obsidian knives and two basalt knives, and 20 obsidian flakes (Skinner and Thatcher 2002).

The projectile points and formed tools, with few exceptions, are from sources located either to the north or east of the site. One Rose Spring and two Eastgate points originated from the Double O source, west of Harney Lake, as did one Elko Corner-notched point. An Elko Eared point came from Beatys Butte, to the south. The sources include Burns (n=2), Indian Creek (n=11), Indian Creek B (n=6), Tule Springs (n=15), Venator (n=24), Double O (n=4), Whitewater Ridge (n=5), Eldorado (n=1), Buck Springs (n=1), Dog Hill (n=2), Burns (n=3), Beatys Butte (n=1), and Wolf Creek (n=2).

The debitage largely originated from local sources to the north and east, including Tule Springs (n=4), Venator (n=9), and Indian Creek (n=2), but also included Unknown 1 (n=1), Riley (n=1), Black Bull Spring (n=1), Mud Ridge (n=1), and Beatys Butte (n=1). The knife (3074-1-A-5), and the biface (02-3074-1-C-9) both were made of Venator obsidian. A large basalt flake tool and a basalt knife were also submitted to NROSL for geochemical identification and (provisionally) identified as Unknown Basalt 1.

The debitage was selected entirely from Unit 2, including 20 artifacts from Quads A (n=14), Quad B (n=5), and Quad D (n=1) of Level 7, closely associated with the Feature 1 hearth. It was hoped that one obsidian source would dominate the debitage sample and an AMS date produced from the Feature 2 hearth would aid in the development of a provisional hydration rate for the primary obsidian source. This did not turn out to be the case. Half of the debitage came from the Tule Spring source and the other half from three other sources, and the range of hydration measurements was too broad (from 1.3 to 2.8 microns, with a range of 1.9 to 2.8 microns for Tule Spring alone). The results of the debitage hydration analysis does cast light on

Table 9.15. Obsidian sourcing and hydration results from 35HA3075.

Sample	Artifact	Hydr.(μ)	Source
Unit 1			
3075-P1-5-1	Cottonwood	2.1	Tule Spring
3075-1-B-1-1	Rose Spring	1.9	Venator
3075-1-B-2-1	Rose Spring	1.5	Venator
3075-1-D-3-1	Elko Eared	2.8	Indian Creek
3075-1-C-4-1	Elko CN	2.1	Indian Creek
3075-1-D-4-1	Elko CN	2.8	Tule Spring
3075-1-B-5-1	Elko Eared	5.7	Indian Creek B
3075-1-D-5-1	Humboldt	4.6	Tule Spring
3075-1-D-5-2	Elko CN	3.9	Venator
3075-1-B-6	Elko	2.1	Indian Creek
3075-1-C-6-1	Elko Eared	2.2	Dog Hill
3075-1-A-7-1	Unknown	1.9	Venator
3075-1-A-7-2	Rose Spring	2.2	Tule Spring
3075-1-A-9-1	Eastgate	1.2	Venator
Unit 2			
3075-2-A-1	preform	1.9	Venator
3075-2-B-1-1	Elko CN	2.5	OO
3075-2-D-1-1	Elko Eared	4.3	Burns
3075-2-B-2-1	Rose Spring	1.2	Tule Spring
3075-2-B-2-2	Elko CN	NA	Venator
3075-2-B-4-1	Elko CN	2.8	Tule Spring
3075-2-D-4-2	Elko	2.8	Tule Spring
3075-2-D-5-1	Knife	2.8	Venator
3075-2-B-6-1	Rose Spring	NA	Tule Spring
3075-2-B-6-2	Elko Eared	2.6	Indian Creek B
3075-2-C-7-1	Rose Spring	2.2	Tule Spring
3075-2-C-7-2	Northern SN	3.9	Burns
3075-2-C-7-3	Leaf	5.9	Tule Spring
3075-2-C-8-1	Unknown	2.8	Indian Creek
3075-2-B-9-1	Elko Eared	1.8	Venator
3075-2-B-10-1	Rose Spring	2.5	Indian Creek
Unit 2 debitage			
3075-2-B-7-5a	flake	2.8	Tule Spring
3075-2-B-7-5b	flake	NA	Venator
3075-2-B-7-5c	flake	2.3	Venator
3075-2-B-7-5d	flake	NA	Tule Spring
3075-2-B-7-5e	flake	1.5	Venator
3075-2-A-7-5f	flake	2.8	Tule Spring
3075-2-A-7-5g	flake	2.3	Unknown 1
3075-2-A-7-5h	flake	2.7	Riley
3075-2-A-7-5i	flake	NA	Venator
3075-2-A-7-5j	flake	3.2	Venator
3075-2-A-7-5k	flake	1.6	Venator
3075-2-A-7-5l	flake	1.6	Venator
3075-2-A-7-5m	flake	2.8	Indian Creek
3075-2-A-7-5n	flake	2.9	Indian Creek
3075-2-A-7-5o	flake	NA	Beatys
3075-2-A-7-5p	flake	2.8	Tule Spring
3075-2-A-7-5q	flake	NA	Black Bull Sp.
3075-2-A-7-5r	flake	3.3	Mud Ridge
3075-2-A-7-5s	flake	1.7	Venator
3075-2-D-7-2	flake	2.0	Venator

Sample	Artifact	Hydr. (μ)	Source
Unit 3			
3075-3-B-2-1	Elko CN	3.0	Wolf Creek
3075-3-B-3-1	Pinstem	NA	Venator
3075-3-C-3-1	Rose Spring	2.4	Whitewater
3075-3-C-4-1	Elko	1.9	Venator
3075-3-D-5-3	Eastgate	2.1	Indian Creek B
Unit 4			
3075-4-B-4a	Eastgate	2.3/4.2	OO
3075-4-B-4b	Eastgate	1.9	Indian Creek B
3075-4-B-4c	Humboldt	2.5	Wolf Creek
3075-4-D-5a	Eastgate	1.8	Venator
3075-4-D-5b	Bas. Knife	-	Unk. Basalt1
3075-4-B-6a	Elko Eared	2.8	Indian Creek
3075-4-B-6b	Elko Eared	2.7	Beatys Butte
3075-4-D-6	preform	2.4	Indian Creek
Unit 5			
3075-5-B-1	Eastgate	2.0	Venator
3075-5-B-4a	biface	2.0	Venator
3075-5-B-4b	Rose Spring	2.8	Indian Creek B
3075-5-B-5	bas. tool	-	Unk. Basalt 1
3075-5-B-8	Elko CN	1.8	Venator
3075-5-D-9	Stemmed	4.6	Dog Hill
Surface-collected Isolates			
3075-iso-1	Rose Spring	2.4	Tule Spring
3075-iso-3	Elko CN	1.5	Venator
3075-iso-4	Elko CN	3.3	Tule Spring
3075-iso-5	Rose Spring	2.8	Indian Creek B
3075-iso-7	Elko Eared	2.8	Venator
3075-iso-8	Eastgate	3.3	OO
3075-iso-9	Eastgate	1.6	Whitewater
3075-iso-10	Elko CN	3.2	Tule Spring
3075-iso-11	UNK	4.5	Whitewater
3075-iso-12	Elko	5.4	Buck Spring
3075-iso-14	Elko CN	3.9	Tule Spring
3075-iso-15	Elko Eared	3.5	Whitewater
3075-iso-16	Columbia type	3.5	Indian Creek
3075-iso-17	Rose Spring	2.1	Venator
3075-iso-18	Elko Eared	4.2	Venator
3075-iso-19	Elko CN	2.4	Venator
3075-iso-20	Concave Base	6.6	Indian Creek
3075-iso-21	Stemmed	NA	Venator
3075-iso-22	Elko CN	3.0	Tule Spring
3075-iso-24	Eastgate	2.7	Venator
3075-iso-28	Elko CN	6.4	Indian Creek
3075-iso-29	Rose Spring	2.7	OO
3075-iso-30	Eastgate	2.8	Indian Creek
3075-iso-31	Rose Spring	3.9	Tule Spring
3075-iso-32a	Rose Spring	1.6	Venator
3075-iso-32b	Rose Spring	2.3	Venator
3075-iso-33	Elko Eared	1.4	Indian Creek
3075-iso-34	Rose Spring	2.7	Eldorado

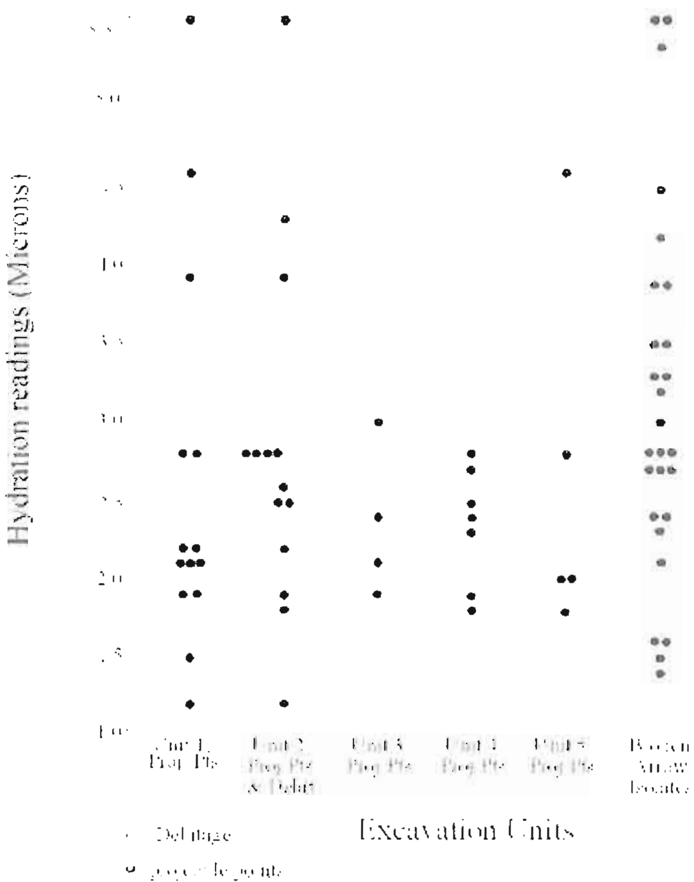


Figure 9.22. Obsidian hydration measurements from the Broken Arrow site. The graph shows late deposition of artifacts in the excavation units when compared to the broad span of time evident in the points collected as isolated finds across the site.

the perception that the location of Rose Spring and Eastgate points in levels 2 through 4 might be representative of an occupation that is distinct and separate from the underlying deposits (levels 6 and 7) containing Elko Corner-notched points. It appears now that, based on the range of obsidian hydration measurements in deposits underlying the Rose Spring and Eastgate points, there is considerable mixing of the house floor sediments. This is not surprising when one considers the use and re-use that probably occurred at the location.

Botanical Remains

Paleobotanical identifications were carried out by Dr. Marge Helzer of the University of Oregon. Samples were selected only from Unit 2, Quads A and B, in association with the Feature 1 hearth. Botanical analysis occurred in two stages. The first stage involved the identification of charcoal specimens for radiocarbon dating purposes, and the material was derived either from composite samples obtained during screening, or from *in situ* specimens when possible. The intent of the charcoal analysis was to obtain specimens from short-lived plant species for greater accuracy in dating the site. Soil flotation analysis was undertaken to determine the variety and nature of plant remains that might have been utilized by the inhabitants of the occupation area. The results of the analyses are summarized below in Tables 9.16 and 9.17.

Charcoal samples from Unit 2, Quad A, included specimens from levels 3 through 11 for a total of five samples and the samples from Quad B included material from levels 3 and 8, for a total of two samples. The botanical remains identified in the charcoal samples included greasewood, juniper, rabbitbrush, sagebrush, pine, an unidentified variety of conifer and willow; a total of seven varieties. All but conifers can be found in the vicinity of the site today. Willow was an important source of material for basketry and wickiup construction. All of the other plant materials are known to have been used medicinally or for food and fiber (Fowler 1986, 1989; Couture 1978).

The plant material recovered from the soil flotations had all of the previously mentioned varieties of charcoal, plus a wide variety of economically important seeds. Included were the seeds of bulrush, cattails, chenopod/amaranths (cheno-ams), greasewood, rabbitbrush, and wada (for which the *Wada'tika* are named). All are known to have been used for food or medicinal purposes (Fowler 1986, 1989; Couture 1978), and all would have been readily available in the nearby lake and marshland setting. Several species that were recovered at Laurie's site are absent from this assemblage, including bluegrass and buckwheat seeds and Mountain mahogany. The presence of Mountain mahogany establishes an important link between the uplands and Laurie's site, and the absence of this material from the densest cultural concentrations at Broken

Table 9.16. Charcoal analysis results from the Broken Arrow site.

Sample no.	Provenience	Species	Common name	Weight
3075-2-A-3-4	Unit 2, QA, L3	Juniperus	juniper	<0.01g
		Conifer		0.07g
3075-2-A-7-10	Unit 2, QA, L7	Juniperus	juniper	0.96
		Pinus	pine	0.11g
		Salix	willow	0.12g
3075-2-A-8-6	Unit 2, QA, L 8	Artemesia	sagebrush	0.04g
		Sarcobatus	greasewood	0.08g
		Juniperus	juniper	0.67g
		Conifer	not juniper	0.13g
3075-2-A-9-4	Unit 2, QA, L9	Artemesia	sagebrush	0.05g
		Sarcobatus	greasewood	0.18g
3075-2-A-11-12	Unit 2, QA, L11	Artemesia	sagebrush	0.11g
		Sarcobatus	greasewood	0.35g
		Salix	willow	0.06g
3075-2-B-3-5	Unit 2, QB, L3	Conifer	not juniper	0.09g
3075-2-B-8-14	Unit 2, QB, L8	Artemesia	sagebrush	0.03g
		Chrysothamnus	rabbitbrush	0.05g

Arrow suggests that either the direction of travel to Broken Arrow differed from Laurie's site, or some activities that occurred there were of a different nature. Mountain mahogany was an important resource for digging sticks, bows, atlatls, and projectile points, and its presence at Laurie's site may indicate that repair or manufacturing of these tools was taking place there.

Table 9.17. Macrobotanical analysis results from the Broken Arrow site.

Sample no.	Provenience	Species	Common name	Weight
3075-2-A-3	Unit 2, Q A, L 3 (35-40 cm)	Cheno-Am	Chenopod/Amaranth seed	<0.01g
		Suaeda	wada seed	<0.01g
		Scirpus	bulrush seed	<0.01g
		Typha	cattail seed	<0.01g
		Sarcobatus	greasewood charcoal	<0.01g
		Artemesia	sagebrush charcoal	<0.01g
3075-2-A-4	Unit 2, Q A, L 4 (37-39 cm)	Cheno-Am	Chenopod/Amaranth seed	<0.01g
		Suaeda	wada seed	<0.01g
		Scirpus	bulrush seed	<0.01g
		Typha	cattail seed	<0.01g
		Artemesia	sagebrush charcoal	<0.01g
		Sarcobatus	greasewood charcoal	<0.01g
3075-2-A	Unit 2, Q A (57-60 cm)	Cheno-Am	Chenopod/Amaranth seed	<0.01g
		Cheno-Am	Chenopod/Amaranth embryo	<0.01g
		Suaeda	wada seed	<0.01g
		Scirpus	bulrush seed	<0.01g
		Typha	cattail seed	<0.01g
		Chrysothamnus	rabbitbrush seed	<0.01g
		Sarcobatus	greasewood charcoal	<0.01g
		Artemesia	sagebrush charcoal	<0.01g
		Unidentifiable	charcoal	0.01g
3075-2-A-6	Unit 2, Q A, L 6 (65-70 cm)	Cheno-Am	Chenopod/Amaranth seed	<0.01g
		Suaeda	wada seed	<0.01g
		Suaeda	wada embryo	<0.01g
		Scirpus	bulrush seed	<0.01g
		Typha	cattail seed	<0.01g
		Sarcobatus	greasewood charcoal	<0.01g
		Artemesia	sagebrush charcoal	<0.01g
		Juniperus	juniper charcoal	0.01g
		Unidentifiable	charcoal	0.02g
3075-2-A-7	Unit 2, Q A, L 7 (72-75 cm)	Cheno-Am	Chenopod/Amaranth seed	<0.01g
		Cheno-Am	Chenopod/Amaranth embryo	<0.01g
		Suaeda	wada seed	<0.01g
		Typha	cattail seed	<0.01g
		Sarcobatus	greasewood charcoal	<0.01g
		Artemesia	sagebrush charcoal	<0.01g
		Juniperus	juniper charcoal	0.16g
3075-2-A-8	Unit 2, Q A, L8 (82-86 cm)	Cheno-Am	Chenopod/Amaranth seed	<0.01g
		Cheno-Am	Chenopod/Amaranth embryo	<0.01g
		Suaeda	wada seed	<0.01g
		Artemesia	sagebrush charcoal	<0.01g
		Chrysothamnus	rabbitbrush charcoal	<0.01g
		Conifer	unknown conifer charcoal	0.04g
		Juniperus	juniper charcoal	0.25g
3075-2-A-9	Unit 2, Q A, L 9 (92-95 cm)	Cheno-Am	Chenopod/Amaranth seed	<0.01g
		Cheno-Am	Chenopod/Amaranth embryo	<0.01g
		Chenopodium	chenopod seed	<0.01g
		Suaeda	wada seed	<0.01g
		Typha	cattail seed	<0.01g
		Artemesia	sagebrush charcoal	0.05g
		Sarcobatus	greasewood charcoal	0.01g
		Unidentifiable	charcoal	0.04g
3075-2-A-10	Unit 2, Q A, L 10 (107-111cm)	Cheno-Am	Chenopod/Amaranth seed	<0.01g
		Cheno-Am	Chenopod/Amaranth embryo	<0.01g
		Suaeda	wada seed	<0.01g
		Typha	cattail seed	<0.01g
		Artemesia	sagebrush charcoal	0.05g
		Sarcobatus	greasewood charcoal	0.01g

Table 9.17 (continued) Macrobotanical analysis results from the Broken Arrow site.

Sample no.	Provenience	Species	Common name	Weight
3075-2-A-11	Unit 2, Q A, L 11 (112-116 cm)	Cheno-Am	Chenopod/Amaranth seed	<0.01g
		Cheno-Am	Chenopod/Amaranth embryo	<0.01g
		Chenopodium	chenopod seed	<0.01g
		Suaeda	wada seed	<0.01g
		Typha	cattail seed	<0.01g
		Chrysothamnus	rabbitbrush seed	<0.01g
		Unidentified	seed	<0.01g
		Artemesia	sagebrush charcoal	0.6 g
		Chrysothamnus	rabbitbrush charcoal	<0.01g
		Sarcobatus	greasewood charcoal	0.01g
3075-2-A-12	Unit 2, Q A, L 12 (122-126 cm)	Cheno-Am	Chenopod/Amaranth seed	<0.01g
		Cheno-Am	Chenopod/Amaranth embryo	<0.01g
		Suaeda	wada seed	<0.01g
		Artemesia	sagebrush charcoal	0.05g
		Sarcobatus	greasewood charcoal	0.01g
		Unidentifiable	charcoal	0.01g

Faunal Remains

Faunal remains recovered from Laurie's site were identified by the author. The specimens were generally very small fragments of small mammals fish, and birds including muskrat, jackrabbit, Tui chub, coot, and various kinds of waterfowl. Lagomorphs were abundant and fish remains were infrequent, certainly a peripheral resource despite the proximity of the lake. Large mammals such as deer and antelope were also represented, particularly in association with the Feature 1 hearth and immediate surroundings. Other species noted in the assemblage included badger, raccoon and possibly mink. Although tremendous numbers of bone fragments were recovered at Broken Arrow, there was a perceptible increase in the quantities of unfused bones, suggesting that the site was utilized during the late spring and summer months when immature animals were in abundance. As was the case with the Lauries's site analysis, all of the files related to the faunal analysis have been lost, so the above summary will have to suffice until the faunal remains can be re-analyzed and reported elsewhere.

Summary

Archaeological investigations at the Broken Arrow site consisted of work at three excavation areas based on guidance provided through preliminary testing. The southernmost unit was designated Unit 1. Unit 2 was dug 60 meters to the north. The northernmost unit was 10 meters from Unit 2 and identified as Unit 3. A hearth feature that was identified in Unit 2 led to the excavation of Units 4 and 5 to better explore the nature of the occupation and resulted in the identification of the Feature 2 compacted clay surface. The two features together suggest that a wickiup or similar type of structure was present. Spatial patterning of artifacts within the excavation units and in association with the two features indicates that a structure approximately 3 meters in diameter was situated there. Artifact accumulations were high across the site, but particularly so in Units 2, 4, and 5 in association with the hearth and floor. Distinct patterning of artifacts was also present within the units, as it became apparent that the variety and nature of the artifacts being recovered from Units 4 and 5, at the western portion of the excavation block, was different from those in Unit 2, to the east. Bone tools, abraders, cores, and Stage 2 bifaces are examples of artifacts represented in the western units that are either not present in Unit 2, or present in smaller numbers. It is likely that some items were being stored near the wall of the structure, or that discrete activities were occurring in that portion of the wickiup.

Obsidian sourcing and hydration studies indicated that the primary travel routes to Broken Arrow originated from the north or east, particularly in association with Rose Spring and Eastgate points. Elko points indicate a slightly wider range of travel with more western sources represented, but, overall, the emphasis is mainly on the sources to the north and east. Elko, Rose Spring, and Eastgate points were being used concurrently at the site and the absence of Gatecliff Series and Desert Series points indicates that occupations were probably occurring after 2200BP and before 1000 BP, a range that is supported by the radiocarbon dates. Isolated projectile points that were recovered at Broken Arrow indicate that use of the site occurred in some capacity throughout the course of the Holocene, although Gatecliff, Northern Side-notched, and Desert Side-notched points were not found as isolates, either. The botanical remains emphasize nearby resources with the exception of two specimens of conifer, and the faunal remains indicate that small mammals, birds, fish and large game, all locally available, were being utilized at the site. Fish seem under-represented with regard to the proximity of the lake and marsh.

Whiting (1950:19) noted that human activity at Malheur Lake intensified near the beginning of September when the wada seeds ripened and when saltbush and chenopod seeds were also available for harvest. The time was marked with festivities, there were side trips to harvest fruit, and communal game drives took place as well. There is evidence at Broken Arrow to support the ethnographic documentation provided by Whiting. Chenopod and wada seeds are present in the cultural deposits of the site and bulrush seeds may provide evidence of subsistence as well as the presence of mat houses constructed from bulrush stalks. Coniferous plant materials could have been acquired during forays into the foothills to collect fruit for winter storage, then brought back to the site for the manufacture of tools. There are large quantities of leporid bones, particularly those of jackrabbits, as well as large game and waterfowl. Muskrats are present, but not in the numbers that were seen at Laurie's site. There is a considerable amount of immature unfused small mammal bone, suggesting that site use may have occurred in the summer months when immature muskrats were more readily available.

While there is plenty of support for the descriptions of activities provided by Whiting (1950), the Broken Arrow site does not seem particularly well suited for a winter camp location. Fresh water would not be readily available during the winter, firewood would be limited to localized supplies of greasewood and sagebrush, and the site is not sheltered. The Headquarters site across the bay or the Crow Ranch near Voltage would have been much better suited for winter habitations, having all the amenities listed above. Chenopod and wada seeds that were identified in the Broken Arrow deposits could have been stored previously and transported to the site for use. The presence of waterfowl and immature mammal remains suggests occupations occurred during the warm months when both would have been available in quantity.

In summary, archaeological evidence supports the activities identified by Whiting (1950) as having occurred at Malheur Lake, but the location of the Broken Arrow site does not seem appropriate for a winter occupation, nor do some kinds of resources that are present within the cultural deposits. The same is true for Laurie's site as well. It is intriguing that the Broken Arrow and Laurie's sites are situated in such close proximity, yet each reflects a different set of activities that occurred at about the same time, and neither produced evidence that seems particularly appropriate for winter camp occupations. This estimation may be colored to some degree by the author's knowledge of currently unreported sites near Malheur Lake that are extensive, tremendously rich in cultural materials, and occupy settings with abundant supplies of firewood, water, and shelter.

CHAPTER X
SUMMARY AND CONCLUSIONS

The genesis of this study was in the Hoyt, Morgan, and Hines sites, at data recovery excavations undertaken by the Oregon State Museum of Anthropology as mitigation for highway modifications proposed by the Oregon Department of Transportation. Each of the three sites exhibited characteristics that were distinct, and suggestive of ethnographic land use patterns as recorded by Whiting (1950), though none were situated in locations she had specifically identified. My work at the three sites prompted curiosity about the relationship of the archaeological record to the ethnographic record. I felt that a study of other sites within the area utilized by the Harney Valley Paiute might shed light on the prehistoric behavioral patterns of the *Wada'tika*, and other inhabitants of the region through time, particularly if they targeted locations mentioned in Whiting's account. It might be possible through such a study to either confirm or negate the patterns described by Whiting and help to enhance the archaeological record in either case. To that end, a search was undertaken to identify additional sites that might be suitable for such an effort. It led ultimately to the excavation of the Knoll and RJ sites, located in the highlands north of the Harney Valley in 2000, and the Broken Arrow and Laurie's sites, near Malheur Lake, in 2001 and 2002. These four sites were excavated by the University of Oregon Archaeological Field School under my direction.

Excavations at the Hoyt, Morgan, and Hines sites were undertaken with guidance from data recovery plans developed for the Hoyt and Morgan sites (Jenkins and Connolly 1995), and for the Hines site (O'Grady et al. 1997). The strategy outlined in these data recovery plans also guided the work at the Knoll, RJ, Laurie's, and Broken Arrow sites, although at a considerably reduced scale. The research designs identified five principal topics including regional culture history; paleoclimatic, environmental and cultural change; settlement-subsistence patterns; cultural relations and ethnic group territories; and prehistoric technologies. Research questions were developed within these five topical areas to address key issues on more specific levels. Questions were generally the same for the Hoyt, Morgan, and Hines sites on the northern perimeter of the Harney Valley, because their proximity to one another subjected them to similar climatic, cultural, and environmental influences. The Knoll, RJ, Broken Arrow and Laurie's sites are more widely distributed through the Harney Basin drainage system, but climatic, cultural, and environmental processes at work in these sites would probably also have been similar. In this chapter I will discuss seven sites in terms of the principal research topics originally set out, then continue the discussion in relation to Whiting's (1950) ethnographic account. Finally I conclude by discussing future research needs in the Harney Valley, bringing to bear the role of current archaeological theory in planning for the next phase of research.

Research Topics

Regional Culture History: Site Summaries

The Hoyt site is treated as a single component occupation because of evident mixing of early and late artifacts in the deposits, but there was also clear evidence that the deposits as a whole had accumulated over a significant period of time. The site yielded a radiocarbon date of 1830 BP from Feature 1, and another assay of 220 BP was obtained from organic material recovered in an area where FCR and burned bones were noted. The latter date seems out of place, since the material was collected approximately 35 cm deeper in the deposits than the 1830 BP sample. Some degree of mixing between older and more recent cultural materials at the Hoyt site is apparent through the occasional finding of late point types in lower levels, and earlier point types in upper levels. Hydration rims on both formed tools and debitage showed both earlier and later clusters of hydration rinds, but thin rims were occasionally found in lower deposits and thick rims in higher deposits. Despite these instances, the bulk of specimen proveniences show that there were culturally significant differences between the earlier and later occupations at the site.

The Morgan site produced three radiocarbon dates, including one of 950 BP at the West Locus where a single late Holocene component was noted, and two dates at the East Locus, 760 BP and 1170 BP (Feature 4) associated with late Holocene occupations. These three radiocarbon dates were from hearths located in the late (upper) component. No dateable organic materials were recovered from a stratigraphically distinct, older component at the East Locus, but the presence of Elko and Large Side-notched points suggest that site use there extended back into the middle Holocene. The association of middle and late Holocene projectile point types in deposits at both loci may indicate some degree of stratigraphic mixing, but it may also indicate that these points were being used concurrently over a long period of time up to 1000 years ago. At the East Locus, located on the leeward side of a lobe of Sand Hill, the preservation of an early component may be in part due to the site's sheltered location away from the year round prevailing winds emanating from the southwest.

At the Hines site, a single radiocarbon date of 1060 BP was returned on charcoal recovered from a hearth in the North Block. Recovery efforts were largely focused around the Central Locus, where excavations were divided between a North and South Block. The North Block contained a single late Holocene component. The South Block contained an upper Late component that was probably the same age as the North Block component, and a lower Early component consisting of concentrated lithic debitage, a biface, utilized flakes and three cores. No temporally diagnostic artifacts were recovered in the Early component. The Early component was identified statistically through the use of obsidian hydration rims and by the presence of two peaks in the debitage counts; one between 25 and 30 cm and one between 50 and 55 cm. Organic cultural materials suitable for radiocarbon dating were almost nonexistent in the Late component of the site. None were recovered from the Early component. Artifacts in the Late component displayed clear evidence for spatial variation in site use, whereas the Early component artifacts seemed to cluster in shallow depressions that may have had more to do with deflation and the settling of heavier materials into eroded pockets than with human utilization of the site.

The Knoll site was divided into North and South loci based on two concentrations of cultural material roughly 80 meters apart. Unit 2, in the South Locus, had two concentrations of cultural material. The Early component was found between 60 and 90 cm and an AMS date of 1780 BP was returned on charcoal from Level 8, between 70 and 80 cm. The Late component was noted between 10 and 40 cm and included a metate and chipping debris designated as

Feature 2, an Elko point, and a variety of other tools that were not temporally diagnostic. An AMS date of 1000 BP was associated with the Feature 2 metate in the Late component. A single radiocarbon date of 450 BP was assayed on charcoal recovered from the Feature 1 hearth in the North Locus. The artifacts recovered from the deposits into which the Feature 1 hearth was intruded included five Northern Side-notched points. The points predate the Feature 1 hearth by ca. 3500 years or more. Obsidian hydration data indicate that at least some site use occurred during the late Holocene.

The RJ site is extensive and our efforts consisted of sampling a small area at its north end. Units 1 and 3 were situated in an erosional environment on the ridgetop, and the thin sediments covering the bedrock may have been blown away repeatedly over time to be replaced with more recently deposited material. The RJ site yielded three radiocarbon dates on samples from Units 2 and 4, both of which were located below the ridge top in sheltered areas where sediment accumulation was apparent over time. Unit 2 produced an AMS date of 1000 BP on charcoal from Level 4 of Quad A, and a second date of 1590 BP was produced from charcoal in Level 7 of the same quad. The artifact counts indicated a single peak in Level 3 of both quads, and two Rose Spring points were collected from Levels 1 and 3, temporally consistent with the Unit 2 radiocarbon dates. Unit 4 also revealed one peak in cultural materials in Level 4 and a single radiocarbon date of 2920 BP came from the same level. One Elko and one Northern Side-notched point were also collected in Level 4; another Elko was collected higher in the deposits. The Elko points would be expected in association with a ca. 3000 year old date, but the Northern Side-notched type is commonly associated with a time depth of 4000 to 7000 years BP, so the point found is probably either out of place or curated for re-use. The radiocarbon date from Unit 4 is the oldest date returned for the seven sites reported in this study. A single peak in artifact concentrations was present in Units 2 and 4, indicating only one apparent archaeological component, but considering the range of artifacts present on the RJ site, the artifact concentration may be attributable to limited use of that portion of the site or geomorphic processes at work.

The Broken Arrow site yielded two AMS dates, one of 1810 BP from Level 7 of Unit 2 and one of 2030 BP from Unit 4. The Unit 2 date was on charcoal collected from the Feature 1 hearth, which was a cluster of fire-cracked rock, large and small mammal bones, and very dark charcoal-laden sediments. Other artifacts associated with the hearth included Elko and Rose Spring points, biface fragments, projectile point fragments, a drill, several shell beads, cores, utilized flakes, and ground stone, some of which was incorporated into the hearth ring. Unit 4 was excavated adjacent to Unit 2. The radiocarbon date was assayed on charcoal recovered from Level 8 (80-90 cm) of Quad B, within compacted sediments believed to be an occupational surface, possibly a house floor, and designated as the Feature 2 compacted clay surface. The Feature 1 hearth was located just southeast of Quad B, situated on the compacted surface. A few artifacts were recovered in the compact sediments, including mano and metate fragments, fire-cracked rock and a large shouldered knife. The sediments above the occupational surface (between 60 and 80 cm) produced two Elko points, burned bone, fire-cracked rock, and more ground stone fragments. The Feature 1 hearth and the occupational surface were the only radiocarbon-dated features at the Broken Arrow site.

In Unit 2, bone counts increased downward through level 8 (the Feature 1 hearth was in levels 7 and 8) and declined thereafter. Debitage counts increased through Level 3, leveled through Level 7, then tapered off from Level 8 through Level 12. In Unit 1, to the south, bone and debitage counts increased through Level 8, and Unit 3 had peaks in both bone and debitage in levels 2 and 5. The bimodal distribution of these artifacts in Unit 3 is not marked by similar rises and falls in other artifacts, and there is some concern that the accumulation in Level 2 may be attributable to lag deposits on a shallowly buried erosional surface. In sum, the evidence for possible multiple components at the Broken Arrow site is not clearly supported, although the range of projectile point types present on the site indicates the location has been occupied repeatedly over the last 4,000 years or more.

Investigations occurred at Laurie's site during the 2001 and 2002 field seasons, resulting in test excavations at three house pits. Units 1 and 2 were excavated in House 1 in 2001, and charcoal samples from levels 5 and 8 of Unit 2 produced AMS dates of 1000 and 1590 BP respectively. One AMS date of 1770 BP was returned on charcoal collected from Level 4 of Unit SP1, a probable house floor. Two AMS dates were also produced from levels 5 and 9 of Unit 1 in House Pit 2, located just north of House Pit 1. Level 5 (50-60 cm) produced a date of 140 BP, which is believed to be from charcoal redeposited through bioturbation. The presence of a Rose Spring point, ground stone, fire-cracked rock, and other artifacts are suggestive of an occupation similar to that documented in House Pit 1. Charcoal collected in Level 9 produced an AMS date of 1580 BP, which is much better suited to the cultural materials in association. Artifacts recovered in levels 8 and 9 included a shell bead, a Northern Side-notched point, two Elko points, ground stone, fire-cracked rock, and a variety of bone fragments including several muskrat mandibles. A stone ball, chert biface, and mano were collected in Level 10. The Northern Side-notched point is out of place, considering the ca. 1600 year-old age of the deposits in House 2, but it could well be an isolate or have been curated for use by the later occupants. Bone and debitage counts from both units of House 1 indicate that depositional characteristics differed for these two types of artifacts. In Unit 1, debitage counts increased downward through Level 4, and tapered off slightly through levels 5 and 6 before increasing again in Level 7. The same was true in Unit 2, where counts increased through Level 4, decreased slightly in Level 5, and increased again in Level 6. Bone counts showed individual peaks in Level 6 of Unit 1 and Level 3 of Unit 2. The debitage alone could be indicative of a bimodal distribution, but, taken in conjunction with the single peak in bone counts, the aggregate distribution seems to indicate that a single 30-40 cm component is present at House 1 of Laurie's site.

Regional Culture History: Radiocarbon and Obsidian Hydration Dates, and Lithic Technology Comparisons

The existence of clearly defined cultural features less than 2000 years in age, which are preceded by scattered materials of greater antiquity, is exemplified by the sites described above, and is common to sites in certain kinds of settings in the Harney Valley at large. A compilation of 60 radiocarbon dates from Harney Valley sites (Table 10.1) reveals that 55 sites (91%) date between 100 and 2000 BP, three (5%) date between 2000 and 3000 BP, one (2%) dates to 3470 BP, and one (2%) dates to 9610 BP. Oetting (1990a, 1990b) reported that diagnostic projectile points collected during surveys along the northern shore of Malheur Lake seemed to indicate a period of intensive occupation during the last 4000 years, with only about 11% of the sample originating before that time. Oetting (1990a, 1990b) noted that using data obtained from surface collecting at partially eroded sites may have introduced a bias by mixing temporally discrete occupations, creating the appearance of one long-term continuously intergrading occupational sequence. In any case, the typological evidence seems clearly to indicate that human use of the Harney Basin intensified in the latter portion of the Holocene, at least along the Malheur lakeshore. It is a pattern that fits well with evidence from other wet basins in south-central Oregon including the Fort Rock Basin (Aikens and Jenkins 1994; Jenkins 1994; O'Grady

1999; Wingard 2001) the Chewaucan Basin (Oetting 1989) and Warner Valley (Eiseldt 1998; Tipps 1998; Weide 1968).

The limited quantities of early to middle Holocene artifacts found so far in intact deposits probably reflects the concealment of earlier artifacts by fluvial, lacustrine, and aeolian geomorphic processes in wet basin settings, and the relative lack of archaeological excavations away from such lakeside settings where the likelihood of finding earlier, intact deposits may be better. Oetting (1990a:120) noted that all of the early to middle Holocene points found during the Malheur Lake surveys were recovered from the northwest shore. Clifford (1997), reporting on a survey conducted south of Harney Lake, found that 14 of the 27 sites (52%) identified during his survey contained Great Basin Stemmed points, which date between 11,000 and 7,000 BP (Oetting 1994:54). She further noted that Great Basin Stemmed points accounted for 78% of the temporally diagnostic artifacts found during that survey. These two examples seem to indicate that geomorphic processes have exposed early artifacts in some areas, and concealed them in others, suggesting that there are more early sites in Harney Valley than current research results show. If the circumstances of the sites reported in my study are any indication, finding intact, datable deposits older than 2000 BP in central Harney Valley may always prove difficult (Table 10.1).

Table 10.1. Radiocarbon dates from Harney Valley archaeological sites.

Site Name	Sample No.	C-14 Date	Calib. Date BP*	Location	Reference
Stubblefield	Beta-76974	130±120	290 (260, 230,130, 20, 0) 0	Feature 2,	Dugas et al. 1995
35HA975*	-	150±70	280 (260, 210, 140, 20, 0) 0	Ring 15	Burnside 1998 pers. com.
35HA2095	Beta-49697	160±50	280 (270, 210, 140, 20, 0) 0	Burial 1	Burnside 1998 pers.com.
Blitzen Marsh	Gak-3294	170±80	290 (270, 200, 150, 10, 0) 0	Test pit 2	Fagan 1974
Blitzen Marsh	Gak-3296	220±80	310 (280) 0	Test pit 2	Fagan 1974
Hoyt	Beta-88083(AMS)	220±60	300 (280) 0	FCR/bone	O'Grady 2006
Lost Dune	WSU-4807	260±50	310 (300) 0	Hearth 3	
35HA1906	Beta-49253	280±50	430 (300) 290	Burial 4	Burnside 1998 pers. com.
35HA2095	Beta-49696	300±50	440 (310) 290	Burial 20	Burnside 1998 pers. com.
35HA1906	Beta-46963	310±60	460 (310) 290	Burial 1	Burnside 1998 pers. com.
35HA2095	Beta-49695	310±50	440 (310) 290	Burial 9	Burnside 1998 pers. com.
Lost Dune	QL-4801	320±22	430 (420, 410, 320) 310	Hearth 1	Lyons and Mehringer 1996
Lost Dune	QL-4800	330±14	430 (420, 390, 320) 310	Hearth 2	Lyons and Mehringer 1996
Lost Dune	NSRL-2647	330±50	470 (430, 390, 320) 300	bone clust.	Lyons and Mehringer 1996
Lost Dune	NSRL-2648	350±60	490 (430, 360, 330) 310	near Hearth 1	Lyons and Mehringer 1996
35HA975	-	350±80	430 (360) 330	Ring 17	Burnside 1998 pers. com.
Headquarters	Beta-66634	370±70	460 (340) 340	charcoal lens	Dugas and Bullock 1994
Headquarters	Beta-66630	400±50	510 (480) 330	hearth	Dugas and Bullock 1994
Headquarters	Beta-66632	430±80	530 (500) 330	cache pit	Dugas and Bullock 1994
35HA1899	Beta-49698	460±60	530 (510) 480	burial 2	Elston et al. 1993
McCoy Creek	Beta-31736	480±70	540 (510) 490	Feature 11	Musil 1995
Indian Grade	Beta-22608	530±60	550 (540) 510	oven, Comp I	Jenkins and Connolly 1990
Stubblefield	Beta-76972	580±50	640 (550) 530	Feature 1	Dugas et al. 1993
Stubblefield	Beta-77124	610±40	650 (630, 610, 560) 550	burial, Feat. 4	Dugas et al. 1993
Headquarters	Beta-66628	670±80	670 (650) 550	midden	Dugas and Bullock 1994
Stubblefield	Beta-76973	670±60	660 (650) 560	hearth, Feat. 5	Dugas et al. 1993
35HA1906	Beta-49694	700±60	670 (660) 570	Burial 3	Burnside 1998 pers. com.
35HA1914	Beta-57831	820±100	890 (720) 660	hearth	Dugas et al. 1993
Morgan	Beta-88081	870±60	900 (760) 700	hearth	O'Grady 2006
Blitzen Marsh	Gak-3297	930±150	970 (900, 870, 830, 790) 670	Test pit 2	Fagan 1974
Headquarters	Beta-66629	960±100	950 (910) 670	Stratum 3	Dugas and Bullock 1994
McCoy Creek	Beta-28037	990±90	970 (930) 790	hearth, floor 2	Musil 1995
Headquarters	Beta-66631	1040±70	980 (940) 920	Stratum 20	Dugas and Bullock 1994
35HA1904	Beta-58183	1050±70	1050 (950) 920	hearth, Feat. 1	Elston et al. 1993
35HA1905	Beta-49692	1050±70	1050 (950) 920	Burial 1	Burnside 1998 pers. com.
Morgan	Beta-88079	1060±70	1050 (950) 920	hearth	O'Grady 2006
35HA1911	Beta-49699	1070±70	1060 (960) 930	surface bone	Raven and Elston 1992
Paiute Spring	Gak-3304	1090±130	1160 (970) 910	Test pit 5	Fagan 1974
Blitzen Marsh	Gak-3299	1110±80	1070 (980) 940	Test pit 2	Fagan 1974
McCoy Creek	Beta-35150	1140±60	1080 (1060) 970	House floor 2	Musil 1995
Indian Grade	Beta-26254	1150±90	1170 (1060) 950	Component II	Jenkins and Connolly 1990
Hines	Beta-105663(ams)	1160±50	1130 (1060) 980	hearth, Feat. 1	O'Grady 2006
Morgan	Beta-88080	1260±60	1270 (1170) 1080	hearth, Feat. 4	O'Grady 2006
McCoy Creek	Beta-31734	1270±70	1280 (1220, 1220, 1180) 1080	House floor 1	Musil 1995
Blitzen Marsh	Gak-3295	1280±90	1290 (1230, 1210, 1180) 1070	Test pit 1	Fagan 1974
McCoy Creek	Beta-31735	1340±60	1300 (1280) 1180	pit, floor 2	Musil 1995
Blitzen Marsh	Gak-3300	1400±100	1360 (1300) 1260	Test Pit 2	Fagan 1974
Indian Grade	Beta-22605/Eth-32351410±100		1390 (1300) 1270	hth. Comp. III	Jenkins and Connolly 1990
Indian Grade	Beta-22609	1440±110	1410 (1320) 1270	hth., Comp. III	Jenkins and Connolly 1990
McCoy Creek	Beta-9573	1480±110	1505 (1350) 1290	charcoal band	Musil 1995
Indian Grade	Beta-22606	1670±80	1690 (1550) 1500	hth., Comp. III	Jenkins1990
Blitzen Marsh	Gak-3301	1820±110	1870 (1720) 1580	Test pit 2	Fagan 1974
35HA1899	Beta-49691	1830±60	1830 (1730) 1640	burial 1	Elston et al. 1993
Hoyt	Beta-88082(AMS)	1890±60	1880 (1830) 1730	cache/feature	O'Grady 2006
McCoy Creek	Beta-31737	1900±100	1940 (1830) 1710	over chrt comp.	Musil 1995
Indian Grade	Beta-22607	2000±90	2040 (1940) 1840	hth., Comp. III	Jenkins and Connolly 1990
Blitzen Marsh	Gak-3302	2350±80	2430 (2350) 2320	Test pit 2	Fagan 1974
Indian Grade	Beta-22604	2840±220	3260 (2940) 2750	North Locus	Jenkins and Connolly 1
Dunn Site	Beta-31537/Eth-56603255±65		3560 (3470) 3390	house floor	Musil 1995
35HA342	USGS-461B	8680±55	9820 (9640, 9610, 9580) 9530	beach shell	Gehr 1980

*Calibrated dates BP at 1σ (Stuiver and Reimer 1993).

Thus, the presence of middle Holocene occupations at many sites may seldom be confirmed by any other evidence than obsidian hydration measurements and projectile point cross-correlation.

Obsidian sourcing and hydration dating was conducted on 628 artifacts recovered from the seven sites reported here. Obsidian recovered from the sites generally reflected the use of nearby sources. The Hoyt, Morgan, and Hines sites, located near Burns Butte, were dominated by the Burns Butte and Dog Hill sources, for both of which provisional hydration rates have been established. Ozbun (et al. 1996) and Connolly (Appendix) noted an accelerated rate of hydration for these sources (up to $10\mu^2/1000$ years) in comparison with other source specific rates from central and southern Oregon. A comparison of the hydration bands on diagnostic projectile points from these three sites confirmed that the rapid hydration rate is characteristic of Burns Butte and Dog Hill obsidians in the Hoyt, Morgan and Hines depositional settings, and that band thicknesses widen on earlier temporally diagnostic points. Hydration analysis based on the hydration rate of $10\mu^2/1000$ years indicates that a major period of artifact deposition occurred between 4500 and 1500 years ago, with the greatest intensity between 2000 and 3000 BP. Based on the few relevant radiocarbon dates at the study sites (1820 BP at Hoyt, 2920 at RJ, and 2000 BP at Laurie's), the fairly intense 2000 to 3000 BP period of site use would have been barely visible through radiocarbon dating, and would have been most noticeable through peaks in debitage at the Hines South Block and Morgan East Locus.

Lithic technology comparisons between earlier and later components at the Morgan, Hines, and Knoll sites add to our knowledge of how the sites may have been used over time. Debitage, utilized flakes, a Stage 2 biface, and three cores constituted the Early component at the Hines site recovered in the South Block. The cores and an abundance of debitage indicate that lithic reduction was an important activity during the early occupations, in keeping with the site's location at the base of a sizeable obsidian source. Broken projectile point fragments, bifaces in all stages of reduction, and cores attest to the continued importance of lithic reduction during late occupations as well. High quantities of ground stone fragments and paleobotanical remains further suggest that plant gathering and processing increased in importance around that time (1500 BP – historic).

At the East Locus of the Morgan site, the Early component included Large and Small Side-notched, Elko Corner-notched, and Eastgate projectile points; Stage 3 and Stage 4 biface fragments; a metate fragment; and three mano fragments. The Late component of the East Locus produced Rose Spring and Cottonwood Triangular points, all stages of biface reduction, and one mano fragment. The West Locus of the Morgan site (considered to be late component materials) contained Small Side-notched, Elko series, and Eastgate points; all stages of biface reduction; and an abundance of ground stone, including manos, metates, and abrading stones. The presence of only late stage biface fragments in the Early component is important, suggesting that the site was a temporary stopping point where Stage 3 preforms prepared at the adjacent quarry continued to be shaped along the route from the quarry site to the next destination. Ground stone was present in all components at the site, indicating that plant processing was a regular activity during all periods of site use. Small mammals accounted for most of the faunal remains during both earlier and later periods of site use. Very few birds and no fish were recovered in the cultural strata.

An additional item of interest is the temporal variation in projectile point assemblages between the West Locus and the East Locus of the Morgan site. Similar projectile points were recovered in the Early Component of the East Locus and the single component of the West Locus, but the Late Component of the East Locus produced the only Rose Spring and Cottonwood Triangular points found at the site, suggesting that it also saw a later period of use than is seen at the West Locus. Obsidian hydration evidence supports this finding. Two Rose Spring points produced hydration rims ranging from 2.3 to 2.7 microns. An additional reading of 3.7 microns on one of the points (977-23-Y-B-1-1) could be residual to the initial production of the flake from which the point was manufactured. Two Eastgate points had rims measuring 3.2 and 3.7 microns in width. One Elko point had a readable hydration rim of 3.6µ, and a Side-notched point had rims measuring 5.3 and 5.6 microns in width.

Paleoclimatic, Environmental, and Cultural Change

The Hoyt, Morgan, and Hines sites are similar in terms of their general setting, being situated on elevated locations overlooking the marshy floor of Pleistocene Malheur Lake. The Broken Arrow and Laurie's sites are also similar to one another, being situated lower and adjacent to the modern lake shore. The RJ site is located in the Stinkingwater Mountains, and the Knoll site is in the Silvies Valley to the north, both occupying more upland settings. During the time these sites were occupied, waterways crossing the Harney Valley floor were probably broad and marshy, with numerous sloughs, channels, and low energy stream channels threading their way across, depending on the time of year and amount of precipitation falling annually. The uplands to the north of Harney Valley rise sharply from the valley floor, providing a very different environmental setting. This ecological borderland would have allowed the human occupants of the region a variety of opportunities for obtaining different kinds of resources over a relatively short distance and may have been an important factor in the positioning of the Hoyt and Morgan sites. The same is true for the Hines site, although the nearby obsidian source was surely an important factor at its location. The positioning of the Broken Arrow and Laurie's sites near the lake shore, the Hoyt, Morgan and Hines sites at mid-elevation settings, and the Knoll and RJ sites in upland settings afforded their occupants different opportunities for the acquisition of subsistence items and other kinds of resources necessary for the manufacture of equipment such as basketry, matting, and weaponry.

The placement of the seven sites investigated at different elevations within the Harney drainage basin provides opportunities to examine climatic, environmental, and cultural changes in the area over time. The relationship of the changing climatic conditions during the last 4000 years is demonstrated in Figure 10.1. Radiocarbon dates from the seven study sites are compared with the results of Wigand's (1987) pollen analysis at Diamond Pond, located on the east side of Blitzen Marsh. All of the sites were occupied during the period defined by Oetting (1994) as Late Archaic 1, from 2,000 BP to 1,000 BP, which was characterized by dryer conditions during the time between 2000 BP to 1400 BP, and wetter conditions from 1400 BP to 1000 BP. It is interesting to note that human use of the Harney Valley was more dispersed during the wetter period, and more focused on the lakeside setting during drier conditions.

Pollen analysis was conducted by Cummings (et al. 1998) on undated, though probably late Pleistocene – early Holocene soil samples recovered from lake deposits underlying the Hines site. Cummings (et al 1998) noted higher quantities of Pinus pollen in the lower two lake samples, suggesting that pines grew closer to the site than they do currently. Sagebrush, as now, was the principal vegetation on the basin floor. The upper lake sample showed a decline in Pinus pollen, while plants bearing saline soil-tolerant pollens increased, indicating that the lake was drying and pines were no longer found near the site. Juniper and oaks occurred during this later period, and spruce occupied higher elevations nearby. The macrobotanical analysis indicated that many of the shrubs, grasses, and forbs that were present

Oetting's Chronology	Diamond Pond Pollen Record	Harney Sites
Mid-Archaic I 5000-3000	4000-2000 wet	
Mid-Archaic II 3000-2000		RJ: 2920+/-40
Late Archaic I 2000-1000	2000-1400 dry	Broken Arrow 2030±40 Laurie's 1890±40 Hoyt 1890±60 Laurie's 1770±50 Broken Arrow 1720±40 Knoll:1780+/-40 RJ: 1590+/-40 Laurie's 1580±40
	1400-900 wet	Morgan 1260±70 Hines 1160±50 Morgan 1060±60 Knoll:1020+/-40 RJ:1000+/-40 Morgan 870±60
Late Archaic II 1000-historic	Ca. 500 dry	Knoll:450+/-60
	300-150 wet	Hoyt 220±60 Laurie's 140±40

Figure 10.1. Radiocarbon dates for the study sites, as related to climatic inferences from Diamond Pond and Oetting's Lake Abert cultural chronology (Wigand 1987, Oetting 1994).

when the site was being used are similar to those currently found there today, with the notable exception of camas, which was tentatively identified at the Hines site.

Prouty (1996) reported that possible camas bulb fragments were recovered from the Morgan site, indicating that the species may once have been more widespread in the Harney Valley than it is today. Prouty (1996) noted very limited quantities of paleobotanical remains at the Hoyt and Morgan sites, attributing their absence to possible erosion of the site deposits. Sagebrush, grass seeds (including Wigeon grass, a wetland species), juniper, and processed edible tissues were recovered from the Morgan site. The Hoyt site contained sagebrush, grass seeds, and processed edible tissue. A trace of biscuitroot was also recovered, which was probably transported from the uplands.

Botanical investigation of the RJ site was limited to the analysis of charred material that was being considered for radiocarbon dating. The identified specimens reflect plant species that are currently present at the site. All identified species were (and are) utilized by Native peoples for food and medicinal purposes and include juniper, bitterbrush, currant or gooseberry, unidentified fruits and berries, and unidentifiable fragments of fruity and starchy processed edible tissues.

The analysis of charred botanical materials was also undertaken to identify materials suitable for radiocarbon dating at the Knoll site. All of the botanical materials recovered would be easily gathered within a short walk from the site today, including bitterbrush, juniper, an unidentified conifer, rabbitbrush, greasewood, and sagebrush. A twig from a currant or gooseberry shrub was also collected at the site.

Botanical samples recovered from Unit 1 of Laurie's site also reflect floral communities present in the area today, with the exception of mountain mahogany, which was undoubtedly transported from neighboring highlands. Seeds included those of cheno-ams, bulrush, cattail, and wada, with buckwheat, bluegrass, and rabbitbrush present in some samples. Charcoal included rabbitbrush, greasewood, sagebrush, saltbush, juniper, and mountain mahogany.

The Broken Arrow site charcoal and flotation samples produced evidence of willow, pine, juniper, bulrush, cattails, chenopod/amaranths (cheno-ams), greasewood, rabbitbrush, and wada. Several species that were recovered at Laurie's site are absent from this assemblage, including bluegrass and buckwheat seeds and mountain mahogany. The identification of pine and another unidentified conifer at Broken Arrow is also suggestive of transport between the lowlands and upland areas. For the most part, the botanical specimens indicate that, with the exception of two varieties of conifers, most of the plant species can be found on the site today.

Other researchers have demonstrated that vegetation in the Harney Valley has varied over the long course of the Holocene. In sediment cores collected at Diamond Pond, located south of Malheur Lake, Wigand (1987) observed considerable variation in the abundance of aquatic versus terrestrial plant species through the analysis of a series of core samples, containing an uninterrupted sequence of pollen deposition spanning the last 5500 years. During the time that the study sites were in use, Wigand noted increased periods of moisture at 1400, 1000, and 900 BP, and indications that droughts occurred at both 700 and 5000 BP. The record provided by

Diamond Pond reveals that climatic fluctuations could occur rather quickly, with transitions of 25 to 40 years between wet or dry periods. The Diamond Pond sequence is the most detailed to emerge from the northern Great Basin and serves as a very useful marker for climatic events that surely affected human occupants. The paleobotanical record from the seven sites reported here is not fine-grained enough, however, to provide supportive evidence for site use during a specific climatic event.

The faunal record from the seven sites is limited, due in part to the loss of files containing the zooarchaeological analysis of the Broken Arrow and Laurie's sites, and the absence of faunal remains at the RJ site. The zooarchaeological results from the Hoyt Morgan, and Hines sites provide evidence for the use of animal resources from specific habitats. The most common remains are from small terrestrial mammals, e.g. rodents and lagomorphs, which could readily be found in the marshland/grassland settings to the south or the upland setting to the north. However, small numbers of waterfowl elements were identified in all of the sites, a few fish remains were recovered from the Hines and Hoyt sites, and beaver and muskrat bones were identified at the Hines site, all of which are common in wetland settings. No species that are common only in upland habitats were identified in any of the sites. Small quantities of eggshell may be indicators of site use during the late spring or early summer months.

In sum, the floral and faunal assemblages recovered from the sites suggest that conditions during the last 2000 years supported similar plant and animal communities to those seen today. The influences of modern human activity such as livestock grazing and the draining of some areas and irrigation of others have certainly affected the modern distribution and frequency of some resources, and may have contributed to the retreat of the wetland southward towards the Harney and Malheur lake basins. Despite human alterations, the hydrologic system of Harney Basin remains quite dynamic, with widespread flooding occurring during the mid-1980s and again at the time of this writing.

Settlement and Subsistence

Judging by the artifact assemblages, it is evident that the various sites under investigation were utilized for different purposes. An abundance of ground stone at the Morgan site suggests an orientation toward plant processing. At the Hines site, high quantities of formed tools, cores, and debitage, along with naturally occurring obsidian nodules, indicate an emphasis on quarrying and lithic reduction. The wide variety of botanical remains and relatively large quantities of ground stone may indicate additional use of the Hines site for the procurement of plant resources. The Hoyt site yielded an abundance of faunal remains (including high percentages of large game animals) and formed tools, which suggest an orientation towards hunting or the processing of faunal resources. The Knoll site contained an abundance of large bifaces in a variety of reduction stages, and direct access to basalt and obsidian tool stone which created an attraction to the site. The acquisition of various kinds of food resources is evident at the site, though no one resource appears to have been targeted. The RJ site was clearly associated with root collecting both through location and artifacts found in the assemblage. Laurie's site and the Broken Arrow site are in close proximity to each other, yet the artifacts and subsistence remains indicate that activities at the two sites were quite different. Both were intensively occupied, both contained evidence of dwellings and both produced rich tool assemblages. Laurie's site had an abundance of muskrat bone and concentrated areas of fish bone, while Broken Arrow contained few fish remains, an abundance of jackrabbit and bird bone, and significant amounts of immature small mammal bone. Both sites contained evidence that a variety of seeds were being utilized as well.

At each site, one late Holocene activity area or temporary camp was identified, along with evidence for earlier occupations extending back as far as 4000 BP. The sheer abundance of radiocarbon dates from Harney Valley falling after 2000 BP supports the argument that human occupation intensified after that time, but it will be prudent to reserve judgement on this matter until additional research occurs away from the erosion-prone lakeside settings.

By using the basic inferences suggested by the artifact assemblages and comparing them to ethnographic descriptions of human movement in and around the Harney Valley, it is possible to consider how the seven sites might fit into a generalized pattern of site use. Couture (1978) and Whiting (1950) documented root collecting in the Stinkingwater Mountains and surrounding areas in early May, followed by dispersal of family groups in the summer to collect seeds and other resources. Ground stone tools found in quantity at the Hines and Morgan sites indicate plant processing activities. The recovery of bulb fragments and grass seeds at these sites further supports this interpretation. It is doubtful that either of the sites were destination points for the collection of bulbs, given the small quantities recovered and the highly productive grounds known to exist elsewhere in the hills to the northeast. However, root collection and preparation at temporary camps en route to Pine Creek and the Stinkingwater Mountains is plausible. The abundance of grass seeds recovered suggests that the sites were probably more important for seed processing during the summer months, and prolonged periods of site use might have occurred then. In either case, the Hines and Morgan sites would have provided only temporary stopping points as people moved from one area to another in pursuit of other resources.

At the Hoyt site, the emphasis on hunting and the processing of animal resources may fit the seasonal ethnographic pattern. Game could be taken at any time of year, but hunting as an organized subsistence activity generally took place in the late summer and fall. The Blue Mountains near Seneca and John Day were favored locations, especially for elk, while rabbit and antelope drives were conducted near the Crowcamp Hills, in the northern portion of Harney Valley (Couture 1978). When viewed in terms of the known winter habitations at or near the lakes and general seasonal ethnographic rounds, it appears that the Hoyt and Morgan sites probably served as temporary camps for people leaving the winter lake side villages and traveling toward (ethnographically) known upland destinations in the spring and early summer. The Hoyt site may have been used by those coming back toward the lake side in the fall, and the range of artifacts and density of cultural materials suggests that it may have also served more in the capacity of a base camp, from which subsistence and resource procurement activities were staged.

According to patterns of movement described by Whiting, the Knoll site could have been visited by Harney Valley travelers during the summer and early fall months, as they moved en route toward Seneca and John Day to hunt, collect berries, and fish. The site provides evidence of quarrying, the acquisition and processing of game -- particularly small mammals -- and utilization of currants and other plant products. The site has been utilized over the last 4000 years, at least.

The RJ site fits well in Whiting's framework of seasonal passages to important resource areas. The root camps of the Stinkingwater Mountains and Pine Creek divide are well reported and they have served as an attraction for generations of Native peoples, including some from well outside of the Harney Valley. Archaeologically, evidence of root-collecting is difficult to identify and the thin sediments of the root grounds offer little protection for organic remains. Nevertheless, traces of faunal remains and fragments of burned seeds, processed edible tissue, and unidentifiable fruit tissues were identified at the RJ site. The abundance of large basalt chopping tools suggests that some activity related to wood working, probably the manufacture of digging sticks, was also occurring at the site. The annual seasonal round would have begun at spring root camps such as the RJ site, and evidence from obsidian sourcing indicates that tools were either being brought to the site from the northern edge of the Harney Valley or from a variety of sources to the north and east of the site. One possibility is that people were bringing obsidian to the site from the Burns area, then bringing other material back from areas to the north and east as they fished along the Malheur River or collected other resources nearby.

Laurie's site has abundant evidence of plant processing, including large quantities of fragmented ground stone and a variety of seeds from grasses and shrubs. The faunal evidence indicates that aquatic and terrestrial species were being utilized including both large and small game. At least three house pits were identified by testing at the site, producing evidence that a small lakeside village stood at the location between ca. 1500 to 2000 years ago. The houses and diversity of tools suggests that use of the village occurred over a lengthy period of time – possibly for weeks (or longer) instead of days – and that a variety of activities took place there, ranging from subsistence practices to the possible repair and replenishment of basketry, clothing, and weaponry. The site fits well within Whiting's description of human activities at Malheur Lake, which she identified as the main residential zone. Plant remains found at Laurie's site indicate that marshland plant seeds, wada and other seeds were being collected, or at least stored, there, and the presence of mountain mahogany establishes a tie with the uplands. That fits well with the trips into the Crowcamp Hills to pick chokecherries, described by Whiting (1950:19) as having occurred around the same time as the September gatherings to await the ripening of the wada.

The Broken Arrow site, close to Laurie's site, is a location that shares much in common with the latter, but also differs in significant ways. Broken Arrow was occupied at least between ca. 1800 BP to 2000 BP. There is evidence that a dwelling, probably a wickiup, once stood near the summit of the dune, and numerous artifacts suggest that it was occupied for a longer duration than are many of the open sites scattered around the Harney Valley. The site also has evidence of seed acquisition, including seeds of emergent marshland vegetation and wada. In addition, a variety of large and small game species are represented in the faunal assemblage though fish does not appear to be a key dietary item. The site fits well into the ethnographic pattern of resource acquisition in the summer or early fall, as described by Whiting.

Cultural Relations and Ethnic Group Territories

The temporary nature of the sites examined here limits their potential for providing information about ethnic group territories and long term changes. First, the sites *are* temporary, meaning that the artifact assemblages, though substantial in some cases, are limited in scope when compared with what might be found in a pit house village occupied for six months or so, and less likely to include ethnic markers such as fancy ground stone. Also, temporary camps are somewhat unsuited for answering questions of ethnicity because they are common to both highly mobile groups such as the Paiutes, and semi-sedentary groups like the Klamaths. Second, the sites are exposed to the elements. Perishable items like basketry and matting, which provide clues to ethnicity through both construction and artistic motifs, seldom survive long term exposure. Third, the sites were occupied infrequently during the last 4000 years, providing only a patchwork glimpse of use.

The most compelling currently known example of the archaeological expression of ethnic affiliation in Harney Valley prehistory was presented by Lyons (2001) in his analysis of the Lost Dune site, located south of Malheur Lake. Dating to ca. 500 years BP, the site yielded pottery, chert, and sandstone abraders that originated near the Owyhee River and eastward into Idaho, as well as opaline silicates from the Tosawihi source in northern Nevada. Based on the ceramic evidence, the site reveals that Shoshones were active in the Harney Valley during that time and traveled a circuitous route to get there. The Lost Dune site is one of very few with evidence of ceramic technology in the northern Great Basin of Oregon. The Lost Dune site is also important because it contains an abundance of Desert Side-notched projectile points, considered by many as a key marker for Numic-speaking peoples and a diagnostic indicator of late Holocene occupation of archaeological sites.

One of the best indicators of possible ethnic affiliations from the seven sites studied was their chronologically diagnostic projectile points. The Hines and Hoyt sites produced some points that were not readily assignable to Great Basin typologies, but are well-documented from Columbia Plateau sites such as Wildcat Canyon (Dumond and Minor 1983) and Pacquet Gulch (Jenkins and Connolly 1994). These included Pinstem points at the Hines and Broken Arrow sites, and Expanding Stem-3 and Contracting Stem types 2 and 3 at the Hoyt site (Dumond and

Minor 1983:170). Pinstem points sometimes occur in the Fort Rock Basin as well, and it is possible that Columbia Plateau populations were visiting portions of these two basins in the past. Plateau peoples are known to have participated in the spring gatherings at the "root camps" near Pine Creek or the Stinkingwater Mountains (Couture et al. 1986) in historic times.

Obsidian sourcing may provide an important window into local territories, though it does little to cast light on ethnicity (Figures 10.2 - 10.4). Obsidian sources for formed tools from the Hoyt, Morgan, and Hines sites reflect use of local sources including Burns Butte and Dog Hill, with tool stone from those sources averaging between 60% to 100% of the site totals for obsidian. Most non-local tool stone originated to the north and west. Late period points such as Rose Spring and Eastgate showed the highest proportions of obsidian from local sources. At the Knoll and RJ sites, obsidian tool stone came mainly from sources in the surrounding area, especially to the north at Whitewater Ridge, southward to Burns, and eastward to Venator. It must be noted, however, that all of the tool stone source localities cover much broader areas than the assigned place-names would suggest. At the Broken Arrow and Laurie's sites, there is a distinct regional orientation to the acquisition of tool stone, with the majority of obsidian originating from sources to the north and east of the sites. The pattern is strongest among the Rose Spring and Eastgate points. Elko points reflect a slightly broader array of sources including some west of Malheur and Harney lakes, but the emphasis on northern and eastern sources is still readily apparent.

Jenkins and Connolly (1990:112) first reported on the relationship between the resource area of the Harney Valley Paiutes and sources of obsidian recovered from the Indian Grade Spring site in the Stinkingwater Mountains. They noted that "prehistoric populations who used the Indian Grade Spring site ranged throughout an area comparable to that documented in the ethnographic record for the Harney Valley (Burns Band) Paiute."

Lyons et al. (2001:286) suggest that limited obsidian sources were utilized at Lost Dune around 2000 BP, identifying an area they refer to as the Western Malheur/Catlow resource procurement zone between 2000 BP and 500 BP. They noted that people gained access to more distant sources less often than central ones, and interpreted the correlation as indicating that "people using a particular low-lying wetland community foraged only so far as the surrounding upland areas having the resources they needed (2001:286-287)."

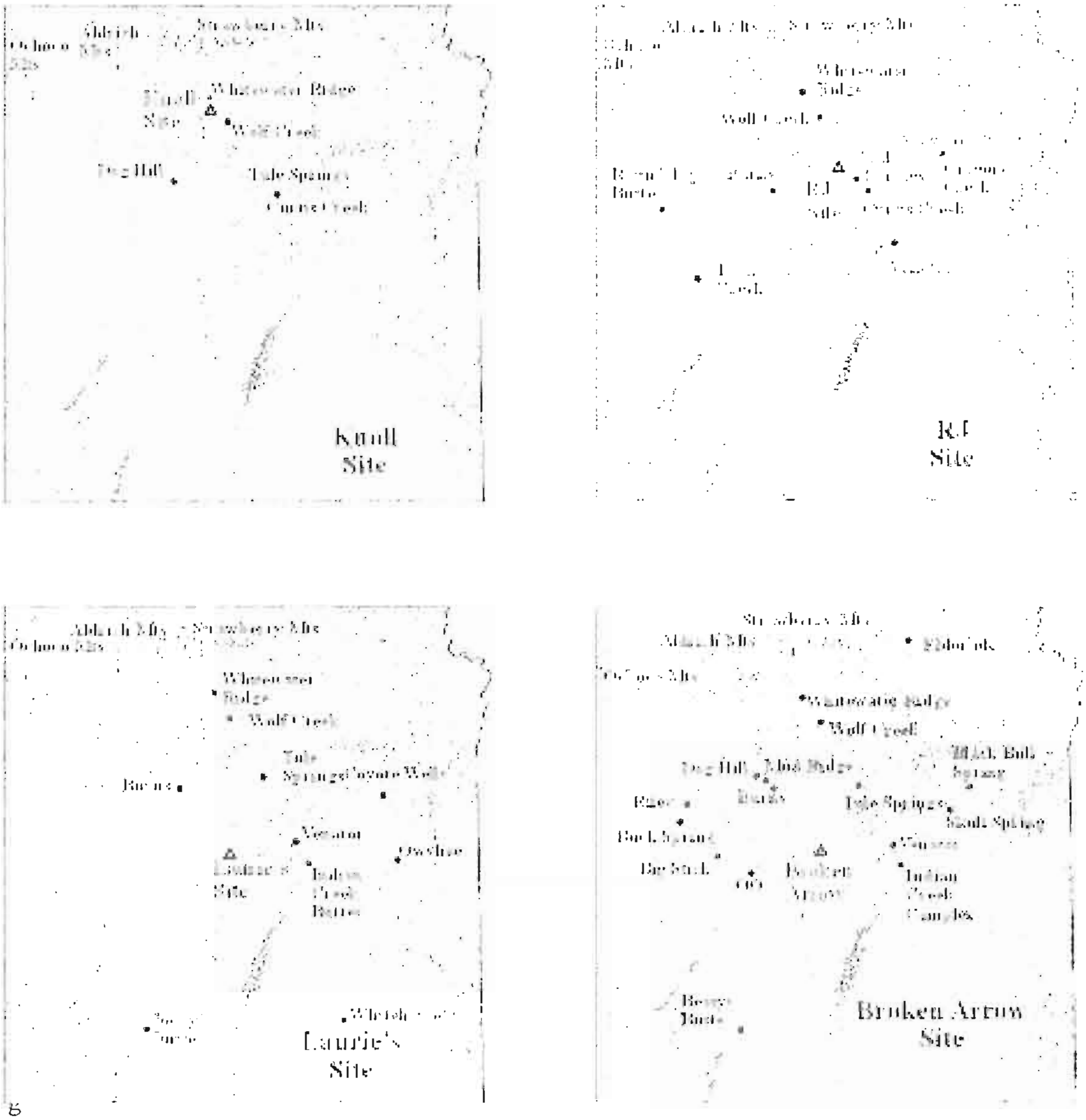


Figure 10.2. Obsidian sources for the Knoll, RJ, Laurie's, and Broken Arrow sites.

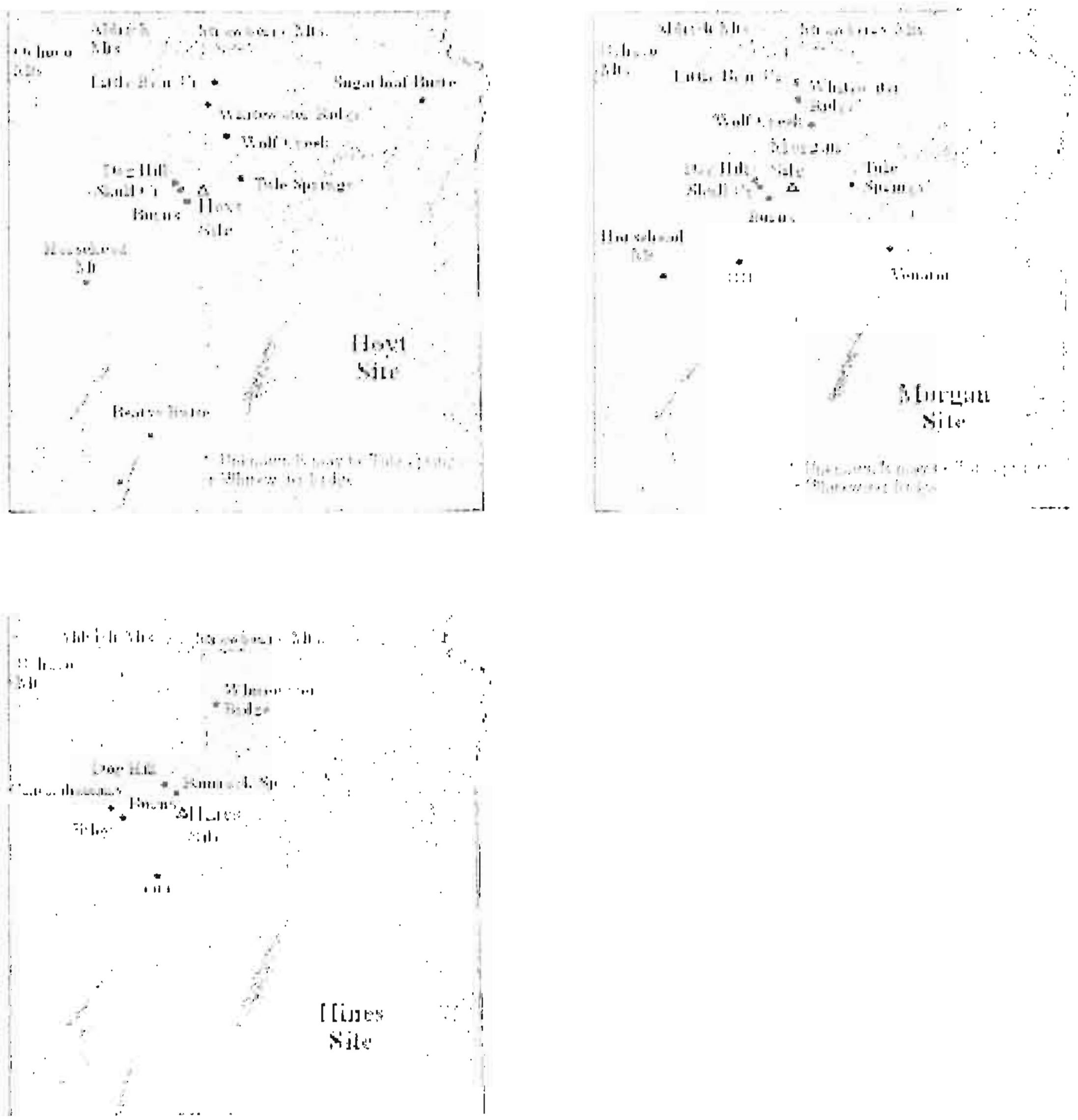


Figure 10.3. Obsidian sources for the Hoyt, Morgan, and Hines sites.

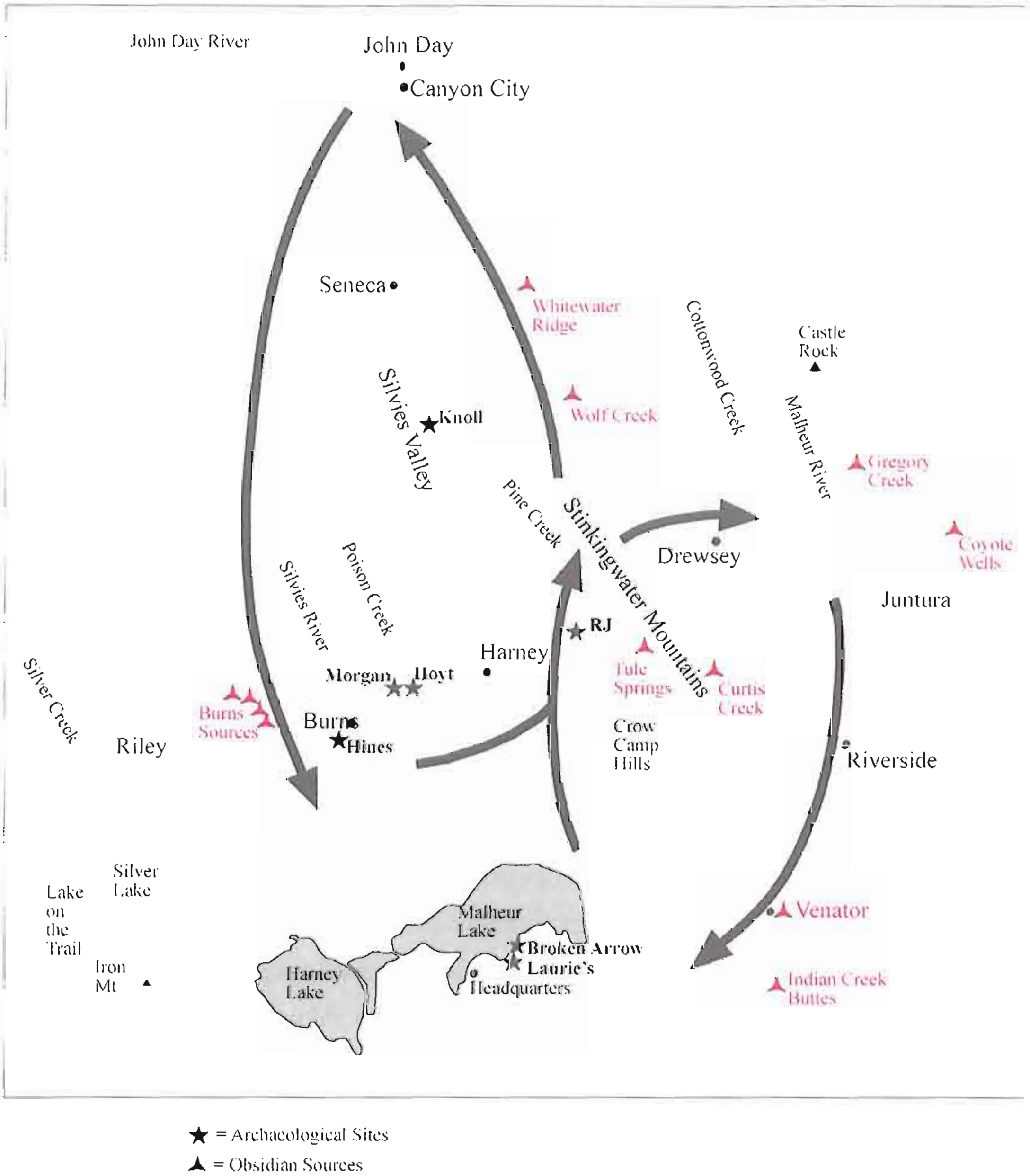


Figure 10.4. The relationship between the study sites (stars), the dominant obsidian sources (triangles), and patterns of movement (arrows) described by Whiting (1950).

Musil (2002: 73-79) reported the obsidian sourcing results from archaeological testing at the Headquarters site in 2001. He identified Upper and Lower components at the site, the lower dating between ca. 6900 BP and 7200 BP, the upper undated. Twenty-five obsidian flakes from the lower component were geochemically sourced, with 84% originating from the Glass Butte source to the west. Sources represented in the 23 flakes analyzed from the Upper Component were largely from north and east of Harney Valley, including Burns (39%) Venator (30%), Tule Springs (13%), Glass Buttes (4%) and Indian Creek Buttes (9%). Clearly we must entertain the possibility of considerable change over time in patterns of obsidian procurement in the Harney Valley.

Some observations important to the topic of resource use and group territories arise from the examination of obsidian source distributions seen at the study sites (Figures 10.1 - 10.3): First, the relationship between the area described as having been utilized in the Harney Valley seasonal round, as described by Whiting (1950), and the distribution of obsidian sources at the Knoll, RJ, Laurie's, and Broken Arrow sites (dating from 2000 BP to historic contact) is strong. The connection between the ethnographic record and the archaeological record apparently is one that extends well back in time. Second, the Hoyt, Morgan and Hines sites produced substantial quantities of Burns and Dog Hill obsidian, yet neither of these sources are well represented in the formed tools found at the Knoll, RJ, Laurie's, and Broken Arrow sites. Burns obsidian seems to have a very localized range, even though the tool stone quality is high. Third, the area which produced low percentages of obsidian tool stone, from the west edge of Harney Valley southward to Steens Mountain, is roughly equivalent to a territorial boundary zone historically disputed by the Burns Paiute and Klamath Tribes. Other factors such as the availability of resources in this zone, including tool stone, may have a part in this, but the distinction is apparent in this data set. Fourth, very little obsidian from sources in other important surrounding basins, including Catlow Valley, the Chewaucan Basin, Fort Rock Valley, and Warner Valley is perceptible through the obsidian from the seven Harney Valley sites reported herein, at least for the last 2000 years of occupation. Investigations of this matter in future research may go far towards providing insights into ethnicity and the territorial borders that separated aboriginal populations in central Oregon.

Prehistoric Technologies

The most prominent representation of prehistoric technology at the seven sites is through chipped stone projectile points, bifaces, drills, scrapers, gravers, cores, large flake tools, edge modified flakes, and debitage, the by-product of their manufacture. Chipped stone tools were manufactured from obsidian, basalt, or CCS, with obsidian accounting for the vast majority of all items. Typological categorization and attribute analysis of both tools and debitage was undertaken, and some obsidian artifacts were further analyzed through the use of geochemical sourcing (X-ray fluorescence) and hydration rim measurement. Radiocarbon dates indicated that the seven sites were primarily occupied within the last 2000 years, during the time of overlap between Elko and Rosegate projectile point technologies. The presence of older projectile point types such as Northern Side-notched reveals that the sites (or localities) were also used before 4000 years ago.

Other artifact categories included ground stone, abrading stones, hammer stones, atlatl weights, bone tools, and beads. Variation in the types of tools, along with the frequency and variety of floral and faunal remains, all contributed in the determination of what kinds of activities were occurring at each site.

The Hoyt site yielded 32 projectile points which were classifiable under the established Great Basin typology (Thomas 1981). They included 7 Rose Spring, 2 Eastgate, three Elko Eared, five Elko Corner-notched, four Northern Side-notched and two Small Side-notched, and one Humboldt Concave-base. Six projectile points were more appropriately classified through the Columbia Plateau typology developed by Dumond and Minor (!983). These included one Expanding Stem-3, four Contracting Stem-2, and one Contracting Stem-3 point. One point was typologically unclassifiable, and one was classifiable only as side-notched. The remaining tool assemblage included 129 edge-modified flakes, 23 projectile point fragments, 7 drills or awls, 58 biface fragments, 24 pieces of ground stone, 24 cores, 7 core and flake tools, 3 bone tools, 4 abraders, and a single atlatl weight.

At the Morgan site one Cottonwood Triangular, three Eastgate, three Rose Spring, one Elko Eared, four Elko Corner-notched and three Side-notched points were recovered. Other artifacts consisted of 8 projectile point fragments, 1 drill, 18 bifaces or biface fragments, 51 edge-modified flakes, 5 cores, 18 ground stone tools, 1 stone bead, 2 hammer stones, and 1 CCS chopper.

The Hines site produced 28 chronologically diagnostic projectile points, including 15 Rose Spring, four Eastgate, five Small Stemmed points, one Elko Corner-notched, two Elko Eared, and one Northern Side-notched point. Also collected were 17 point fragments, 34 bifaces or fragments, five drills, 189 edge-modified flakes, 12 cores, 14 ground stone tools, one abrader, one stone bead, and one bone tool.

Eight projectile points were found at the Knoll site, including five Northern Side-notched, one Elko Corner-notched, one Humboldt, and an unclassifiable point base. Also collected were 31 bifaces or fragments, 3 large flake tools of basalt, 17 edge modified flakes, and 8 cores. Ground stone included a triple-grooved abrader, three metate fragments, a mano fragment, and a pestle.

The RJ site produced 20 projectile points or hafted tools developed on a projectile point base, including 1 Cottonwood Triangular, 2 Desert Side-notched, 5 Rose Spring, 2 Elko Eared, 4 Elko Corner-notched, 1 Northern Side-notched, 1 Humboldt, 1 Malheur Stemmed, a large obsidian dart point that appears to be side-notched, an eared base that has been modified through retouching, a crude drill fashioned from a biface fragment, and a hafted scraper of basalt. Twenty-two bifaces in all stages of lithic reduction were collected, as were five drills or awls, twelve core and flake tools, seventeen edge- modified flakes, and eight cores. Three metate fragments and one mano fragment were also found.

Artifact counts were dramatically higher at the lakeside sites. Laurie's site yielded 41 projectile points from 3 house pit features. They include eleven Rose Spring, eight Eastgate, one Rosegate, five Elko Eared, three Elko Corner-notched, two undifferentiable Elko Series, two Northern Side-notched, one Contracting Stem, two Stemmed, and one Malheur Stemmed. Two points that were typologically unassignable, one knife, sixty-eight bifaces and fragments, a graver, four drills and awls, twenty-one edge-modified flakes, and nine cores compose the remainder of the chipped stone assemblage at Laurie's site. Other tools consisted of one abrader, one stone ball, 21 metate fragments, 12 manos, one bowl fragment, and two unidentifiable pieces of ground stone. Also found were ten beads of stone bone, and shell; and nine bone artifacts that include three bone tubes, a bead, a whistle, two awls, a spatulate tool, and a bone object of unknown use.

The Broken Arrow site produced 82 projectile points, including 16 Rose Spring, 14 Eastgate, 15 Elko Eared, nine Elko Corner-notched, four unclassifiable Elko Series points, one Pinstem, two Malheur Stemmed, two Northern Side-notched, one Humboldt, one Stemmed, and 11 typologically unclassifiable points. Other artifacts included 26 stone, bone, and shell beads; a hafted scraper; eight drills; 121 bifaces and biface fragments; 62 ground stone objects (28 mano fragments, 31 metate fragments, two pestle fragments, and one unknown object); 39 edge-modified flakes; eight cores; four bone tools and one bone pendant; two abraders; and a pipe bowl fragment.

The above inventory of artifacts is quite redundant, and that alone is of interest. The typologically classifiable projectile points comprise a core group of Rose Spring, Eastgate, and Elko points which is consistent for all but the Knoll site and indicates that the three point types were used concurrently, primarily between 2000 BP and 1000 BP. Often found with these three prominent point types are Desert Side-notched and Cottonwood Triangular points after 1000 BP, and Northern Side-notched points prior to 4000 BP. Desert Side-notched, Cottonwood Triangular, and Northern Side-notched points are incidental in many respects to the other evidence of site use and suggestive of isolated deposition or brief stopovers at the sites. Humboldt, Malheur Stemmed, and some Plateau types are also present, though infrequent, and Gatecliff points are virtually absent, although they are common in many areas of the Harney Valley. Desert Side-notched points are surprisingly uncommon given the ubiquity of other kinds of arrow points on prominent and stable late Holocene land forms in the area. One would expect that a site like Broken Arrow, where a sheet deposit of diagnostic projectile points spans the entire Holocene, would have also proven an attractive location for populations carrying the Desert Side-notched tool kit.

Other artifacts were clearly indicative of the kinds of activities occurring at each site and some were of such a specific nature that the implications of their presence are quite clear. The RJ site provides a good example of this, in that the presence of heavy duty basalt choppers in a root-collecting area suggests that digging sticks were also manufactured there. Similarly, at the Hines and Knoll sites, heavy concentrations of debitage, cores, and readily available tool stone signal that lithic reduction was a key activity. The Hoyt site has a wide array of tool types, strongly suggesting that the site served as a stopover for foraging and collecting groups on the northern edge of the valley just as the lakeside sites did in that locale. At the Laurie's and Broken Arrow sites, varied and prolonged site use is indicated by the broad range of utility artifacts, including drills and awls, gravers, ground stone, abraders, hafted scrapers, and bone tools, coupled with the presence of decorative, leisure, or ceremonial artifacts which might include beads, bone whistles, stone balls, and pipes. These two sites may have been central places, to which people returned after foraging and collecting events before setting out on the next forays, and probably places that were occupied by a small resident population while foraging and collecting occurred.

Figures 10.5 and 10.6 reveal a strong relationship between the results of mass analysis of debitage recovered from the seven sites, and experimental data sets for various stages of lithic reduction, as previously reported by Connolly (1999) and Connolly and Byram (2001). In Figure 10.3, the Hoyt, Knoll, RJ, and Broken Arrow sites are tightly grouped. Predicted stage values are somewhat lower at Laurie's site, and The Morgan and Hines sites fall out considerably lower than the others. It comes as somewhat of a surprise that the Knoll site debitage stage values are in keeping with lithic reduction sites some distance from the quarries, but the Feature 2 ground stone and debitage cluster at Knoll does contain a high quantity of fine flakes derived from late stage lithic reduction, which plays a significant role in the analytical outcome. In Figure 10.4, an approximate ranking of assemblages is provided through the comparison of one flake weight variable against one flake count variable (Connolly and Byram 2001:69). Most of the sites fall into the Stage 3 ranking, suggesting they might have contained a workshop area where bifacial cores were fashioned into other tools, and it is significant that the three sites exhibiting the widest array of tools – Hoyt, Laurie's, and Broken Arrow – are grouped most closely together in this analysis. The Morgan and Hines sites are identified with earlier stages of lithic reduction, and the Knoll site, though Stage 3 in ranking,

Figure 10.5. The relationship of mass analysis results from the seven sites, to lithic debris generated through staged experimental means(after Connolly and Byram 2001). The graph indicates that lithic reduction at the Morgan and Hines sites involved recently quarried tool stone

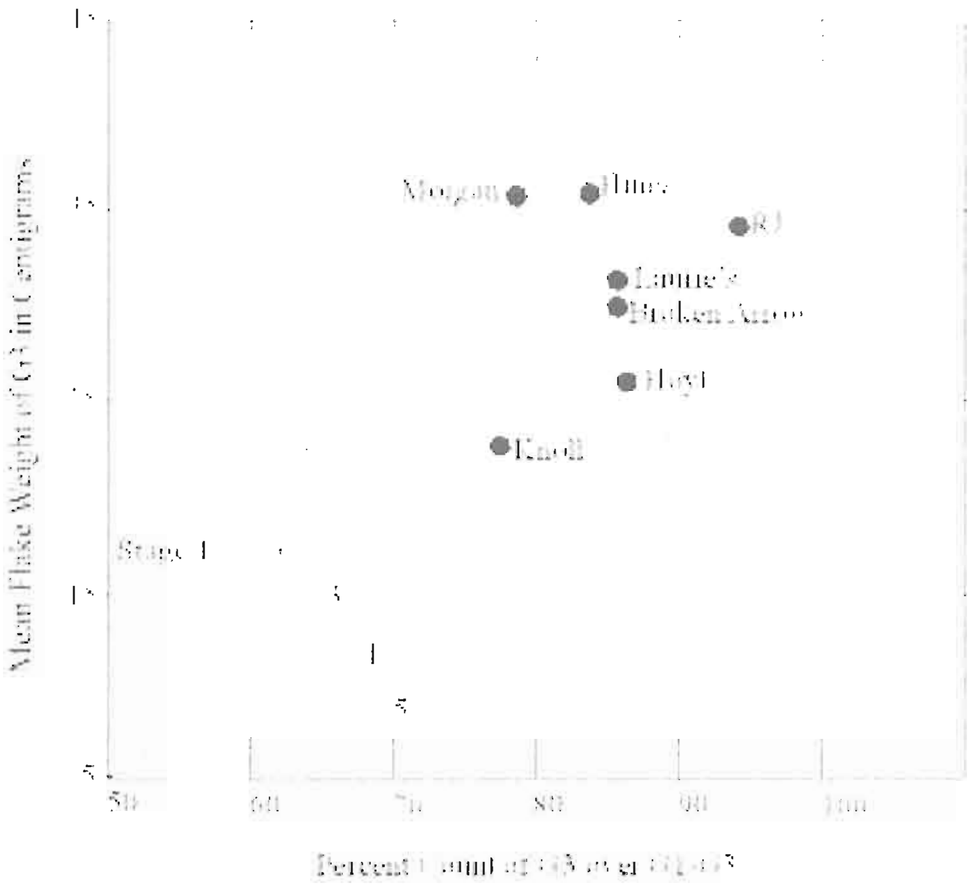


Figure 10.6. Scatter plot of flake weight and percentage,showing the relationship of the study site assemblages to lithic reduction stagesestablished with experimental data (after Connolly andByram 2001). Laurie's, Broken Arrow, and Hoyt (base camps)are more closely associated in comparison to the task-specific sites.

is seen to have lithic reduction results that are distinct from other site assemblages in the same category. The RJ site, though associated with a fairly specific range of activities, was also inhabited for prolonged periods in conjunction with the root harvests, and may reflect a more residential lithic assemblage as a result.

The Sites in Relationship to Harney Valley Patterns of Mobility

As discussed previously, the seven sites reported in this study have site setting and artifact assemblage characteristics that provide unique glimpses into the past 2000 years of Harney Valley prehistory. The characteristics of each site also allow for comparisons on inter- and intra-site levels, and, upon the completion of such comparisons, allow researchers to begin considering the sites in terms of subsistence and settlement systems and the possible behaviors that motivate the spatial patterning of sites across the landscape.

The seven sites I have documented fit into a settlement pattern that includes task-specific camps, male-dominated hunting sites, female-dominated broad-spectrum central base camps, and winter sites positioned to take advantage of local amenities such as shelter, water, and fuel, as well as stored foods. I believe the Hoyt, Laurie's, and Broken Arrow sites to be "central places", or base camps positioned to better serve the needs of women and children. Despite dense and varied accumulations of artifacts at each of the three sites, I do not believe that they are winter camps for reasons that are outlined below. The other four sites are more specific to certain kinds of activities, quarrying, small game hunting, and some berry processing at the Knoll site; lithic reduction, small game hunting, and plant processing at the Hines and Morgan sites; and root collecting at the RJ site.

Whiting (1950), Couture (1978), and Couture et al. (1986), make it clear that a variety of food items, both floral and faunal, factored into the diet of the Harney Valley native inhabitants. Floral resources in particular played a prominent role in decisions that were made regarding the allocation of labor and time. Because of the role that climatic vicissitudes played in the availability of certain kinds of resources, even those which were often abundant, such as geophytic roots, could be found in short supply when weather took a turn for the worse. According to Couture, "it was explained to me that the Indian way of life was patterned after the lifestyle of ants: It was proper to work from spring until fall, collecting food and wood, and store it away in preparation for winter. Those that didn't do that would suffer the consequences (Couture 1978:35)." As for the division of labor, Couture (1978:37-38) offers the following:

> "Hunting was the province of men, but women assisted in communal drives and also took small game such as groundhogs. Men made the equipment for the hunt including the manufacture of stone tools, nets, and twisted the bark fiber

> for cordage (Stewart 1941:389). They also prepared the willow trap for fishing while women cooperated in retrieving fish from the trap and prepared it for drying. Women's role centered on domestic tasks, the gathering of wild plants for food, and the gathering of insects. The preparation of food for storage, hauling of wood and water, cooking, sewing, hide dressing, weaving of rabbit-skin blankets, basketry, and cradleboard manufacturing were preeminently a woman's work. House building was a cooperative venture, with men setting the frame and women applying the covering.
>
> The division of labor extended to children. Boys learned to hunt, make their own bows, arrows and sling shots, while girls learned to dress hides, sew, cook, prepare meat for drying, gathered roots tended small children, all in preparation for a productive adult life."

It appears then, that productive roles among the Harney Valley Paiute were well established and probably followed a pattern of behavior that had proven successful for thousands of years. Even in good times, one had to be prepared for the worst that winter might bring. As Aikens (1993:18) put it: "The natural setting to which Oregon's Great Basin peoples were adapted was a rich one, extreme and demanding, yet generous to those who knew it well." One reflection of that "knowing" is the variability in the artifact assemblages of the sites reported here. In some instances, people came to places at certain times, for specific purposes. At other times, it may be the case that they came to a particular area and positioned themselves to take advantage of a suite of resources in the surrounding area. The south edge of Malheur Lake is a place where a variety of resources are available within close range. Open lake, shallow marshes, greasewood flats, dunes and grasslands, sagebrush steppe, and juniper-cloaked uplands are all within a half day's walk. A day or more on foot will put people well on their way to areas of major ecological transition; Duck Butte, Barren Valley, and the Stinkingwater Mountains to the east, Steens Mountain to the south, thousands of square kilometers of wetlands in Blitzen Marsh, and many thousands more north of Malheur Lake. To the north beyond that were the great expanses of upland root grounds, hunting areas, the streams from which salmon were taken, and thousands of acres of camas between the lake and the foothills.

Do the seven archaeological sites reflect short term use for specific purposes, with limited variation in tool kits, or longer term use with broad assemblages of tools (Figure 10.7) for a

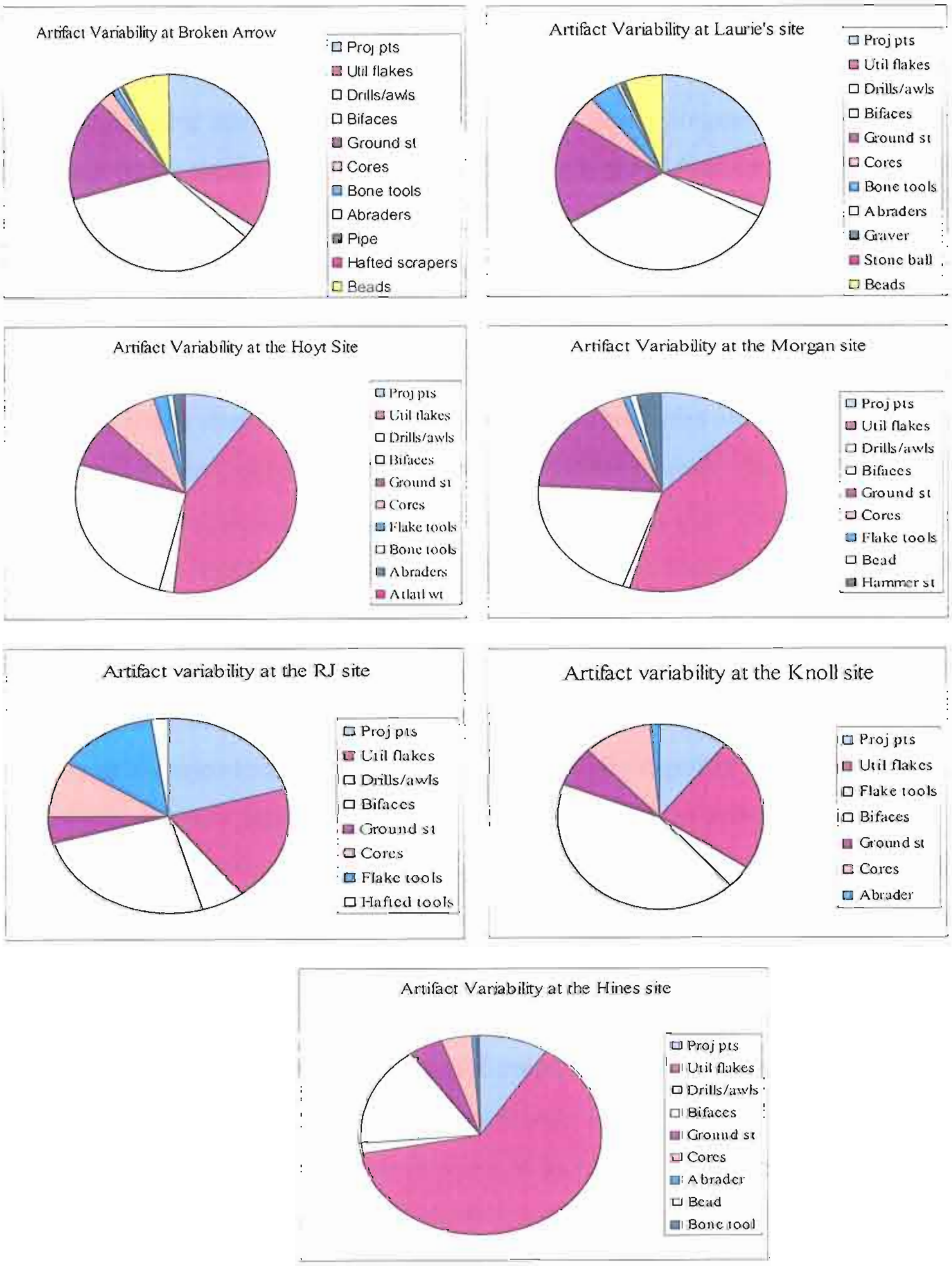


Figure 10.7. Pie charts showing variability at each of the seven study sites by artifact counts.

variety of tasks? The answer is, "both". As shown in Figure 10.7, the Hines, Morgan, Knoll and RJ sites certainly contain a more limited range of tools than the Hoyt, Laurie's, or Broken Arrow sites, and inferences drawn from the site setting, available resources, and associations of tools indicate that fairly specific activities were occurring at these four sites, augmented, of course, through other kinds of resource acquisition as permitted by time and opportunity. The Morgan and Hines sites have an emphasis on lithic reduction activities, along with some small game hunting and plant collecting. The RJ site is a substantial root camp, and the Knoll site is a quarrying location at which some hunting and berry collecting may have occurred. The Knoll, Morgan, and Hines sites reflect more male-dominated activities including lithic reduction and hunting, though plant acquisition does factor into the use of each. The RJ site, as a root camp, is considered to be dominated by female activities, though it is clear from Whiting's and other accounts that entire families occupied the root camp during certain periods.

At the Hoyt, Laurie's, and Broken Arrow sites, a much broader range of artifacts are present and artifact concentrations are significantly richer, indicating that occupations were longer in duration and a variety of activities could have been taking place during stays there. Based on the variation in artifacts and the richness of site deposits, among other aspects, I believe that the Hoyt, Laurie's, and Broken Arrow sites fit the pattern of "central places" as described initially by Raven (1990) and elaborated upon by Zeanah (2004) for the Carson Desert region. These are sites that are either positioned by Malheur Lake and its associated marshlands, or in areas where access to varied resources is assured. The activities at such places can be said to be female-dominated by virtue of their placement, with access to a variety of marshland resources in close proximity, and by the need for males to conduct logistical forays to areas more suitable for hunting, tool stone acquisition, and other resources.

The Laurie's and Broken Arrow sites are located in an area fully exposed to the buffeting of storms, and anyone who has camped near that part of the lake even as late as May can attest to the ferocity of the winds there. At both sites, the archaeological deposits are rich and concentrated, and they can exceed half a meter in depth. The stratigraphy at both sites indicates that these are not complex accumulations, and radiocarbon dating indicates that there are hundreds of years of deposition at best, not thousands. If the sites are winter villages, they denote a relatively limited era of occupation, perhaps during a specific period of time when climatic conditions were mild, and favorable to the widespread dispersal of village sites. At the same time, a site does not necessarily have to be a winter village just because it is near the lake, and habitations where people stayed for more than a few weeks are bound to have considerable accumulations of artifacts, especially if intensive resource procurement and processing is taking place.

A better explanation is offered through the concept of central place foraging. The Broken Arrow, Laurie's, and Hoyt sites are positioned at locations where a wide variety of floral and faunal resources would have been available within a relatively short distance, and it may be the case that a core group of inhabitants maintained a steady population at these locations while others ventured out on a series of logistical forays in pursuit of various resources. As resource productivity declined, a move could be made to the next location where such activities again occurred or different strategies were employed. Central place foraging accounts for a variety of situations which are otherwise not as readily explained, sexual division of labor among them.

Zeanah's (2004) study of the Carson Desert region focuses on the sexual division of labor, and suggests how different men's and women's roles lead to different kinds of assemblages at sites used primarily by men or primarily by women. He utilizes information derived from soils maps to identify the prehistoric range of various kinds of vegetation and, by extension, available resources prior to landscape changes affected by the arrival of Euroamericans. Recognizing a total of 41 soil-based habitats, he defined a series of men's and women's prey sets from such habitats based on ethnographic information. He then examined the foraging return rates for each prey set, including both floral and faunal resources, to determine optimal prey sets for different men's and women's activites that can be categorized through seasonal availability. Zeanah (2004:4) felt that hunting by males may not have been a particularly efficient way of provisioning families and that the distribution of meat among the village community probably served a purpose that was not focused on simple sustenance. As he put it: "These questions arouse suspicion that Great Basin men and women foraged to achieve different ends; men hunted because of the mating opportunities they gained by sharing meat, whereas women gathered to provision their children (2004:4)."

Zeanah realizes that the subsistence efforts of a hunting and gathering band may not exclusively be focused on optimal caloric returns, although the more efficient the return of resources, the more natural selection benefits are conveyed to the population. Optimizing the ability of both men and women to contribute to the common good while minimizing travel and transport costs is not going to be entirely possible. Zeanah (2004:26) observes:

> "It is clear that men's foraging returns are not crucial to determining when and where hunting oriented settlement strategies may have occurred. Instead, the critical factor concerns women's requirement to reliably feed their children. This was often best achieved by residing in women's best foraging patches in the Late Holocene Great Basin, where temporal fluctuations in resource abundance often made food storage mandatory. Hunting must be sufficiently productive and reliable to overcome women's provisioning constraint for a hunting-oriented strategy to be favored. Otherwise, men should hunt logistically. Mere demonstration that higher hunting returns were feasible in the past is insufficient basis for expecting a hunting-oriented economy to have occurred. This is an important lesson in the Great Basin where archaeologists have often constructed models in which men's subsistence choices either explicitly or implicitly drive prehistoric subsistence-settlement strategies."

In Harney Valley, the best foraging patches for women would be near the marsh, at sites such as Hoyt, Laurie's and Broken Arrow, where small mammals, waterfowl, and both xeric and mesic plant species would be available within close range. At various times, the entire population could be congregated there. At other times, groups could split away to carry out hunting forays in the highlands, acquire tool stone in various places, or partake in a variety of activites and tasks related to the day-to-day business of life. Resources that were being acquired may not necessarily have been stored at the sites where they were initially obtained, but they may have been processed there prior to storage elsewhere in preparation for winter.

In the case of the study sites, we can not look directly to the archaeological record to identify items that tie the uplands and lowlands together except at Laurie's site, where mountain mahogany was recovered among the botanical remains. Mountain mahogany was an important resource for the manufacture of highly valued tools -- ranging from digging sticks, bows, and atlatls, to projectile points -- that would have been transported over considerable distances and kept for long periods of time. The deposition of this plant species in the house pits indicates people who camped at Laurie's site had also visited the uplands on previous occasions.

We can also look at the range of variability within the site assemblages and the possible implications regarding length and season of occupation to determine if the study sites might be central places. Considering the variety of artifacts at the Hoyt, Laurie's and Broken Arrow sites, the richness of the deposits, and the absence of complex stratigraphy that would show repeated occupations occurring over extensive periods of time, I suggest that they represent central places that served as residential bases for foraging populations. These populations transported a variety of plant and animal resources to the sites, carried out a variety of processing activities in association with the replenishment and maintenance of clothing, basketry, and weaponry, then moved on to carry out other kinds of resource acquisition in preparation elsewhere for the coming winter.

Centrally located base camps are not the expectation at all times of the year. The correlation between Whiting's account of the seasonal round and the results of this archaeological study, including the findings from the Hines, Morgan, Knoll, and RJ sites, prove that. They are locations that would have been effective at certain times of the year, and Whiting's description of the September congregations at Malheur Lake offer an example of such behavior. The people arrived in time to wait for the ripening of the wada, and the collection of other seeds occurred during that time, along with trips to the Crowcamp Hills to collect chokecherries for processing in preparation for winter. The archaeological evidence at the Laurie's and Broken Arrow sites attests to the collection of various seeds, and the faunal evidence also indicates the availability of immature small mammals and waterfowl, which would not have been have been so prevalent in winter game harvests. The Hoyt site, which also operated as a central base camp, appears to have had a greater focus on the acquisition of faunal resources, both large and small terrestrial species. The summer and late fall would have been the best time for operating out of central places because of the potentially wide range of available resources during that time of the year. Such places satisfy the likely need for a centralized location where food and material stores coming in from afield could be accumulated, processed, and watched over, as well as the need for a stable location where less mobile members of the population, young and old, would remain while others traveled about.

In the spring, the entire population may have mobilized to participate in the upland root gatherings, followed by passage northward to the Malheur River fishing camps. In the late summer and fall, some went northward towards John Day for hunting and berry picking and others would have moved toward the lake. As winter came on, people congregated in protected areas where the essentials of life were within easy reach, food stores were accumulated, and snow did not get too deep.

Why may Laurie's and Broken Arrow, though centrally located, not be winter village sites? Because of their patterns of deposition, resource richness, and stratigraphic simplicity, as well as ethnographically demonstrated requirements which they do not meet. A winter village should be a place that has access to fresh water, fuel, and shelter from storms. There are some locations that fulfill this set of standards on the margins of Malheur Lake, of which the Headquarters site is a particularly noteworthy example. The location of the site adjacent to Sod House Spring and the Donner und Blitzen River provided fresh and abundant water and supported the growth of plant species needed for fuel. The topographic relief provided protection from storms as well as campsites above flood stage. One would expect to find a complex superposition of archaeological evidence indicating that aboriginal camps were revisited over many millennia in such a place, given the appropriate geomorphic circumstances. That has proven to be the case, as was shown through the numerous archaeological investigations that have taken place there, particularly those of Thomas (1979), and Dugas and Bullock (1994). Stratigraphic complexity was not as evident in other excavations at the Headquarters site, probably due to the location of the work and the degree of historic alteration that had occurred in some places.

Undoubtedly, other locations in the vicinity of Malheur Lake were also used as winter camps. The McCoy Creek site (35HA1263) in Diamond Swamp has evidence of storage pits, clay-lined house floors, deeply stratified deposits, and substantial quantities of ground stone (Musil 1995), as does the Blitzen Marsh site (35HA9) reported by Fagan (1973). Another probable winter village site was reported to me by property owners during the 2000 and 2001 field seasons. Located on the south shore of Malheur Lake, the Mahoney site (known locally as "Indian Town") is situated on a high shoreline adjacent to a spring, and artifacts recovered from cultural deposits there span the Holocene. Specimens include one Clovis point, stemmed points, crescents, a variety of middle and late Holocene point types, and historic trade beads. The owner reported that artifact bearing deposits in one place exceeded the reach of his backhoe (approximately 12 feet) during utility trenching. The Crow Ranch, located just east of the Headquarters site, is also situated near an artesian spring and may also be the site of a winter camp. Artifacts found there range from at least one Clovis point to historic trade beads and deposits there are reported to be deep and stratified.

Future Research in Harney Valley

This dissertation has evaluated seven prehistoric sites in the Harney Valley that were occupied for various reasons during the last 2000 years. While it has elaborated on a period of human activity that occurred primarily between 2000 BP and 650 BP, it has also provided a broader evaluation, identifying areas of future archaeological research that will greatly benefit our understanding of human behavior in the region.

Continuing research in later sites will further fill out our understanding of land use and settlement. Large-scale archaeological investigations in the primary deposits of known winter village locations such as the Headquarters or Blitzen Marsh sites would be immensely helpful for developing a greater sense of scale regarding the archaeological constituents of such a site, and the relationship of seasonally occupied central places and task-specific camps to them. Work at task-specific camps where the likelihood exists of encountering evidence relating to the processing of camas, grasses, fruits, nuts, and berries would also be useful for building a balanced perspective on the kinds of artifact assemblages that should be expected in such places. The same is true for sites where fishing occurred, both in lake and riverside settings, sites where evidence of rabbit and antelope drives might be present, as well as those relating to bighorn sheep, deer, and elk hunting, and perhaps places where crickets were once gathered.

The pre-2000 BP record of human activity needs to be clarified by focused additional research. The most productive approach in the near term will be quantitative distributional studies of projectile point types across the Harney region, as a way of showing the kinds of places favored by people at earlier periods. Targeted research in promising buried sites of earlier periods will be key to filling out our understanding of these periods.

Establishing a context for the late Pleistocene-early Holocene period is vital to understanding long term changes in human use of the area. Thomas and O'Grady (2006) already have research under way to develop an overview of early sites and isolated finds that will incorporate information from site forms, reports, and recorded isolates to build on this theme. There are areas within the Harney Valley such as the "lakes district" northwest of Harney Lake that have considerably higher frequencies of stemmed and fluted points, but the available information has not yet been synthesized to date to provide insights about site placement on the landscape, possible relationships of sites to ancient shorelines, and whether or not site placement may convey information about the effects of geomorphic processes or early patterns of human land use. It is well known that large scale climatic changes occurred during the course of the Holocene and even greater changes took place during the transition from the Pleistocene to the Holocene. This knowledge factors into the decisions that Great Basin archaeologists make in their search for early sites. Shorelines, terraces, and concentrations of dunes can all be traced to geomorphic processes that were spawned from changing climatic events, some earlier and some later, and a greater emphasis needs to be placed on testing sites located on such landforms to get a better grasp of the activities and specific dates during which they were occupied.

The middle Holocene, for the purposes of this discussion, encompasses a period ranging from 7000 BP to 2000 BP and Northern Side-notched and Elko points are key diagnostic artifacts found during the period. Important climatic events were at work in the Great Basin during the middle Holocene, including a transition from dry conditions around 7000 BP, a sustained period of greater effective moisture and abundant resources from 5000 to 3000 BP, then fluctuating conditions until approximately 2000 BP. Large scale climatic changes undoubtedly affected human use of the Harney Valley to a considerable degree, but how those transitions are manifested in the archaeological record is not understood with sufficient depth. Information about the distributions of Northern Side-notched points within Harney Valley would be an effective means of looking at the patterns of land use between 7000 and 4000 BP. Northern Side-notched points are regular finds at all of the sites reported here, but there is little systematic understanding of where sites that are dominated by this type of point are situated.

Elko points are everywhere in the Harney Valley, a testimony to the attractiveness of the region beginning around 5000 years ago. Considering that a period of greater effective moisture was developing before that time and that lake levels would have been higher as a result, it is expected that substantial village sites with dense concentrations of Elko points should be encountered in association with high shorelines or other elevated land features. Oetting (1990 a and b, 1999) witnessed concentrations of artifacts, including Elko points, on a previously unprecedented scale during post flood surveys of Malheur National Wildlife Refuge lands in the late 1980s, and he suggested that human use intensified in the region about 5000 BP. Significant gains in our understanding of human use of the Harney Valley could be made by conducting test excavations at sites dominated by Elko points located on shorelines well above modern lake levels. Identifying and evaluating "Elko-specific" components, particularly components dating between 4000 and 2000 BP, would shed light on the archaeology of the region after the use of

Northern Side-notched points had declined, and before the arrival of bow and arrow technology. Many Elko sites would have been positioned in relation to ever-changing shorelines, and were likely affected to a great degree by lacustrine erosional processes.

Desert Side-notched points, which occur in the northern Great Basin after ca. 1000 BP, are interesting from the standpoint that little geomorphic change has occurred since the points were deposited, but the artifacts appear to be irregularly distributed within Harney Valley. Sites dominated by these late Holocene points should tell us about aboriginal use of the area just prior to historic contact.

Four periods could be evaluated through studies of the distributions of the temporally diagnostic artifacts mentioned above: (ca. 12,000 – 8,000 BP for Paleo-Indian points, 7,000 – 4,000 BP for Northern Side-notched points, 6000 – 1000 BP for Elko points, and 1,000 BP to the historic period for Desert Side-notched points). Systematic knowledge of the Paleo-Indian and Northern Side-notched point distributions in particular will go far toward answering questions regarding the effect that the dynamic lake system had on sites dating before 2,000 BP.

The concept of central places -- as described earlier utilizing concepts outlined in Zeanah's (2004) work in the Carson Desert -- which has been used in the foregoing to identify the principal reasons for the positioning of the Hoyt, Broken Arrow, and Laurie's sites, is one that can also be expanded upon by studies of the diagnostic categories of artifacts listed above. Identifying key sites that may have served as central places and task-specific sites that were satellites, then conducting test excavations at each, will directly address the importance of central place foraging over time.

If the distribution of sites containing Desert Side-notched points is markedly different from sites pre-dating that period, and if the kinds of sites differ from the pattern of winter villages, central places, and task specific sites suggested herein, then there is additional weight behind the concept of population replacement and a pattern of behavior that reflects use of the Harney Valley by people adapted to drier conditions after 1000 BP but operating in the same general region.

This dissertation is focused on the 2000 to 650 BP period, in which Elko, Rose Spring, and Eastgate points are found concurrently. Shifting the focus to Elko-specific sites occurring between 4000 to 2000 BP will be necessary to expand the archaeological time depth of the region with greater detail. Because of the ubiquity of Elko points throughout Harney Valley, it may be more realistic to identify components ranging from 4000 to 2000 BP within multi-component sites that would be suitable for the purpose, but identifying sites dating to that period alone would be ideal.

The same is true for the distribution of sites containing Northern Side-notched points. Northern Side-notched site distributions may suggest patterns of behavior based on adaptations to a different suite of landforms and resources. It is true that all of the sites in this study contained the points, but the Knoll site was the only location where they composed the majority of the projectile point assemblage. A literature search of existing site forms and survey reports can be carried out at the Burns District Bureau of Land Management to identify promising site locations. Test excavations targeting Northern Side-notched sites in varied geographic settings will help to address the utility of the central place foraging model for humans operating in the Harney Valley during the early middle-Holocene period from 7000 to 4000 BP.

Only 11 fluted points have been recovered from Burns District Bureau of Land Management property over the years, including several from the south shore of Malheur Lake (Thomas and O'Grady 2006). None have been found in stratified deposits, but all are associated with lakes, playas, and other hydrologic features. Efforts are currently underway to identify and survey hydrologic features, including old shorelines, which might prove to be suitable locations for Clovis-era sites. Five Western Clovis or Clovis variant points have been recovered in the last six years of these surveys. Paleo-Indian sites containing Stemmed points are more common and they are regularly encountered during surveys in the Harney Valley, particularly in association with old playa shorelines. An inventory of Stemmed point sites and isolates, and Clovis isolates, is being developed to explore the distribution of such artifacts across Burns District BLM lands (O'Grady and Thomas 2006). The lack of stratified Paleo-Indian sites in the Harney Valley and the limited number of studies that have been conducted on such sites (Bonstead 2000, Gehr 1980, Wriston 2003) make this a challenging temporal category for exploring the concept of central places, but our continuing efforts to discover and record early Holocene sites and isolates will prove useful in building a framework for well informed discussions of long term human use of the Harney Valley. The data indicate that people have been in the Harney Valley over a long span of time, and they probably favored a few kinds of locations. More work is needed to define their presence more fully and allow consideration of what their early lifeway was like. It may be that their "central places" were lakeshores and playas, but searching varied land surfaces in other kinds of settings as well will be needed to show if that impression is likely to be correct.

The rich data base of obsidian sourcing and hydration data that has been constructed by the Burns District Bureau of Land Management will be a tremendous resource for achieving a better understanding of possible travel and transport routes through the region at different periods of time, and possibly shed light on prehistoric territories. A more widespread study will be helpful in understanding the relationship of populations in neighboring valleys and drainage basins of archaeological importance -- such as the Catlow Valley, Warner Valley, Lake Abert-Chewaucan Marsh, Alkalai Lake, and Fort Rock Basin -- to the population residing in the Harney Valley. Obsidian sourcing research has great potential for expanding our knowledge of intra-regional movements and extra-regional connections, and it is an area of research that yields high returns in knowledge for the effort expended.

There is still considerable new research and much synthesis of the existing literature to be done before we are in a position to speak confidently of long term archaeological trends in the region, but the present research shows that continued efforts will yield fruitful and perhaps occasionally surprising results.

APPENDIX
GEOCHEMICAL SOURCING AND OBSIDIAN HYDRATION STUDIES AT THE HOYT, MORGAN, AND HINES SITES

A STUDY REPORT BY THOMAS J. CONNOLLY,
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Obsidian Studies

Obsidian Source Analysis

Each geologic source of obsidian tends to be quite homogeneous in its trace element composition, and distinct from other geologic sources; as a result, individual sources can be identified by trace element geochemistry. A number of techniques have been used to "fingerprint" obsidian sources, but x-ray fluorescence spectroscopy (XRF) is most commonly used because it is non-destructive, accurate, and relatively inexpensive (Harbottle 1982; Rapp 1985; Williams-Thorpe 1995; Glascock et al. 1998; Herz and Garrison 1998). Patterns of obsidian source use in archaeological studies may help to identify specific activity areas or tool manufacturing events at a site level, and, on a regional level, can inform on procurement ranges, boundaries, travel routes, the curational value of particular formal artifact types, and the presence of trade and exchange systems (Ericson 1981; Hughes 1978, 1990; Hughes and Bettinger 1984).

Sourcing Results

A total of 365 obsidian specimens from the Hoyt (35HA2422), Morgan (35HA2423), and Hines (35HA2692) sites were submitted for XRF analysis to Geochemical Research Laboratory in Portola Valley, California (Hughes 1996) or Northwest Research Obsidian Studies Laboratory in Corvallis, Oregon (Skinner et al. 1996, 1998). This number includes 20 projectile points and 108 pieces of flake debitage from the Hines site, 11 projectile points and 59 flakes from the Morgan site, and 29 projectile points, 28 other bifaces, and 110 flakes from the Hines site. Geochemical source assignments are identified in Tables 1 through 3.

In some cases, the precision of geochemical source typing exceeds the practical reality of obsidian distributions, especially in the case of overlapping secondary deposits of obsidian that originally derived from separate vents. A number of distinct geochemical source types represented in the present data set are members of such proximate and geochemically related source groups (Figure 1).

The *Dog Hill*, *Skull Creek* (also known as the Mud Ridge source), *Rimrock Spring*, and *Burns Butte* (also known as the Burns or Radar Hill source) sources all derive from the hills west and northwest of the modern community of Burns. These distinct geochemical types generally occur from north to south as listed (i.e., the Dog Hill source is centered ca. 15 km northwest of Burns and the Burns Butte source is centered immediately west of Burns), but obsidian from these sources occur as float cobbles over broadly overlapping areas, and along the drainage of Silvies River.

A number of distinct geochemical types occur along the drainage of Silver Creek, at a distance of ca. 40 to 50 km west and southwest of Burns including, from north to south, the *Chickahominy*, *Riley*, *Buck Spring*, and *Double O* obsidian types. These obsidians occur as local outcrops, but also occur as float material over broad areas. Buck Spring obsidian, in particular, appears to be associated with the widespread Rattlesnake ashflow tuff, which covers a vast area from Warner Valley to the John Day River basin. Despite the widespread occurrence of this material, it is not common in archaeological contexts, possibly due to its variable toolstone qualities.

A large complex of obsidian sources is found in and around Bear Creek Valley east of Seneca, Oregon, an obsidian source area ca. 60 to 70 km north of Burns, including obsidian of the *Whitewater Ridge*, *Little Bear Creek*, and *Wolf Creek* geochemical types identified in the present data set. These geochemical types also occur in the gravels of the Silvies River to the south of the source area.

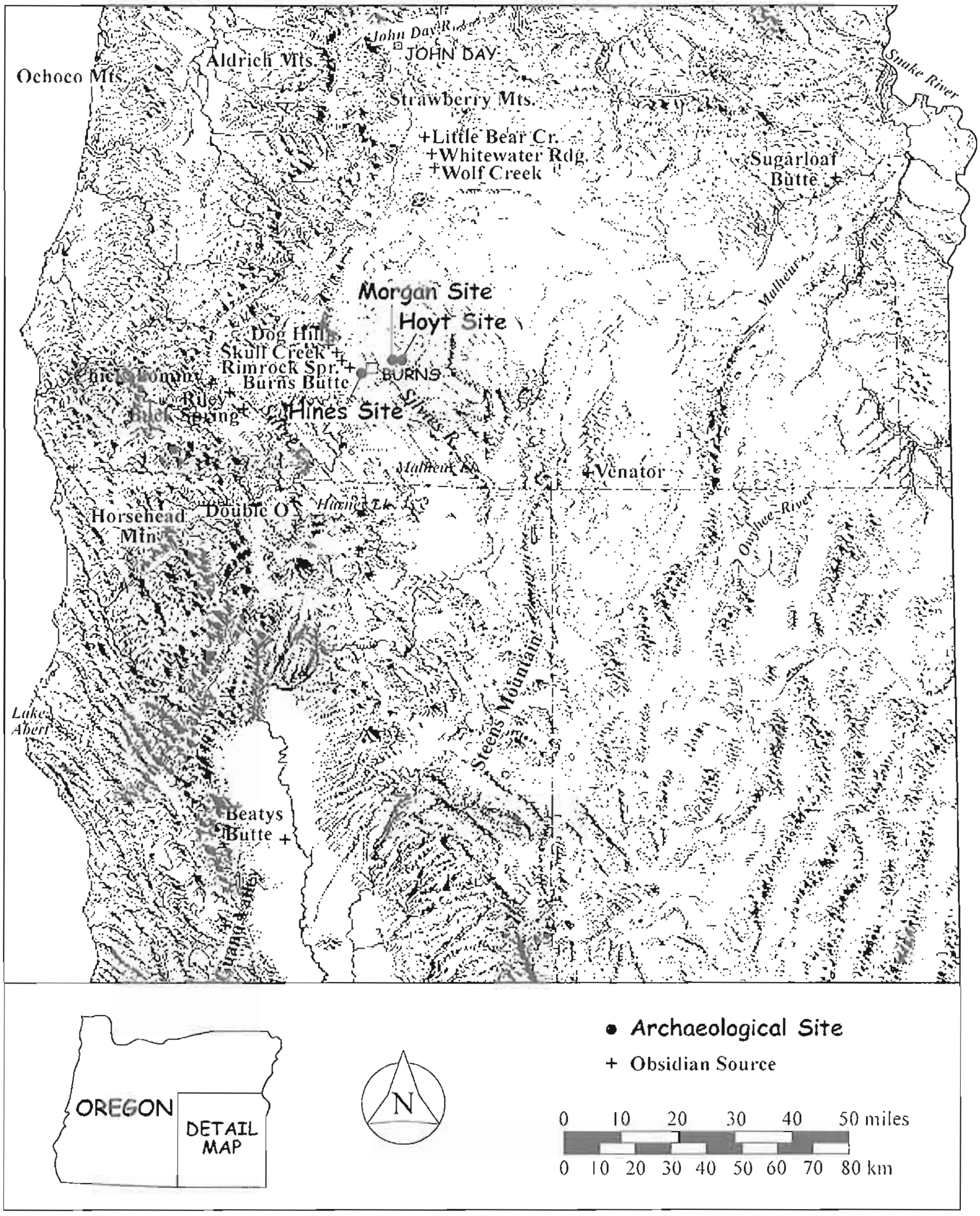

Figure 1. Obsidian Sources found at the Hoyt, Morgan, and Hines Sites.

Table 1. Obsidian source and hydration summary for the Hines Site (35HA2692).

Spec.	Artifact	Hydr (μ)	Source	Spec.	Artifact	Hydr (μ)	Source	Spec.	Artifact	Hydr (μ)	Source
					North Block						
P1-2-2	RS	2.8	Burns Butte	FB-3-1	DRL	.	Burns Butte	CA-6-1b	Flake	2.6	Burns Butte
TP3-1-1	EG	3.0	Burns Butte	FB-4-1	Biface	.	Dog Hill	CB-6-1a	Flake	4.9	Burns Butte
BA-2-1	Biface	2.8	Burns Butte	FB-5-1	Biface	2.7	Burns Butte	CB-6-1b	Flake	5.0	Burns Butte
BA-3-1	Biface	3.2	Burns Butte	FB-6-1	RS	.	Riley	CC-6-1a	Flake	2.1	Burns Butte
BB-5-1	RS	.	Chickahominy	FB-9-1	EG	.	Riley	CD-6-3a	Flake	1.9	Burns Butte
BD-4-1	RS	.	Rimrock Spr.	FC-7-3	RS	3.1	Burns Butte	DC-3-3a	Flake	.	Burns Butte
BD-5-1	Biface	3.4	Burns Butte	FD-5-1	RS	.	Unknown 2	DC-3-3b	Flake	.	Burns Butte
CA-5-3	RS	2.3	Burns Butte	FD-6-1	RS	.	Rimrock Spr.	DA-3-4a	Flake	2.0	Burns Butte
CA-8-1	Biface	.	Dog Hill	GB-2-2	Biface	3.9	Burns Butte	EB-5-6a	Flake	3.3	Burns Butte
CB-3-2	RS	.	Whitewater Rdg	GB-7-1	RS	.	Chickahominy	EB-5-6b	Flake	1.4	Burns Butte
CC-3-1	RS	.	Rimrock Spr.	GB-9-2	Biface	2.4	Burns Butte	FB-6-6a	Flake	3.0	Burns Butte
CC-4-1	Biface	.	Dog Hill	HA-4-1	Biface	2.8	Burns Butte	FB-6-6b	Flake	3.1	Burns Butte
CC-4-2	Biface	.	Buck Spring	HA-5-1	Biface	7.3	Burns Butte	FB-6-6c	Flake	3.7	Burns Butte
CC-5-1	RS	.	Rimrock Spr.	HA-5-2	DRL	1.6	Burns Butte	FD-6-4a	Flake	2.6	Burns Butte
CC-7-1	Biface	2.0	Burns Butte	HB-7-1	Biface	2.8	Burns Butte	FD-6-4b	Flake	2.3	Burns Butte
CD-4-1	Biface	.	Rimrock Spr.	HC-5-1	Biface	.	Burns Butte	FD-6-4c	Flake	2.4	Burns Butte
CD-6-1	Biface	.	Rimrock Spr.	HD-4-1	RS	3.5	Burns Butte	HA-3-1	Flake	.	Burns Butte
DA-4-1	Elko	.	DoubleO	IB-2-1	RS	.	Burns Butte	HA-5-3a	Flake	2.2	Burns Butte
DC-2-1	Biface	.	Unknown 1	IB-4-1	Biface	.	Dog Hill	HA-5-3b	Flake	.	Rimrock Spr.
DC-5-1	RS	1.8	Burns Butte	IB-5-1	RS	2.9	Burns Butte	HA-5-3c	Flake	.	Dog Hill
EB-4-1	Biface	3.0	Burns Butte	ID-4-1	Biface	2.8	Burns Butte	HA-5-3d	Flake	.	Burns Butte
EB-6-1	RS	.	Rimrock Spr.	ID-5-2	Biface	4.1	Burns Butte	HD-5-3a	Flake	3.6	Burns Butte
EB-7-1	EG	.	Buck Spring	BB-5-3a	Flake	7.1	Burns Butte	HD-5-3b	Flake	2.8	Burns Butte
EB-7-2	RS	2.6	Burns Butte	BB-5-3b	Flake	.	Rimrock Spr.	IA-5-6a	Flake	2.7	Burns Butte
ED-2-1	RS	.	Buck Spring	BC-5-3a	Flake	2.5	Burns Butte	IB-5-3a	Flake	.	Burns Butte
ED-3-1	Biface	.	Riley	BC-5-3b	Flake	2.8	Burns Butte	IB-5-3b	Flake	.	Burns Butte
FA-4-1	Biface	.	Rimrock Spr.	BD-5-1a	Flake	1.6	Burns Butte	ID-5-6a	Flake	2.2	Burns Butte
FA-5-1	RS	1.9	Burns Butte	BD-5-1b	Flake	2.9	Burns Butte	ID-5-6b	Flake	3.4	Burns Butte
FB-1-1	EG	4.1	Burns Butte	CA-6-1a	Flake	3.0	Burns Butte	ID-5-6c	Flake	1.8	Burns Butte
FB-2-1	Biface	4.0	Burns Butte								

Table 1 (continued). Obsidian source and hydration summary for the Hines Site (35HA2692).

					South Block						
Spec.	Artifact	Hydr (μ)	Source	Spec.	Artifact	Hydr (μ)	Source	Spec.	Artifact	Hydr (μ)	Source
JB-3-1	Biface	5.7	Burns Butte	KA-10-1a	Flake	6.8	Burns Butte	MC-6-1a	Flake	5.7	Burns Butte
KA-1-1	Biface	9.5	Burns Butte	KA-10-1b	Flake	6.3	Burns Butte	MC-6-1b	Flake	3.9	Burns Butte
KB-6-1	Elko	.	Whitewater Rdg	KA-10-1c	Flake	6.0	Burns Butte	MD-6-1a	Flake	7.5	Burns Butte
LD-11-1	Elko	4.0	Burns Butte	KC-10-1a	Flake	5.4	Burns Butte	MA-11-3a	Flake	5.9	Burns Butte
MC-3-1	Elko	4.4	Burns Butte	KC-10-1b	Flake	6.1	Burns Butte	MA-11-3b	Flake	5.7	Burns Butte
NB-5-1	EG	.	Buck Spring	KD-10-1a	Flake	6.0	Burns Butte	MA-11-3c	Flake	5.5	Burns Butte
JA-4-1a	Flake	6.2	Burns Butte	LA-5-2a	Flake	2.6	Burns Butte	MB-11-1a	Flake	5.4	Burns Butte
JB-4-2a	Flake	2.6	Burns Butte	LA-5-2b	Flake	4.4	Burns Butte	MB-11-1b	Flake	5.5	Burns Butte
JB-4-2b	Flake	.	Dog Hill	LB-5-1a	Flake	3.9	Burns Butte	MC-11-1a	Flake	5.7	Burns Butte
JC-4-1a-a	Flake	5.9	Burns Butte	LB-5-1b	Flake	6.7	Burns Butte	MD-11-1a	Flake	5.9	Burns Butte
Side b		2.7		LD-5-2a	Flake	6.1	Burns Butte	MD-11-1b	Flake	.	Burns Butte
JC-4-1b	Flake	5.7	Burns Butte	LD-5-2b	Flake	.	Unknown 3	NA-4-1a	Flake	7.2	Burns Butte
JD-4-1a	Flake	.	Dog Hill	LD-5-2c	Flake	3.3	Burns Butte	NA4-1b	Flake	7.1	Burns Butte
JD-4-1b	Flake	.	Rimrock Spr.	LA-11-1a	Flake	6.0	Burns Butte	NB-4-1a	Flake	6.9	Burns Butte
JC-11-1a	Flake	6.4	Burns Butte	LA-11-1b	Flake	5.8	Burns Butte	NC-4-1a	Flake	.	Burns Butte
JC-11-1b	Flake	.	Dog Hill	LA-11-1c	Flake	5.6	Burns Butte	NC-4-1b	Flake	6.1	Burns Butte
JA-11-1a	Flake	3.3	Burns Butte	LB-11-1a	Flake	5.8	Burns Butte	ND-4-2a	Flake	4.4	Burns Butte
JA-11-1b-a	Flake	5.3	Burns Butte	LB-11-1b	Flake	5.5	Burns Butte	ND-4-2b	Flake	7.3	Burns Butte
Side b		2.4		LB-11-1c	Flake	6.0	Burns Butte	NA-9-1a	Flake	5.5	Burns Butte
KA-5-1a	Flake	.	Dog Hill	LD-11-2a	Flake	5.9	Burns Butte	NB-9-1a	Flake	6.6	Burns Butte
KA-5-1b-a	Flake	4.1	Burns Butte	LD-11-2b	Flake	5.8	Burns Butte	NB-9-1b	Flake	6.1	Burns Butte
Side b		7.5		LD-11-2c	Flake	6.0	Burns Butte	NC-9-1a	Flake	6.0	Burns Butte
KB-5-2a	Flake	4.5	Burns Butte	LD-11-2d	Flake	6.4	Burns Butte	NC-9-1b	Flake	5.7	Burns Butte
KB-5-2b	Flake	7.0	Burns Butte	MA-6-2a	Flake	6.4	Burns Butte	ND-9-1a	Flake	5.9	Burns Butte
KC-5-2a	Flake	.	Burns Butte	MA-6-2b	Flake	5.8	Burns Butte	ND-9-1b	Flake	5.4	Burns Butte
KC-5-2b	Flake	.	Buck Spring	MB-6-1a	Flake	5.3	Burns Butte	1027-SF-1	Elko	3.3	Burns Butte
KD-5-1a	Flake	3.2	Burns Butte	MB-6-1b	Flake	.	Rimrock Spr.	SF-1	SN	.	Double O

Table 2. Obsidian source and hydration summary for the Hoyt Site (35HA2422).

Spec.	Artifact	Hydr (μ)	Source	Spec.	Artifact	Hydr (μ)	Source	Spec.	Artifact	Hydr (μ)	Source
TP2-3-1	RS	2.7	Burns Butte	EB-6-1d	Flake	5.5	Burns Butte	EC-11-1d	Flake	.	Little Bear Cr.
P5-1-1	SN	.	Little Bear Cr.	EA-6-2d	Flake	4.8	Burns Butte	EC-11-2d	Flake	5.0	Burns Butte
P24-1	RS	3.2	Dog Hill	EA-6-3d	Flake	5.2	Burns Butte	ED-11-1d	Flake	5.0	Burns Butte
AD-13-1	RS	.	Unknown	EA-6-4d	Flake	4.6	Dog Hill	ED-11-2d	Flake	4.7	Burns Butte
DB-11-2	CS	.	Sugarloaf Butte	EB-6-1d	Flake	5.3	Burns Butte	ED-12-1d	Flake	5.5	Dog Hill
EC-13-1	Elko	5.5	Dog Hill	EB-6-2d	Flake	4.8	Burns Butte	ED-12-2d	Flake	4.7	Dog Hill
FA-9-1	RS	.	Wolf Creek	EC-6-1d	Flake	6.0	Burns Butte	EC-13-1d	Flake	4.4	Burns Butte
GC-11-1	EG	.	Unknown A	ED-6-1d	Flake	5.3	Burns Butte	EC-13-2d	Flake	.	Skull Creek
GC-11-2	Elko	.	Unknown	EA-7-1d	Flake	3.9	Burns Butte	ED-13-1d	Flake	5.2	Burns Butte
HA-12-2	SN	4.8	Burns Butte	EA-7-2d	Flake	5.4	Burns Butte	ED-13-2d	Flake	5.7	Burns Butte
IC-10-1	RS	.	Unknown A	EA-7-3d	Flake	5.4	Burns Butte	ED-14-1d	Flake	4.6	Burns Butte
JC-10-1	RS	.	Unknown B	EA-7-4d	Flake	.	Horsehead Mtn.	ED-14-2d	Flake	5.4	Burns Butte
JC-12-1	Elko	.	Beatys Butte	ED-7-2d	Flake	.	Unknown A	EC-14-1d	Flake	4.9	Burns Butte
KB-12-1	BN	.	Whitewater Rdg	EC-7-1d	Flake	5.8	Burns Butte	EC-14-2d	Flake	4.3	Burns Butte
LA-16-1	RS	3.7	Dog Hill	EC-7-2d	Flake	5.1	Dog Hill	EC-15-1d	Flake	5.6	Burns Butte
MA-10-1	Elko	5.3	Burns Butte	ED-7-1d	Flake	4.7	Burns Butte	EC-15-2d	Flake	5.8	Dog Hill
MC-7-1	RS	3.5	Burns Butte	EA-8-1d	Flake	.	Wolf Creek	ED-15-1d	Flake	4.9	Dog Hill
OA-5-1	Elko	5.0	Burns Butte	EA-8-2d	Flake	4.7	Burns Butte	ED-15-2d	Flake	4.5	Dog Hill
OA-9-1	SN	.	Unknown	EB-8-1d	Flake	5.0	Burns Butte	EC-16-1d	Flake	5.5	Burns Butte
SB-11-1	RS	.	Massacre/Guano	EB-8-2d	Flake	.	Unknown A	EC-16-2d	Flake	3.9	Burns Butte
EA-1-1d	Flake	5.4	Dog Hill	EC-8-1d	Flake	3.4	Burns Butte	ED-16-1d	Flake	4.8	Burns Butte
EA-1-2d	Flake	5.0	Burns Butte	EC-8-2d	Flake	4.8	Burns Butte	ED-16-2d	Flake	4.6	Burns Butte
EA-2-2d-a	Flake	5.4	Dog Hill	ED-8-1d	Flake	4.6	Burns Butte	EC-17-1d	Flake	4.7	Burns Butte
Side-b		4.2		ED-8-2d	Flake	5.5	Burns Butte	EC-17-2d	Flake	5.4	Burns Butte
EB-2-1d	Flake	4.5	Burns Butte	EA-9-1d	Flake	6.1	Burns Butte	ED-17-1d	Flake	5.3	Burns Butte
EB-2-2d	Flake	3.7	Burns Butte	EA-9-2d	Flake	5.0	Burns Butte	ED-17-2d	Flake	5.3	Burns Butte
EC-2-1d	Flake	4.8	Burns Butte	EB-9-1d	Flake	4.7	Burns Butte	EA-18-1d	Flake	5.1	Burns Butte
EC-3-1d	Flake	4.3	Burns Butte	EB-9-2d	Flake	5.6	Burns Butte	EA-18-2d	Flake	4.3	Burns Butte
EC-3-2d	Flake	4.8	Burns Butte	EC-9-1d	Flake	6.4	Burns Butte	ED-18-1d	Flake	3.5	Burns Butte
EC-3-3d	Flake	5.9	Dog Hill	EC-9-2d	Flake	4.0	Burns Butte	ED-18-2d	Flake	4.9	Burns Butte
EA-4-1d	Flake	4.8	Burns Butte	ED-9-1d	Flake	4.5	Burns Butte	EB-18-1d	Flake	3.9	Burns Butte
EA-4-2d	Flake	5.6	Burns Butte	ED-9-2d	Flake	5.3	Burns Butte	EB-18-2d	Flake	5.5	Burns Butte
EB-4-1d	Flake	5.3	Burns Butte	EA-10-1d	Flake	5.4	Burns Butte	EA-19-1d	Flake	4.8	Burns Butte
EB-4-2d	Flake	5.7	Burns Butte	EA-10-2d	Flake	5.2	Burns Butte	EA-19-2d	Flake	4.3	Burns Butte
EC-4-1d	Flake	.	Unknown B	EB-10-1d	Flake	.	Unknown A	EB-19-1d	Flake	5.3	Burns Butte
ED-4-1d	Flake	.	Skull Creek	EB-10-2d	Flake	4.7	Burns Butte	EB-19-2d	Flake	5.4	Burns Butte
EA-5-1d	Flake	.	Whitewater Rdg	EC-10-1d	Flake	.	Burns Butte	EC-19-1d	Flake	4.4	Burns Butte
EA-5-2d	Flake	4.9	Burns Butte	EC-10-2d	Flake	5.0	Burns Butte	EC-19-2d	Flake	5.8	Burns Butte
EB-5-1d	Flake	4.8	Burns Butte	ED-10-1d	Flake	5.7	Burns Butte	EC-20-1d	Flake	5.0	Burns Butte
EC-5-1d	Flake	5.4	Burns Butte	ED-10-2d	Flake	3.3	Burns Butte	EC-20-2d-a	Flake	7.6	Burns Butte
EC-5-2d	Flake	5.9	Burns Butte	EA-11-1d	Flake	5.3	Dog Hill	Side-b		5.5	
ED-5-1d	Flake	5.3	Burns Butte	EA-11-2d	Flake	4.5	Burns Butte	EC-20-3d-a	Flake	5.6	Burns Butte
ED-5-2d	Flake	4.5	Dog Hill	EB-11-1d	Flake	4.5	Burns Butte	Side-b		3.6	
EA-6-1d	Flake	4.2	Burns Butte	EB-11-2d	Flake	5.3	Burns Butte				

Table 3. Obsidian source and hydration summary for the Morgan Site (35HA2423).

Spec.	Artifact	Hydr (μ)	Source	Spec.	Artifact	Hydr (μ)	Source	Spec.	Artifact	Hydr (μ)	Source
				West Block							
AA-4-1	Elko	3.6	Burns Butte	EB-6-1d	Flake	4.6	Burns Butte	GA-9-1d	Flake	5.3	Burns Butte
BA-1-1	SN	.	Whitewater Rdg.	EB-6-2d	Flake	.	Horsehead Mtn.	GA-9-2d	Flake	5.4	Burns Butte
EB-6-1	EG	3.7	Burns Butte	GB-6-1d	Flake	6.6	Burns Butte	EB-10-1d	Flake	.	Unknown
GB-6-1	Elko	.	Unknown A	EA-8-1d	Flake	7.0	Dog Hill	GA-10-1d	Flake	.	Skull Creek
JC-7-1	Elko	.	Wolf Creek	EB-8-2d	Flake	1.6	Dog Hill	EB-11-1d	Flake	5.1	Burns Butte
MC-13-1	Elko	.	Venator	EB-8-1d	Flake	.	Horsehead Mtn.	GA-11-1d	Flake	5.0	Burns Butte
GB-4-1d	Flake	4.1	Burns Butte	GB-8-1d	Flake	5.8	Dog Hill	EB-12-1d	Flake	4.9	Burns Butte
				East Block							
TB-4-1	RS	2.5	Dog Hill	UD-4-1d	Flake	5.3	Burns Butte	UC-6-1d-a	Flake	6.3	Dog Hill
UD-9-1	EG	3.2	Dog Hill	UB-4-1d	Flake	4.4	Dog Hill	Side-b		4.5	
YA-5-1	Elko	.	Double O	UB-4-2d	Flake	5.9	Burns Butte	UD-6-2d	Flake	4.4	Dog Hill
YB-1-1-a	RS	3.7	Burns Butte	UA-4-1d	Flake	5.7	Burns Butte	UC-7-1d	Flake	5.6	Dog Hill
Side-b		2.3		UA-4-2d	Flake	5.9	Dog Hill	XD-7-1d	Flake	3.3	Burns Butte
YD-8-1-a	SN	5.3	Burns Butte	UA-4-3d	Flake	4.6	Burns Butte	XD-7-2d	Flake	4.1	Dog Hill
Side-b		5.6		UA-4-4d	Flake	4.6	Burns Butte	UC-8-1d	Flake	.	Burns Butte
XD-1-1d-a	Flake	5.7	Dog Hill	UA-4-5d	Flake	.	Skull Creek	UB-8-1d	Flake	5.8	Dog Hill
Side-b		7.3		XD-4-1d	Flake	4.5	Dog Hill	UB-8-2d	Flake	4.8	Burns Butte
XD-1-2d	Flake	3.6	Burns Butte	XD-4-2d	Flake	4.1	Dog Hill	XD-8/9-2d	Flake	5.3	Burns Butte
XD-1-3d	Flake	6.1	Burns Butte	UC-5-1d	Flake	.	Burns Butte	UA-9-1d	Flake	.	Little Bear Cr.
UA-2-1d	Flake	4.6	Burns Butte	UD-5-1d	Flake	5.4	Burns Butte	UB-9-1d	Flake	.	Whitewater Rdg
UD-2-1d	Flake	5.0	Dog Hill	UB-5-1d	Flake	5.4	Burns Butte	UB-9-2d	Flake	7.7	Dog Hill
UD-2-2d	Flake	5.6	Burns Butte	XD-5-1d	Flake	7.0	Burns Butte	UC-9-1d	Flake	5.6	Burns Butte
UC-2-1d	Flake	.	Burns Butte	XD-5-2d	Flake	4.2	Dog Hill	UC-10-1d	Flake	5.7	Burns Butte
UD-3-1d	Flake	3.0	Dog Hill	XD-5-3d	Flake	.	Unknown B	UD-11-1d	Flake	.	Dog Hill
UC-3-1d	Flake	.	Unknown B	UA-6-1d	Flake	3.7	Dog Hill	XD-11-2d	Flake	5.5	Dog Hill
UC-3-2d	Flake	6.3	Burns Butte	UD-6-1d	Flake	5.6	Dog Hill				

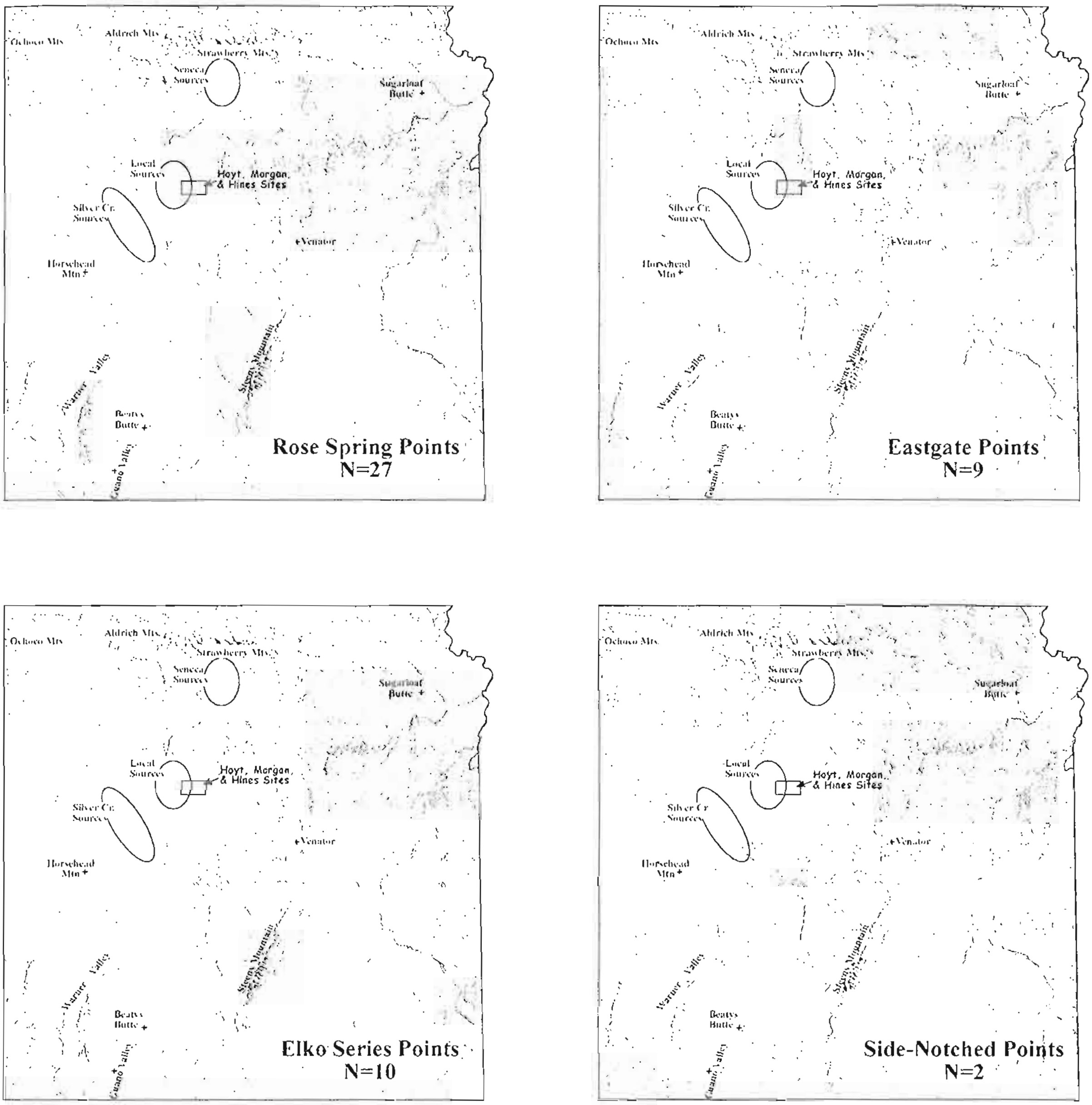

Figure 2. Geochemical Sources represented at the Hoyt, Morgan, and Hines sites by projectile point type. Line thickness is proportional to source frequency

These geochemical types have overlapping distributions, and in some cases are geochemically similar to one another. Skinner (1999) notes that initial trace element studies suggested that Whitewater Ridge and Little Bear Creek geochemical types were distinguishable based on Strontium values (Hughes 1995; Skinner 1995), but analysis of additional source samples has resulted in the grouping of these types, and has led Skinner to consider these a single chemical source, albeit one with a considerable range of compositional variability.

The other sources represented in the obsidian record from the Hoyt, Morgan, and Hines sites are distant, located outside of the Harney Basin. *Horsehead Mountain* is located ca. 65 km southwest of Burns, and the *Venator* source is ca. 65 miles (108 km) southeast of Burns in the upper Malheur River drainage basin. The other identified sources, all well over 100 km distant from the project area, include *Sugarloaf Butte* (ca. 135 km northeast), *Beatys Butte* (135 km south), and the *Massacre Lake/Guano Valley* source (ca. 175 km south).

Mobile hunting and gathering people generally carried with them a tool kit of portable hunting and food processing tools, including bifaces, finished projectile points and other equipment. Such tools were made at base camps, and could be carried considerable distances before being lost or replaced. In areas where quality tool stone was available in abundance, as in the vicinity of the Hoyt, Morgan, and Hines sites, quantities of exotic tool stone material in unfinished form would not be transported far. Sourcing information for formed tools and debitage are tabulated separately (Table 4), and exhibit an expected pattern; obsidian from the local sources accounts for 96% or more of all sourced debitage in each component, while the proportion of exotic material ranges from 14% to 60% of the formed tool assemblage.

One of the main reasons for geochemically sourcing a quantity of debitage, given the expected predominantly local profile, is to confirm a large sample of specimens from a single source to control for the effects of geochemical variability in obsidian hydration analysis. The formed tool assemblage is much more useful for identifying changing patterns of source use variability and direction, and is the focus of the following discussion. It should be noted that projectile point sample sizes in all components are relatively small, so the patterns discussed below should be considered tentative.

Three of the five analytic units shown in Table 4—Hines South, Morgan West, and the Hoyt site—have Elko and side-notched projectile points representing 50% or more of the point assemblage. It is these same three components that exhibit the highest proportions of non-local tool stone, 43% or greater. The two components containing a predominance of late period Rose Spring and Eastgate points—Morgan East and Hines North—also have the smallest proportions (20% or less) exotic tool stone material.

This pattern is upheld by examining source location by projectile point types from all components, as shown in Table 5. At least 50% of all Elko and side-notched projectile points derive from distant sources, and the average distance to source for both types is greater than 30 km. Although the sample sizes are relatively small for these types, the diversity of obsidian types, including a number of distant sources, is notable. The source location of side-notched points made from exotic obsidian is exclusively to the north. Elko points were made from exotic material deriving from diverse areas to the north, and throughout the Harney and adjacent basins to the south and southeast.

In contrast to the earlier point styles, 65% of Rose Spring projectile points were made from local obsidian. A surprising number of Rose Spring and Eastgate points derive from the Silver Creek sources to the west, sources not represented in the Elko and side-notched types. Average source distance for Rose Spring and Eastgate points is less than 30 km.

These patterns suggest somewhat greater mobility over larger ranges in the earlier period, prior to about 1500 years ago when side-notched and Elko dart points were predominant. The greater reliance on local tool stone sources during the last 1500 years suggests the possible presence of a more local resident population, and regular use of the sources along the Silver Creek drainage.

Table 4.Obsidian Source Representation in Relation to sies

	Hines North		Hines South		Hoyt Site		Morgan East		Morgan West	
	Tools	Debitage	Tools	Debitage	Tools	Debitage	Tools	Debitage	Tools	Debitage
Local Sources										
Burns Butte (5 km)	28	33	4	63	5	86	4	21	2	6
Rimrock Spring (10 km)	8	2	-	2	-	-	-	1	-	-
Skull Creek[1] (15 km)	-	-	-	-	-	2	-	1	-	1
Dog Hill (15 km)	4	1	-	4	3	12	2	19	-	-
Total Local	**40 (80%)**	**36 (100%)**	**4 (57%)**	**69 (99%)**	**8 (57%)**	**100 (96%)**	**6 (86%)**	**42 (98%)**	**2 (40%)**	**7 (100%)**
Silver Creek Sources										
Chickahominy (45 km)	2	-	-	-	-	-	-	-	-	-
Riley (40 km)	3	-	-	-	-	-	-	-	-	-
Buck Spring (40 km)	3	-	1	1	-	-	-	-	-	-
Double O (45 km)	1	-	1	-	-	-	1	-	-	-
Total Silver Cr.	**9 (18%)**	**-**	**2 (29%)**	**1 (1%)**	**-**	**-**	**1 (14%)**	**-**	**-**	**-**
Sencca Sources										
Whitewater Ridge (60 km)	1	-	1	-	1	1	-	1	1	-
Little Bear Creek (60 km)	-	-	-	-	1	1	-	-	-	-
Wolf Creek (60 km)	-	-	-	-	1	1	-	-	1	-
Total Seneca	**1 (2%)**	**-**	**1 (14%)**	**-**	**3 (21%)**	**3 (3%)**	**-**	**1 (2%)**	**2 (40%)**	**-**
Southern Sources										
Horsehead Mtn. (65 km)	-	-	-	-	-	1	-	-	-	-
Beatys Butte (135 km)	-	-	-	-	1	-	-	-	-	-
Guano Valley[2] (175 km)	-	-	-	-	1	-	-	-	-	-
Total Southern	**-**	**-**	**-**	**-**	**2 (14%)**	**1 (1%)**	**-**	**-**	**-**	**-**
Malheur River Sources										
Venator (65 km)	-	-	-	-	-	-	-	-	1	-
Sugarloaf Butte (135 km)	-	-	-	-	1	-	-	-	-	-
Total Malheur	**-**	**-**	**-**	**-**	**1 (7%)**	**-**	**-**	**-**	**1 (20%)**	**-**
Total	**50**	**36**	**7**	**70**	**14**	**104**	**7**	**43**	**5**	**7**
Avg. Distance to Source	**14.9**	**5.6**	**23.6**	**6.2**	**49.6**	**6.3**	**13.6**	**11.0**	**39.0**	**6.4**

Table 5 Obsidian Source Representation in Relation to Diagnostic Artifacts

	Rose Spring		Eastgate		Elko		Side-Notched		Other		Total
Local Sources											
Burns Butte (5 km)	12		3		5		2		-		
Rimrock Spring (10 km)	5		-		-		-		-		
Skull Creek[1] (10 km)	-		-		-		-		-		
Dog Hill (15 km)	3		1		1		-		-		
Total Local	20	(65%)	4	(40%)	6	(50%)	2	(40%)-	-		32
Silver Creek Sources											
Chickahominy (50 km)	2		-		-		-		-		
Riley (40 km)	1		1		-		-		-		
Buck Spring (40 km)	1		2		-		-		-		
Double O (50 km)	-		2		-		-		-		
Total Silver Cr.	4	(13%)	5	(50%)	-	-	-	-	-	-	9
Seneca Sources											
Whitewater Ridge (65 km)	1		-		1		1		1		
Little Bear Creek (65 km)	-		-		-		1		-		
Wolf Creek (65 km)	1		-		1		-		-		
Total Seneca	2	(6%)	-	-	2	(17%)	2	(40%)	1	(50%)7	
Southern Sources											
Horsehead Mtn. (80 km)	-		-		-		-		-		
Beatys Butte (135 km)	-		-		1		-		-		
Guano Valley[2] (175 km)	1		-		-		-		-		
Total Southern	1	(3%)	-	-	1	(8%)	-	-	-	-	2
Malheur River Sources											
Venator (015 km)	-		-		1		-		-		
Sugarloaf Butte (175 km)	-		-		-		-		1		
Total Malheur	-	-	-	-	1	(8%)	-	-	1	(50%)	2
Unknown	4	(13%)	1	(10%)	2	(16%)	1	(20%)	-		8
Total	31		10		12		5		2		60
Avg. Distance to Source	23.0		26.7		36.0		32.5		97.5		

Obsidian Hydration Dating

General Principles of Obsidian Hydration Dating

When a nodule of obsidian is fractured, newly exposed surfaces begin to adsorb molecular water from the environment. This process, referred to as obsidian hydration, penetrates the rock from its exposed surface, building as a uniform band of hydration that gradually increases in thickness over time. Under normal conditions a hydration layer may not be microscopically measurable until it has aged several hundred years or more. Time is a key factor in the hydration of obsidian, but other variables affect the rate of hydration including the local temperature regime, depositional context, and the geochemistry of the obsidian itself (Friedman and Smith 1960).

Obsidian hydration has long been used as a relative dating tool in archaeology (Michels and Tsong 1983; Friedman and Trembour 1983). Because it provides a relative age for particular fracture surfaces, individual artifacts can be tested, and often different use episodes on the same artifact can be detected. Though obsidian hydration has often been found to be most useful as an intrasite relative dating technique, understanding of the variables that affect the rate and conditions of hydration are increasing its viability as a chronometric technique.

The predictability of the hydration rate of obsidian was first identified by Irving Friedman and R. L. Smith (1960). They found that as hydration progresses over time (as distance of the hydration front from the fracture surface increases), the rate of hydration slows exponentially. Thus, when hydration thickness is plotted against time, the relationship is curvilinear.

Temperature is also a key variable in the rate of hydration. Friedman and Long (1976; cf. Ambrose 1976:104) found that the rate of hydration increases by 10% with an increase in temperature of 1 degree °C. In central Oregon, elevation is one of the most important factors affecting temperature, and thus hydration rates. Site specific temperature variations are also important; effective hydration temperature may vary significantly by depth within a site deposit (Ridings 1991), and may change throughout the depositional history of a site (Byram 1995). Obsidian artifacts exposed to direct sunlight on the ground surface may hydrate at a rate that is several times faster than obsidian buried at the same locality (Friedman 1977:339). Exposure to extreme temperatures from burning of surface vegetation may also cause the hydration layer to become diffuse or dissipate, effectively resetting the hydration clock (Linderman 1991).

Another key factor in the rate of hydration is obsidian geochemistry (Hughes 1986; Skinner 1983). Although the role of specific compositional elements has not been established, pieces of obsidian from a single source hydrate at the same rate, given temperature and other environmental variables are equal (Friedman and Long 1986). Because obsidian sources are often geochemically homogeneous, hydration rate variability due to geochemistry can be accounted for by comparing hydration readings from specimens known to be from a single geochemical source.

Sample Parameters

Of the 364 obsidian artifacts (tools and waste flakes) submitted for geochemical source analysis, 324 (89%) were identified from the Burns Butte (n=277, 76%) or Dog Hill (n=47, 13%) obsidian sources (see Tables 1 through 3). To control for variation in obsidian geochemistry, only specimens that matched the geochemical profiles of these two sources were submitted for hydration analysis. In the present sample a simple difference of means test showed no significant difference in mean values between hydration values from these two sources, so they are considered together for the present obsidian hydration analysis.

Ten of the submitted specimens exhibited two distinct bands of hydration on different surfaces, indicating that older tools were sometimes scavenged and reused by later visitors (Table 5). From the 276 artifacts yielding readable hydration rinds, a total of 286 hydration readings were made. The distribution of hydration values is shown in Figure 2, along with the previously reported hydration results from the nearby West Monroe site, 35HA2555 (Ozbun et al. 1996).

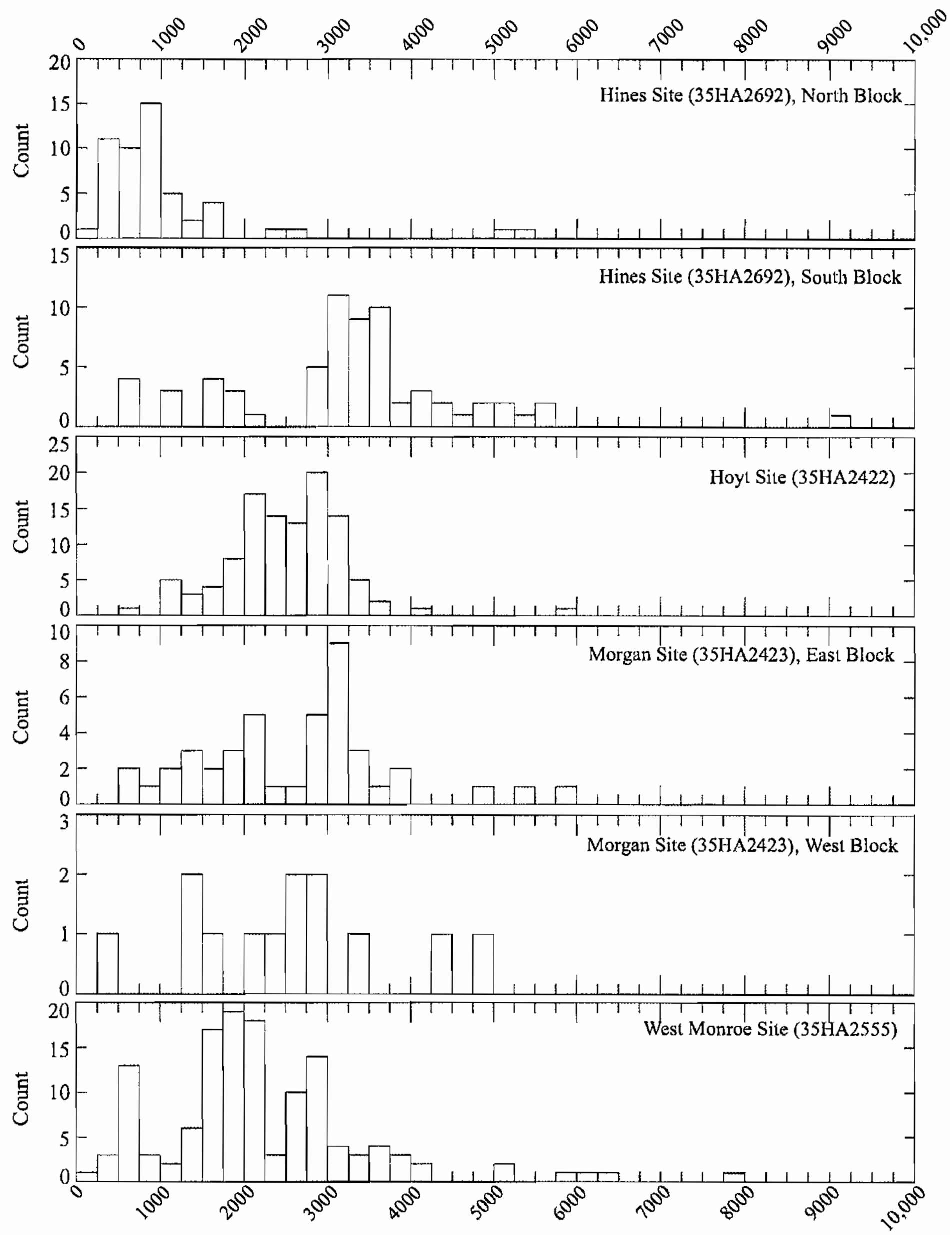

Figure 3. Distribution of obsidian hydration rind values (in microns) for each of the analytic units identified at the Hoyt, Morgan, and Hines sites, and from the previously reported West Monroe site (Ozbun et al. 1996).

Obsidian Hydration Results

The hydration data exhibits a degree of consistency from site to site. The North Block of the Hines site is distinguished in this set (Figure 2) by exhibiting multiple hydration peaks below 3.0μ, with a strong peak at about 2.8μ and minor peaks at 2.3μ and 1.9μ. All other components exhibit their strongest peaks at 4.0μ or more, with strong modes at 4.5μ (Hoyt, Morgan, and West Monroe sites) and 5.5μ (Hines South Block, Hoyt, and Morgan sites).

In light of the radiocarbon ages recovered from these sites, the hydration values are, in general, unexpectedly large, suggesting that this obsidian is hydrating at a rate that is exceptionally fast for the project latitude. This anomaly was noted by Ozbun et al. (1996) in their analysis of the West Monroe site (35HA2555), located just one mile north of the Hines site. They note that while diagnostic artifacts from the West Monroe site suggest occupation within the last 5,000 years, obsidian hydration age estimates based on typical hydration rates for central and southern Oregon (typically in the range of between 2 to $4\mu^2/1000$ years) easily exceed the region's documented ca. 11,000 year antiquity of occupation. Our results are consistent with this assessment.

Since the rate of hydration is temperature dependent, one potential concern derives from the depositional history of the sampled assemblages. Friedman (1977:339) has noted that obsidian exposed to direct sunlight on the ground surface may hydrate at a rate that is several times faster than obsidian buried at the same locality. While all obsidian specimens tested from the Hoyt, Morgan, and Hines sites were recovered from buried contexts, it is possible that their apparently accelerated hydration rate relates to a period of surface exposure at some time in the past. While this is a concern, its effect is moderated to the extent that all specimens share a common depositional history.

Apart from the rate of hydration, there is a poor relationship between obsidian hydration frequency modes from a given site, and radiocarbon-dated features. There are several possible explanations for this. Based on the range of chronologically diagnostic projectile points recovered, it appears that these sites have experienced repeated reoccupations over a considerable period of time. However, the radiocarbon ages appear to be biased in favor of the most recent occupations, probably due to the greater rate of survivability of the more recent features. It is also possible that some external factor has affected the obsidian hydration--such as burning of the landscape, or subterranean thermal activity--independent of the human factor.

Table 5.5. Obsidian hydration samples, by site.

	Total Sourced	Burns Butte	Dog Hill	Other	Hydration Sample	Burns Butte	Dog Hill
Hines Site (35HA2692)	166	128	9	29	[1]116	119	0
North Block	88	61	5	22	52	52	0
South Block	78	67	4	7	[1]64	[1]64	0
Hoyt Site (35HA2422)	128	91	15	22	[1]105	[2]90	[3]15
Morgan Site (35HA2423)	73	35	24	14	52	30	22
West Block	21	10	3	8	13	10	3
East Block	52	25	21	6	[3]42	22	[3]20

[1]Three specimens exhibited two distinct hydration bands, increasing number of hydration readings by three.
[2]Two specimens exhibited two distinct hydration bands, increasing number of hydration readings by two.
[3]One specimen exhibited two distinct hydration bands, increasing number of hydration readings by one.

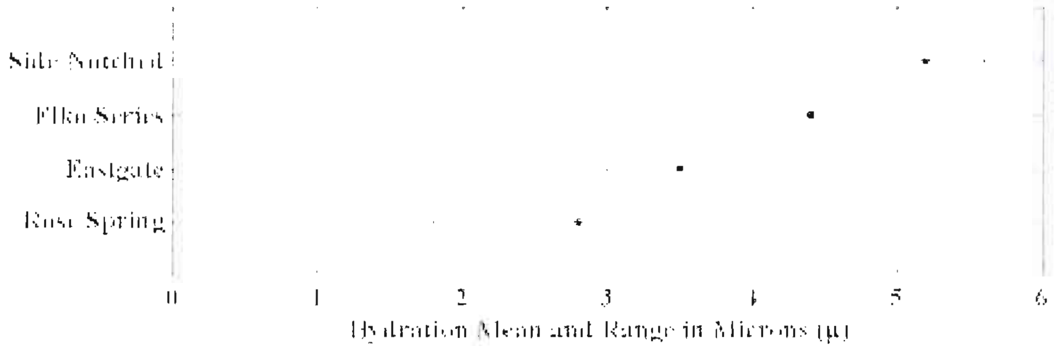

Figure 4. Estimated age ranges of chronologically diagnostic projectile points, based on a hydration rate of $10\mu^2$/1000 years.

Table 6. Obsidian hydration summary statistics for projectile points from the Hoyt, Morgan, and Hines sites.

					Age Estimates @$10\mu^2$/1000 years	
Point Type	N	Mean	std. dev.	Range	Mean Age	Age Range
Rose Spring	14	2.8μ	0.6μ	1.8μ-3.7μ	ca. 800 BP	ca. 300-1400 BP
Eastgate	4	3.5μ	0.5μ	3.0μ-4.1μ	ca. 1200 BP	ca. 900-1700 BP
Elko Series	9	4.4μ	0.9μ	3.3μ-5.5μ	ca. 1900 BP	ca. 1000-3000 BP
Side Notched	3	5.2μ	0.4μ	4.8μ-5.6μ	ca. 2700 BP	ca. 2300-3200 BP

To test the latter assumption, hydration values for all tested projectile points were examined by chronological type. If some external factor has affected the hydration at these sites, it is likely that the expected chronological ordering of diagnostic projectile points would be affected. If the expected order is confirmed, we can assume a measure of validity in the hydration values. The projectile point hydration results shown in Table 6 and Figure 3 confirm the expected chronological order, a result that allows us to dismiss external processes and concentrate on the cultural meaning implied by the obsidian hydration data.

One pattern that is evident in the projectile point data, when compared to the overall hydration profile, is a discrepancy between summary hydration modes (Figure 2) and projectile point hydration modes (Table 6). The combined mean hydration value of debitage from all three sites is 4.9μ (standard deviation=1.3μ, n=237), while the combined mean hydration value of all projectile points is 3.6μ (s.d=1.1, n=29). A difference of means test tells us that these populations are statistically different at the .05 level. Like the radiocarbon dating, the chronologically diagnostic projectile points are biased in favor of the later occupations at the site. For example, the Rose Spring and Eastgate points, which are probably limited to about the last 1500 years, represent nearly 60% of the projectile points recovered from all componentsexplanations for this

Determination of a hydration rate is useful for calculating estimated ages from hydration rind values. There are two common ways of determining a rate of hydration. One method is induced hydration, where obsidian is hydrated by elevated heat and pressure under controlled conditions. The laboratory rate can then be adjusted algebraically to the local effective hydration temperature of a sample locality Meighan 1976; Michels et al. 1983). The second method is to pair hydration values with associated radiocarbon ages, and to calculate a regression equation to relate hydration rind values to calendar ages. Since no induced hydration rate is available for Burns Butte obsidian, we employ the latter technique here.

As noted, the relationship between hydration modes and radiocarbon ages from the sites considered here is imperfect. The most reliable pairs are from the Hoyt site and the northern block at the Hines site. The hydration profile from the Hoyt site shows a strong peak in hydration values at 4.7μ and a radiocarbon age of 1820 cal BP on charcoal collected from below a metate on an old activity surface. The radiocarbon age from the Hines site (1060 cal BP) is from a hearth centered in an activity cluster that exhibited a strong hydration mode at 2.7μ. These two data pairs suggest a hydration rate of approximately $10\mu^2$/1000 years, an exceptionally fast rate as noted above.

We can test the appropriateness of this rate by returning to the projectile point data, for which we know approximate age ranges from stylistic cross-dating. Table 6 summarizes calculated age means and ranges for hydration values measured on groups of distinct projectile point types, calculated at a hydration rate of $10\mu^2$/1000 years. These ranges fall comfortably within the expected age parameters, with Rose Spring points estimated to be 300 to 1400 years old, Eastgate from 900 to 1700 years old, Elko series points from 1000 to 3000 years old, and side-notched points from 2300 to 3200 years old. The side-notched points are noteworthy, as they are neither classic Northern Side-Notched dart points nor small Desert Side-Notch arrow points. These specimens appear to be, on average, slightly older than the Elko series points, but they appear to post-date the peak period of occurrence of the classic Northern Side-Notch variety.

Recognizing that this hydration rate will undoubtedly benefit from future adjustment when more and better data are available, the projectile point age estimates show that it provides reasonable age calculations. Figure 3 provides a distribution of age estimations based on the rate of $10\mu^2$/1000 years. It is noteworthy that two outlier hydration values at 9.0μ and 9.5μ produce age estimates between 7500 and 9500 years ago, estimates compatible with the earliest documented occupations in the Harney Basin (Fagan and Sage 1974; Gehr 1980).

Conclusions

The Burns Butte and Dog Hill obsidian, which predominates at the Hoyt, Morgan, and Hines sites, appears to hydrate at a rate that is considerably faster than most obsidians at the project latitude, an anomaly first noted by Ozbun et al. (1996) at the nearby West Monroe site. At present it is not known whether this relates to the geochemistry of the local sources, or to an unusual depositional history that is common to sites in the northern Harney Basin. Based on the best radiocarbon age associations from the present project, an obsidian hydration rate of $10\mu^2/1000$ years was estimated for the three sites, and tested against expected age ranges for chronologically diagnostic projectile points recovered from the sites. This rate, while considered very tentative, appears to serve as a satisfactory age predictor for the present data set, based on the projectile point test.

With the exception of the North Block of the Hines site, obsidian hydration values from the Hines, Hoyt, and Morgan sites (and the West Monroe site reported by Ozbun et al.) cluster between ca. 3.8μ and 6.5μ, with notable peak values at about 4.5μ and 5.5μ. These hydration values suggest occupations bracketed between ca. 4500 and 1500 years ago, with periods of notable intensity at about 2000 and 3000 years ago. Although nearly 70% (195 of 283) of all hydration values from the three sites fall within this period, only one of the five clearly cultural radiocarbon ages from the sites falls within this range (a calibrated age of 1820 years BP from the Hoyt site). It seems clear that the radiocarbon ages reflect the latest of multiple occupations at these sites, while the earlier occupations are better represented by the obsidian hydration profile.

The North Block at the Hines site exhibits a range of hydration values from about 3.8μ to 1.5μ, with a dominant peak at 2.7μ and minor peaks at 3.3μ, 2.3μ, and 1.8μ. This suggests occupations from 1600 BP to contact, with possible occupation episodes at 1100 BP, 700 BP, 500 BP, and 300 BP. Some obsidian hydration values within this latter range (<3.8μ), as well as a small number of Rose Spring and Eastgate projectile points, are present at all sites, suggesting that at least ephemeral occupations occurred at all sites within the last 1500 years. Additionally, four of the five clearly cultural radiocarbon ages from the three sites fall within this period. All four are from apparent hearth features. If we were to base site chronology only on radiocarbon evidence and the frequency of chronologically diagnostic projectile points, we might conclude that the area was little used prior to 1500 years ago.

The discrepancy between the radiocarbon and obsidian hydration age profiles for these sites is reflected in the significant difference between estimated obsidian hydration ages of projectile points and lithic debitage from the sites. It is possible that these sites may have been used in different ways before and after ca. 1500 years ago. Prior to this time early and middle stage lithic reduction activities appear to have been more important, possibly reflecting the regular quarrying of the local obsidian float cobbles scattered across the landscape, in conjunction with opportunistic hunting and gathering activities. After this time greater numbers of projectile points appear in the assemblages, but accompanied by significantly less lithic debitage.

It is possible, too, that it is not a significant change in site functions that are indicated, but a reflection of a changed technological system. Dart points, such as Elko series points, are typically reduced from larger bifacial preforms. Production of each point requires production of a symmetrical preform from a larger tool blank, a process requiring a considerable amount of lithic raw material. The introduction of the bow and arrow is estimated to have occurred in this area ca. 1700 years ago, marked by the appearance and predominance of small Eastgate and Rose Spring projectile points. These small points can be made on flakes much smaller than the bifacial blanks required for larger dart points, and are thus far more material efficient. It is further possible that a change in the dominant weapons system, from dart-and-atlatl to bow-and-arrow, may account for a significant change in lithic assemblages—the dominant element of the archaeological record—apart from the basic food collecting activities undertaken at these sites. It is possible that smaller, more fragile arrow points, which can quickly be made from a relatively small flake, were more readily replaced, while the larger dart points were more often reworked into usable forms.

However, this technological explanation may not be adequate to explain why domestic features such as fire hearths are under-represented in earlier components.

Finally, a word of caution. The chronological biases inherent in the present data set were recognized by noting the discrepancies between radiocarbon and obsidian hydration age profiles, and between projectile point and debitage hydration profiles. These are biases that, to a considerable degree, are introduced by the limitations of our analytical procedures. On one hand, it is possible to conduct obsidian hydration studies on small pressure flakes, and if small flakes had been systematically selected in the present sample it is possible that the hydration profiles would have more faithfully reflected the occupation histories of these sites. However, reliable determinations of obsidian geochemistry require samples of about dime-size specimens (ca. 10 mm diameter, 2 mm thick; Hughes 1986; Skinner 1998), and since this chemistry can potentially effect the rate of hydration, geochemical source studies will continue to restrict the minimum size of hydrated specimens.

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