PALEOETHNOBOTANY AND HOUSEHOLD ARCHAEOLOGY AT THE BERGEN SITE: A MIDDLE HOLOCENE OCCUPATION IN THE FORT ROCK BASIN, OREGON

by
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A DISSERTATION

Presented to the Department of Anthropology
and the Graduate School of the University of Oregon
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Title: PALEOETHNOBOTANY AND HOUSEHOLD ARCHAEOLOGY AT THE BERGEN SITE: A MIDDLE HOLOCENE OCCUPATION IN THE FORT ROCK BASIN, OREGON

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This study analyzes the botanical and archaeological material from a Middle Holocene occupation at the Bergen site, located in the Fort Rock Basin, Oregon. It serves to complement and enhance over a decade of research focused on regional settlement patterns in the Northern Great Basin. While previous studies in the region have focused on broadly based settlement patterns, this study shifted the interpretive lens toward an in-depth analysis of a single family dwelling, which was occupied some 6000 years ago. It thus introduces the domain of "household archaeology" into the practice of archaeological research in the Northern Great Basin for the first time. Macrobotanical analysis was conducted on 215 soil samples collected on a 50cm

grid from this house. An additional 20 samples were analyzed from a second house structure at the site.

These analyses have provided evidence of diet, environment, and social behavior associated with the prehistoric occupants of the house. The abundance of charred bulrush (Scirpus), goosefoot (Chenopodium), and waada (Suaeda) seeds in the deposits indicates that small seeds of wetland-adapted plants were an important dietary resource during the Middle Holocene in the Fort Rock Basin.

The patterned distribution of botanical material in 215 soil samples across the floor of the house provide strong evidence of prehistoric human activity areas. The highest concentration of seeds and charcoal in the house was located near the central fire hearth, where cooking and food preparation took place. An east-facing entryway is suggested by the presence of a secondary concentration of seeds and charcoal on the eastern edge of the structure. Analysis also revealed a differential distribution of seed types across the house floor. Higher concentrations of bulrush in the northern area of the floor, away from the hearth, suggest the presence of sleeping mats.

Results of this study indicate that plant remains are not evenly distributed through archaeological deposits, therefore care must be taken when sampling for macrobotanical remains. Research at the Bergen site provides the basis for recommendations to assist future archaeologists in determining the best and most cost-effective locations within excavations to take macrobotanical samples.

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CHAPTER I

INTRODUCTION

Within the diverse themes generated in American archaeology over the last 80 years, one can trace a transition from a concern with creating broad-scale culture histories toward developing more refined understandings of settlement and subsistence patterns at a regional level. This dissertation employs the techniques of paleoethnobotany within the parameters of a single 6000 year-old house in order to investigate yet more tightly focused questions about the human sociocultural past. Households represent the most common social component of subsistence (Wilk and Rathje 1982); so by employing "household archaeology," with attention to refined provenience and recovery techniques, archaeologists can learn more about the lives of the people they study as well as the economic and ecological processes associated with them. This is accomplished in the present study by analysis of a Middle Holocene house excavation at the Bergen site, located in the Fort Rock Basin, Oregon.

Paleoethnobotany, or archaeobotany, is the study of past cultures through the examination of human interactions with the plant world. Among other things, it includes the analyses of macrofloral, pollen, and phytolith remains from archaeological sites. Three major themes that currently dominate archaeobotanical studies include domestication of plants, human subsistence patterns, and environmental change over time (Ford 1994). Research at the Bergen site focused on the recovery and analysis of charred seeds and charcoal to investigate regional subsistence patterns and human activities associated with a single Middle Holocene house. The intensive sampling strategy employed in this study represents a first in the examination of ancient hunter-gatherer sites in the Great Basin. Methodological implications, however, extend beyond the Great Basin to investigations of hunter-gatherer communities worldwide.

This research relies on an ecological perspective and is divided into three main areas of inquiry. First, macrobotanical studies were used to investigate patterns of mobility and sedentism among ancient hunter-gatherer peoples. Evidence of plants used by people at the Bergen site during the Middle Holocene (ca. 4000 – 6000 years ago) led to a more complete understanding of subsistence and settlement patterns in the Fort Rock Valley, located in the northwest corner of the Great Basin. Previous archaeological investigations in the Fort Rock Basin have illuminated patterns of settlement and subsistence that include greater sedentism and intensified use of wet, lowland resources during the Middle Holocene, with a shift in emphasis toward upland resources in later times (Jenkins et. al. 2000a). Results of the present study corroborate these findings. Soil flotation samples at the Bergen site provide convincing evidence that small seeds obtained from low-lying wetlands were important dietary resources during the Middle Holocene in the Fort Rock Valley.

Second, the type of microanalysis used in this study provides a different "lens" through which to investigate the early history of the Northern Great Basin. That is, the Northern Great Basin Prehistory Project has largely focused on regional settlement patterns, while the Bergen project focuses intensively on the distribution of plant remains across the floor of a single housepit dating to 6000 BP (years before present). By analyzing the contents of 215 soil samples recovered from the living floor of the house, I was able to identify activity areas associated with the people who occupied the site in ancient times.

Third, this study centers on research methods associated with macrobotanical analyses of archaeological sites. Techniques employed in this research were designed to help evaluate the adequacy of sampling strategies used in the region and to demonstrate the utility of more thorough sampling techniques. While previous macrobotanical studies contained, on average, analysis of 6 soil samples per site, my study contained 215 soil samples from a single occupation layer in a house at the Bergen site. In addition to this, a second house at the Bergen site was identified, and 20 soil samples were analyzed for macrobotanical remains from a portion of this structure. Thus, a total of 235 macrobotanical samples were analyzed from two separate structures at the Bergen site. Results are used to provide recommendations for sampling hunter-gatherer sites in the future. What was learned about the distribution pattern of plant remains across the Bergen house floor will help future researchers in determining the best and most cost effective locations within such excavations to take such samples.

American Archaeology: Refining the Investigative Lens

In order to clarify the contribution of this research, it is important to place it within the general context of American archaeology. Scientific approaches in American archaeology emerged in the 1930's under the perspective of "culture history." This perspective focused on the investigation of culture areas, with an emphasis on general cultural phases, components, and traditions organized into spatial and temporal frameworks (Willey and Phillips 1958).

Although culture history represents the foundation upon which subsequent archaeological approaches have been built, there are some critical limitations to this approach. The primary critique of culture history was that it didn't adequately account for cultural variation and change. Variations in artifact assemblages were submerged within generalized cultural phases. The transition from one phase to another was effectively invisible, given the mode of analysis, and change was typically attributed to outside forces such as migration and diffusion (Dunnell 1986, Trigger 1988, Watson 1995). Culture history was less concerned with obtaining a representative sample of site types within a region, which might inform on social or subsistence organization, and was critiqued for not reconstructing the past or accounting for the *process* of change (Taylor 1948).

These critiques led to a call among archaeologists for an approach that would add intrasite analyses and attention to all aspects of artifactual material to the more traditional chronological investigations (Taylor 1948, Willey and Phillips 1958). Binford (1962,1964) coined the phrase "New Archaeology" to characterize these approaches. Culture was viewed as a behavioral system, rather than as merely chronologically organized phases. Emphasis was placed on spatial variability in sites and assemblages, thought to reflect different aspects of cultural systems. Close attention was paid to settlement patterns, trade, and social organization, as well as questions concerning the emergence of agriculture and social complexity.

While some recent discussions of theory in American archaeology have shifted toward "post-processual" concerns (Hodder 1985, Preucel and Hodder 1996, VanPool and VanPool 1999), much of the archaeology currently practiced in the Great Basin remains focused on ecological perspectives. Key to these perspectives are investigations of settlement and subsistence patterns in which mobility and sedentism are central themes.

Holocene Settlement Patterns: Mobility and Sedentism

Archaeologists and anthropologists have long been interested in the concepts of mobility and sedentism, particularly as they apply to discussions of hunter-gatherer societies. Early on, it was presumed that there existed a natural progression (or cultural evolution) from mobile to sedentary lifeways. Researchers now agree that the process of developing sedentism is much more complex than previously thought. Nevertheless, mobility has often been a defining characteristic of hunter-gatherers, and the process leading to sedentism has been associated with changes in subsistence, demography, trade, territoriality, and social inequality (Kelly 1992).

Kelly (1995, 1992) defines sedentism as a process whereby human groups reduce their mobility such that they stay at the same location for a significant part of the year, or all year. Binford (1980) introduced the concepts of forager and collector strategies in order to discuss the "continuum" of mobile to sedentary lifeways among hunter-gatherers. Foragers employ a "mapping on" strategy in which the group moves to and camps near the resources to be exploited. There is generally no storage of food associated with this strategy. The collector model, in contrast, results when groups choose a habitation site strategically located among a number of different resources. Smaller "task groups" are sent out from the base camp to exploit resources various distances away. Collectors tend to harvest greater quantities of food and stores are accumulated for future use. Residential mobility is thus reduced, and sedentism or semi-sedentism is the result.

The history of archaeological investigations in the Great Basin illuminates these discussions of mobility and sedentism. It begins with Steward's (1938) ethnographic work on Basin-Plateau sociopolitical groups. Steward argued that the sparse and scattered nature of resources in the Great Basin dictated a simple social organization of band level society with the nuclear family as the primary economic and political unit, moving about the landscape to make a living. Jennings' (1957) Desert Culture Concept, early peoples in the Great Basin were characterized as highly mobile hunter-gatherers exploiting desert resources. Heizer (1970) rejected this model of incessant mobility with evidence from Lovelock and Humboldt Caves in Nevada, suggesting that people there were living in permanent settings and relying on rich biotic wetland resources. Subsequent studies over the next two decades have demonstrated that wetland environments were extremely important to populations in the Great Basin by providing a wide range of resources such as plants, birds, mammals, and fish (Fowler and Fowler 1990). Archaeological investigations in the Stillwater Marsh in Nevada (Raymond and

Parks 1990), Nightfire Island in Klamath Lake (Sampson 1985), Lake Abert-Chewhuacan Marsh Basin (Oetting 1990), and Carlon Village in Oregon (Wingard 2001) provide a few examples of wetland adapted sedentary or semi-sedentary communities. Geomorphological and archaeological studies at the Bergen site also provide evidence for sedentism associated with wetland resources.

Researchers are now quick to point out that there are varying degrees of mobility and sedentism. According to Kelly (1992: 43) mobility is universal, variable, and multi-dimensional. Ames (1991) points to evidence of fluctuating settlement patterns in the Plateau to argue that sedentism is not an irreversible process. As long ago as 1978, Aikens argued that both mobility and sedentism were part of the Great Basin cultural picture.

Theoretical discussions on the origins of sedentism have typically centered on two opposing interpretations: the "push" and the "pull" hypotheses. The push hypothesis is based on a stress model. The assumption is that foragers will choose to remain mobile and will only shift to sedentary living when they are forced to as a result of reduced resources or other stresses (Kelly 1992). The pull hypothesis, in contrast, is an abundance model. The assumption is that sedentism is more efficient than mobility and, therefore, groups will choose to become sedentary if the opportunity arises. That is, if resources are sufficiently abundant to support settled groups.

Although archaeologists have long debated the stress/abundance models (Ames and Marshall 1981, Chatters 1995, Kelly 1995), many now recognize the power of both forces. Prouty (1995) argues that the processes of push and pull both operated in the Fort Rock Basin during Late Holocene times. Jenkins et al (2000a) suggest that aspects of both processes may also help to account for settlement patterns in the Late Middle Holocene in the Fort Rock Basin. My research lends credence to these interpretations by providing evidence of diet and environment through an in-depth analysis of archaeobotanical remains from a Middle Holocene site in the region.

Crucial to assessing the factors responsible for settlement shifts are the roles of climate and demography. Evidence for shifts in climate and population densities are considered primary variables that affect people's decisions to stay in one place or forage more widely (Aikens and Jenkins 1994a&b, Ames and Marshall 1981, Chatters 1992, 1995, Jenkins 1994b, Jenkins et al. 2000). Shifts in temperature and moisture can result in the expansion or depletion of particular dietary resources. When resource availability remains constant, however, an increase in population has the potential to cause the kind of "stress" generally associated with a deterioration of the climate. Jenkins et al. (2000) suggest, for instance, that increasing population densities in the Fort Rock Basin may have been a factor in the shift from lowland to upland resources beginning around 3800 BP. They also propose an alternative explanation that focuses on the effects of changes in seasonal climates. It is suggested by Jenkins et al. (2000a) that a shift from colder winters to milder springs may have facilitated the shift from early cultural developments (5600-4500 BP), associated with summer resources such as seeds and fish, toward later developments (3800-3000 BP) associated with upland root crops. My research helps test these hypotheses by contributing to our understanding of the diet of early populations in the region at these critical points in time. One primary way this was accomplished was by significantly increasing the number of soil samples analyzed for botanical remains, which resulted in a larger database from which to generate more convincing interpretations.

In order to predict dietary choices made by hunter-gatherers, archaeologists have adopted the use of optimal foraging models. Initially developed to study non-human foragers, optimal foraging theory assumes that decisions regarding food acquisition will be oriented toward efficiency and profitability (Simms 1987). The optimal diet model holds that foragers will choose resources to exploit based on their abundance and efficiency ranking. Rankings are calculated by weighing the expenditure of energy associated with searching, procuring, and processing resources against the return, or caloric yield. Large game, for instance, are considered higher ranking resources than small seeds. The Bergen site represents a unique situation where abundant large game, small fish, and small seeds were all important resources during the

Middle Holocene in the Fort Rock Basin. Understanding the degree to which small seeds and minnow-sized fish were utilized at the site in ancient times would not have been possible without the intensive analyses conducted in this study. The flotation techniques used to recover botanical remains from soil collected at the Bergen site involved passing the sediment through sieves with mesh sizes as small as .25 mm. This process enabled extremely small seeds and fish bone, which otherwise would have passed through 1/8 inch screens in the field, to be caught in the fine-meshed sieves and analyzed.

Many Great Basin archaeologists adhere to an ecological orientation in their studies and have typically been interested in dietary resources and their associated environments, fluctuations in climate, and changes in population densities over time. Clearly, other variables influenced patterns of mobility and sedentism among hunter-gatherer groups. According to Kelly (2000), however, archaeologists must adhere to these coarse-grained questions when dealing with coarse-grained archaeological records. My study at the Bergen site indicates that finer-grained questions can also be successfully investigated in archaeological sites associated with ancient hunter-gatherers.

Objectives of this Research

My research employs paleoethnobotany and household archaeology in an effort to ask fine-grained questions of what has often been treated a coarse-grained archaeological record. Intensive analyses of two house floors at the Bergen site represent a shift in investigative approaches away from a focus on already-defined settlement patterns toward a more refined study of single family dwellings. The intent was to learn more about what was going on at the site (i.e., how people lived, what they ate, where they performed certain activities). The interpretations from one house are then used to infer social activities across the site, and ultimately, across sites.

This study contributes to an ecological perspective by examining plant remains in archaeological contexts in order to learn more about the vegetable diet and climatic environment associated with early populations in the Fort Rock Basin. Plants have served to satisfy basic human needs such as food, shelter, clothing, and medicine for millennia. Through the analysis of macrofloral remains, pollen grains, and phytoliths preserved in archaeological sites, researchers have been able to gain valuable insights into the diet and environment of ancient cultures (Pearsall 1989, Hastorf and Popper 1988). These techniques, however, have not been extensively applied in the Northern Great Basin. In all previous studies no systematic attempts have been made to identify human activity areas within a site. This is due, in part, to the limited sizes of collected samples. Further, the small numbers of soil samples in these studies have not been sufficient to advance our understanding of climatic changes over time. While referring to the extremely low diversity of botanical remains recovered from the Bowling Dune site, for example, Prouty (1994b) asserts that further excavations and paleoethnobotanical analyses are imperative to our understanding of shifts in environment and demography in the Fort Rock Basin.

This research represents the first attempt to intensively sample for macrobotanical remains in a house floor associated with a hunter-gatherer occupation site in the Great Basin. Under my supervision, 235 soil samples were collected from two Middle Holocene structures at the Bergen site by the University of Oregon Archaeology Field School in 1999 and 2000. Plant remains preserved in these soil samples were analyzed in an effort to identify human activity areas, such as food processing and cooking areas within the site. Investigations of spatial distributions of plants within and between sites are not new to archaeology (see Hill and Hevly 1968, Cully 1979, Hastorf 1988, Cummings 1998). The majority of these studies, however, were done in the American southwest and east, and were focused on advanced horticultural and agricultural societies. My study is the first to address activity areas and spatial distributions of plants within a hunter-gatherer house in the Great Basin.

This research applies paleoethnobotanical analyses, within the domain of household archaeology, toward a growing understanding of hunter-gatherer archaeology. Specifically, this research tested the following hypotheses:

1. Paleoethnobotanical investigations of archaeological sites dating to the Middle Holocene in the Fort Rock Basin indicate that wetland resources, such as small seed plants, were emphasized in the vegetable diet of the human populations during this time.
2. The number of macrobotanical analyses conducted on soil samples previously recovered from sites in the Fort Rock Basin lowlands has been too small to adequately assess the vegetable diet of the early occupants of these sites.
3. Spatial distribution patterns of botanical materials, such as seeds, charcoal, and plant tissue, preserved on the house floor of a hunter-gatherer site, reflect human activity areas associated with the ancient occupation of the site.
4. Using plant remains to both identify human activity areas within ancient houses and to learn more about ancient diets in the region generally will significantly enhance our understanding of early history in the Fort Rock Basin.

CHAPTER II

CURRENT STATUS OF FORT ROCK BASIN RESEARCH

The Fort Rock Basin is located in the northwestern most corner of the Great Basin (Fig. 1). It is one of seven research areas in Oregon designated for study in the Northern Great Basin Prehistory Project, a cooperative program involving the University of Oregon Archaeological Field School, the Lakeview District Bureau of Land Management, and others (Jenkins, Aikens, and Cannon 2000a). This research addresses the changing human ecology of the Fort Rock Basin and its adjacent uplands. As it has been affected by climatic and environmental change throughout Holocene times.

The Fort Rock Basin is bordered to the north by the High Lava Plains, to the west by the Cascade Mountains, and to the south by the woodland marsh lands of the Klamath region (Aikens and Jenkins 1994b). Vegetation within the Fort Rock Basin varies with topography and availability of water. At the highest elevations pine forests, aspen groves, and mountain mahogany depend on captured precipitation. The dryer intermediate elevations support juniper,

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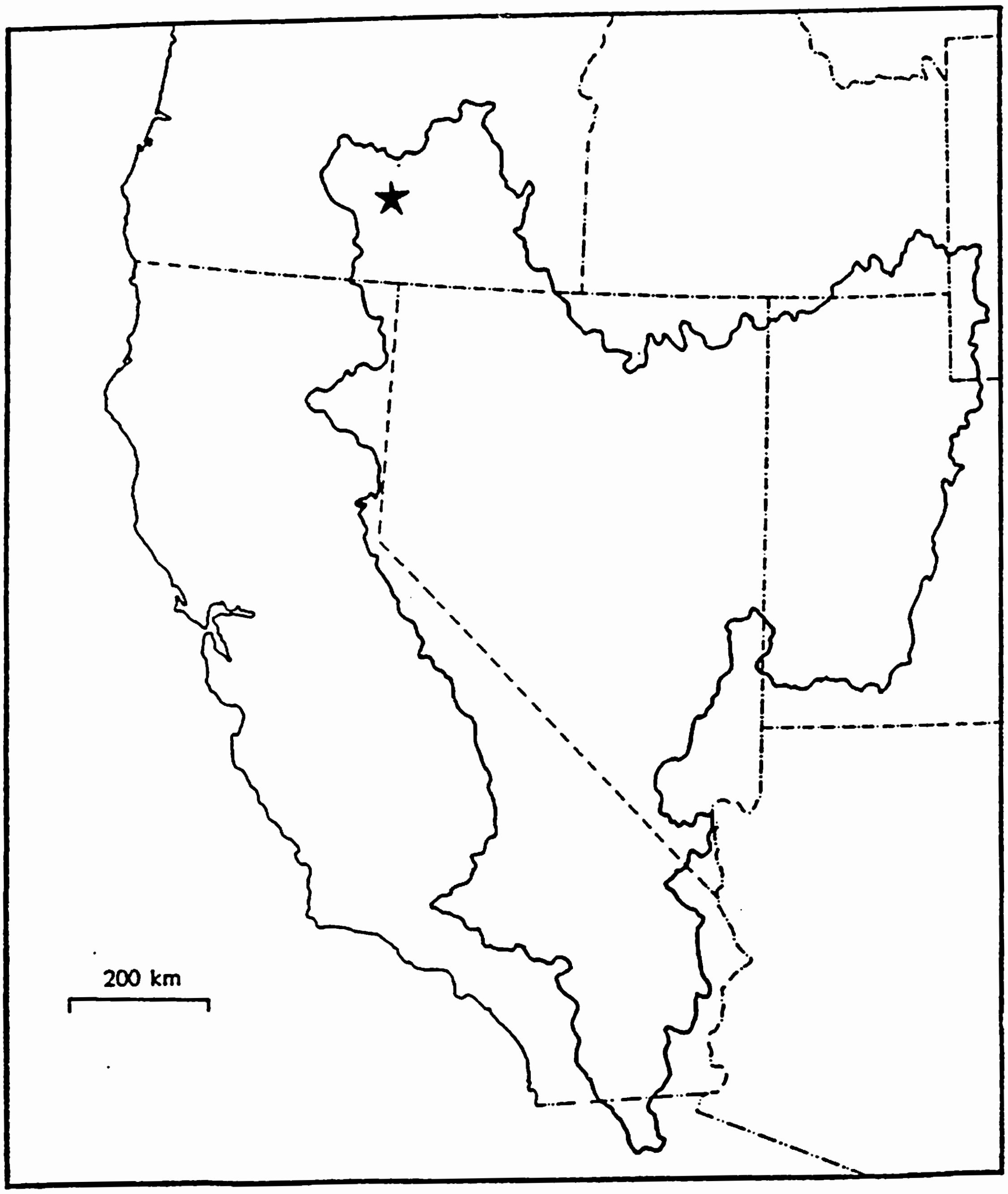


FIGURE 1. Map: Great Basin, Showing the Location of the Fort Rock Basin.

sagebrush, and grasses. Arid lowlands are dominated by xeric plants such as sagebrush, greasewood, and saltbush (Hitchcock and Cronquist 1973, Franklin and Dyrness 1973). Wetland patches within lowland environments, fed by exotic water from the uplands, produce a rich biota including tule, cattail, and other marsh loving plants (Aikens and Jenkins 1994b). Three primary perennial streams feed into the Fort Rock Basin from the west, accounting for most of the basin's water. Silver Creek, Buck Creek, and Bridge Creek feed into Paulina Marsh near the town of Silver Lake (Freidel 1994). During particularly wet years, when winter precipitation is high, Paulina Marsh flows into Silver Lake. At the time of Freidel's publication in 1994, Silver Lake was completely dry; since that time it has filled and created a rich marshland, and is now receding into a wet meadow stage. Overflow from Silver Lake during wet periods is channeled into a series of playas to the east and north, particularly Thorn Lake, located east of the Connley Hills. During times of extreme moisture, water flowed north from Thorn Lake along the eastern boundary of the Connley Hills as far north and west as Beasley Lake (Droz and Jenkins n.d.), some 40 km from Silver Lake along an extensive channel system.

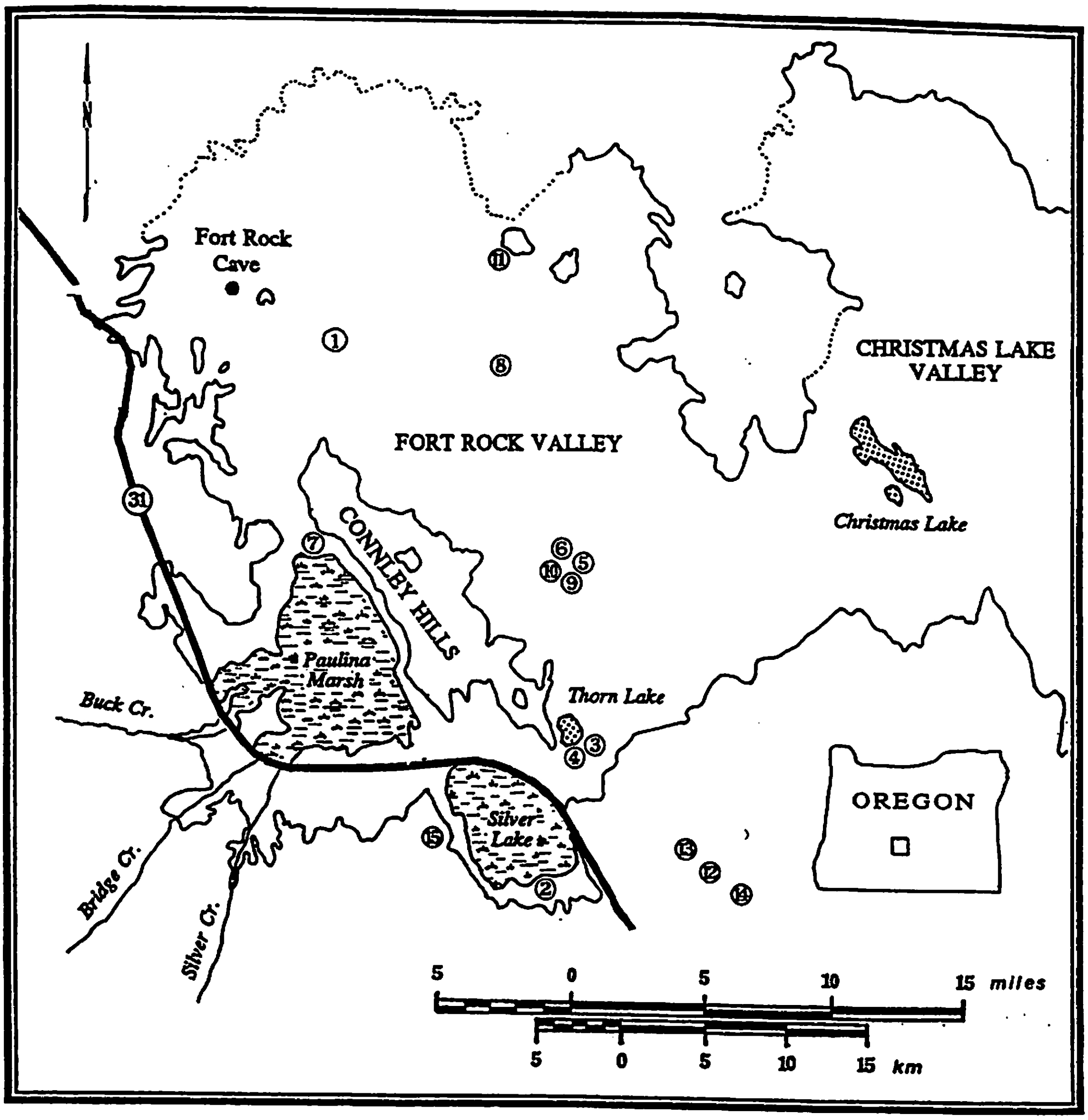
Regional and local variations in the climate had profound effects on populations in the Fort Rock Basin as well as elsewhere in the Great Basin (Aikens and Jenkins 1994b). Annual fluctuations could produce sharp changes in the availability of particular resources. When there was ample precipitation in winter months (usually in the form of snow), stream runoff into lowland marshes produced a rich diversity of biotic resources. During years of reduced precipitation, stream flow would decrease, overflow playas would dry up, marshes would shrink, and the associated plant and animal resources would diminish (Aikens and Jenkins 1994b). In order to survive, people in the Fort Rock Basin were forced to plan and adjust for markedly unstable environmental conditions. Archaeological evidence indicates that this was accomplished both through the accumulation of stored foods and through a redistribution of populations both in and out of the basin. (Aikens and Jenkins 1994a&b, Jenkins 1994b).

Overview: Main Trends in the Holocene Occupation of the Fort Rock Basin

People lived in the Fort Rock Basin throughout the Holocene, over 10,000 years. Human occupation may even date as far back as 13,000 years (Bedwell 1973, Aikens and Jenkins 1994b). Jenkins et al. (2000a) divide the geologic epoch of the Holocene into four main periods in order to highlight important developments in the cultural chronology in the Northern Great Basin. The sequence includes: Early Holocene (12,000 - 7600 BP), Transitional Early-Middle Holocene (7600 - 5600 BP), Late-Middle Holocene (5600 - 3000 BP), and Late Holocene (3000 BP - Historic times).

The Early Holocene is best represented in the Fort Rock Basin by residential bases and temporary foraging camps located near marshes and lakes (Jenkins et al. 2000a). Archaeological excavations in Fort Rock Cave and the Connley Caves in the Silver Lake Valley offer the primary evidence (Fig. 2). The Connley Caves are located a short distance from Paulina Marsh, which served as an important resource for the early human populations in the region. Tool assemblages suggest a broad-spectrum adaptation among highly mobile populations during the Early Holocene (Jenkins et al. 2000a). A substantial reliance on rabbits and waterfowl is evident during the Early Holocene, while plant processing was less important than during the subsequent Middle Holocene. The bones of pikas, now restricted to the High Cascades, and campfire charcoal from pine, which does not now descend to the elevation of the Connley Caves, point to a cooler and wetter climatic regime during the Early Holocene.

Human occupation dropped off dramatically during the Early-Middle Holocene at the Connley Caves, associated with a climate change which caused major drying of Paulina Marsh (Bedwell 1970). A shift toward a warmer drier climate surely diminished marshland settings and made them more evanescent, but people continued to exploit marshes when moisture fluctuations made them biotically productive. Jenkins et al. (2000a) argue that local and short-lived fluctuations in the climate included wet periods which led to



① Bergen Site	⑥ Bowling Dune	⑪ Cougar Mountain Caves
② Carlon Village	⑦ Connley Caves	⑫ Boulder Village
③ Big M	⑧ Kelly's Site	⑬ Teri's House
④ Zane Church, Zane Church 40 No. 2 and 3	⑨ Locality I	⑭ Scott's Village
⑤ DJ Ranch	⑩ Locality III	⑮ Ratz Nest

FIGURE 2. Map: Location of Sites and Landmarks Discussed in Text. (Adapted from Greenspan 1994).

extremely rich wetlands and grasslands in the lowlands. Cultural assemblages dating to this time are comparatively few in number and represent temporary foraging campsites in ecotonal settings close to a variety of resources. Plant processing issuggested by the presence of manos and metates in many of these sites, but are typically unformed expedient tools, also indicative of temporary sites where people stayed for a short time and then moved on to other resources (Jenkins et al. 1999a).

The Late-Middle Holocene represents a shift back to generally wetter conditions as evidenced by lowland sites in which fish was an important resource. Evidence for substantial occupations and stored, or cached, goods appear in the archaeological record at this time. In addition, faunal and botanical remains suggest that Tui chubs (a small sucker) and small seeds were being intensively exploited (Jenkins et al. 1999a). Population growth and a greater degree of sedentism is initiated by increased numbers of sites in the Fort Rock Basin, storage pits, and a greater diversity of artifact assemblages. Jenkins (1994b) argues that climate and population fluctuations must be viewed in the context of both local and regional patterns. For instance, palynological evidence from Diamond Pond, located near the Steens Mountains in eastern Oregon, indicates that during the Late Middle Holocene the Northern Great Basin was experiencing an intensive wet period (Wigand 1987, Mehringer 1986). Evidence is critical: as Jenkins et al. (1999:44) point out, "Middle

Holocene populations undoubtedly fluctuated in and around the 'wet' basins of the Northern Great Basin as subsistence resources were affected by climatic and environmental variability. One of the possible effects of terminal Early-Middle Holocene (ca. 6000 BP) circumscription in such a setting might have been to dramatically and rapidly increase Fort Rock Basin populations when resources were abundant locally, and scarce extra-locally; such as when there was too much water or snow in surrounding regions."

The Late Holocene shows continued occupation of lowland settings but also marks a shift toward a greater emphasis on upland settings (Aikens and Jenkins 1994a). Primary plant resources in the uplands included geophytic roots and bulbs, however seeds and berries were also exploited. Emphasis on upland resources, with a continued but more transient use of the lowland marshes, are most likely related to a decreased reliability of marsh resources associated with drought. It has also been suggested that long-term regional responses to demographic conditions (high populations) and increasing dependence (intensification) on roots in the uplands affected patterns of resource exploitation during the Late Holocene.

Pollen Analysis from Silver Lake Deposits

In an attempt to learn more about local fluctuations in water levels and associated resources in the Fort Rock Basin, I collected a stratigraphic sequence of soil samples to be analyzed for pollen from a hand-dug trench along the shore of Silver Lake (Fig. 3). Fourteen samples were processed and analyzed by Dr. Linda Scott Cummings of PaleoResearch Institute.

The deposit on the shore of Silver Lake was selected for analysis because previous studies by the University of Oregon near Carlon Village (Wingard 2001) indicated the presence of these rich organic sediments, interpreted as marsh accumulations (Droz 1997). The stratigraphic sequence sampled for pollen contained a 40 cm thickness of this dark organic soil, as well as sediments above and below. The base of this deposit produced a radiocarbon date of 6470+/-70 BP. This radiocarbon date, and evidence introduced below, suggests that the top of the sampled sequence dates to about 2800 BP.

Cyperaceae (plants of the sedge family) and Typha (cattail) pollen appear all through the sampled deposit, indicating that marshes were present throughout the record. However, three main pollen zones are evident during the time the dark organic soil accumulated. At approximately 6400 BP, open water is represented in this location by the presence of Myriophyllum (aquatic plant) pollen and Pediastrum spores. Pediastrum is an algae that is intolerant of high levels of salinity, while Botryococcus (also found in the deposits) is an algae more tolerant of saline conditions (Davis et al. 1972, Whiteside 1965). After this early wet period, significantly drier conditions and low water levels, associated increased salinity, are made evident by increasing quantities of Botryococcus algal spores. A return to open water follows, as evidenced by higher levels of Myriophyllum pollen and Pediastrum algal spores.

It is likely that this second wet phase associated with open water in Silver Lake correlates with the high-energy beach line identified by Droz (1997) and dated to approximately 2800 BP. The earlier wet phase, dating 6400 BP, correlates with the time that people were living at the Bergen site, on the shore of Beasley Lake. Open water conditions in Silver Lake were necessary for overflow channels and playas to fill, and water to move north to fill Beasley Lake.

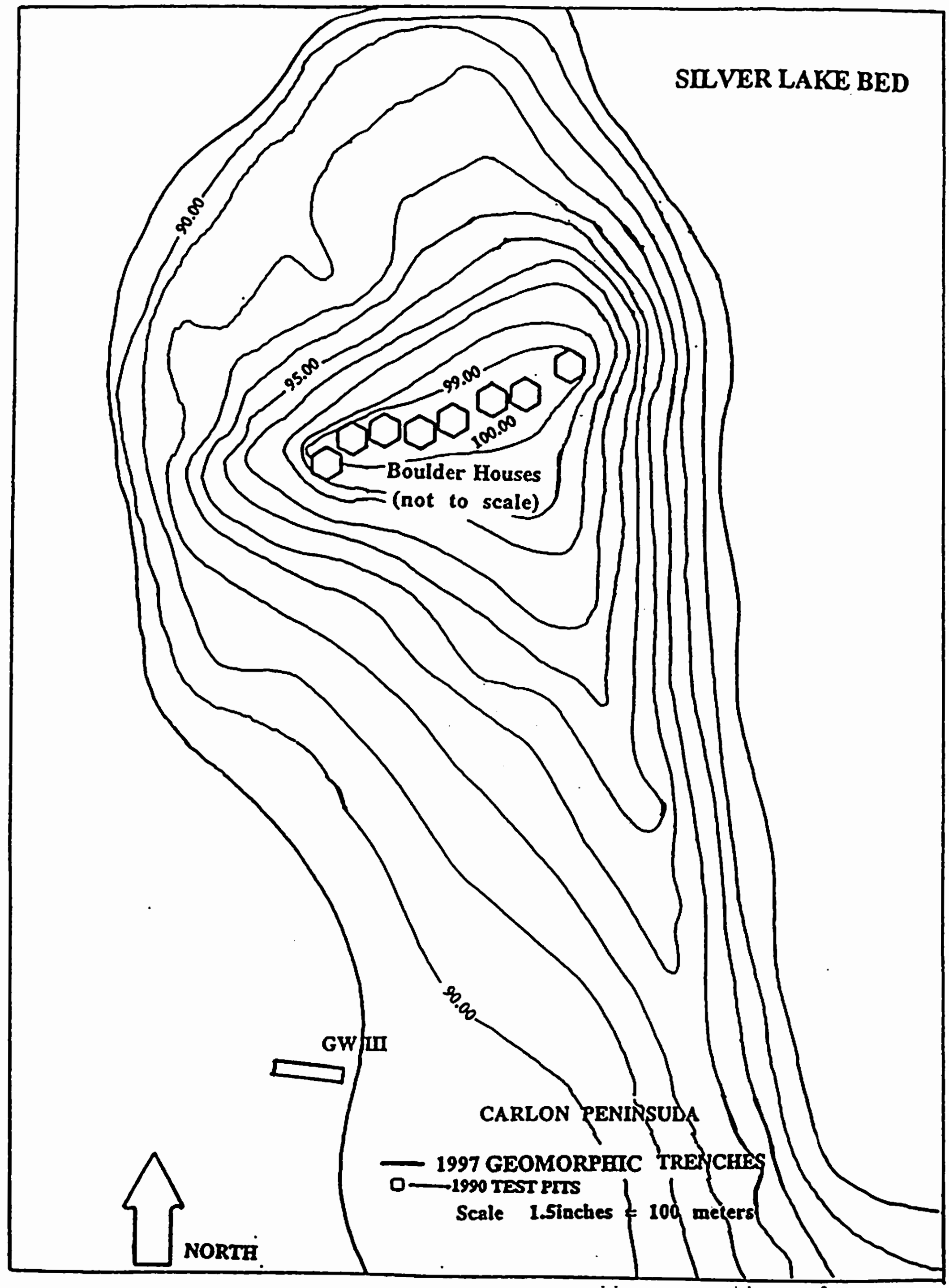


FIGURE 3. Location of Trench on the Shore of Silver Lake.

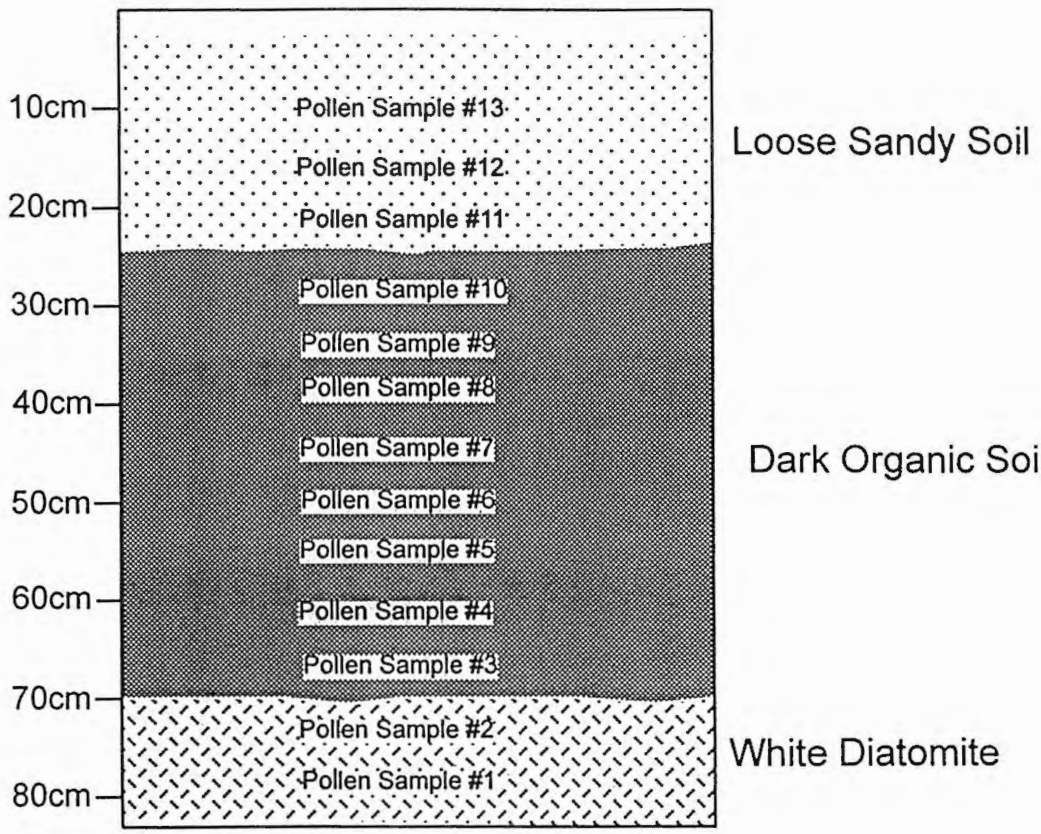


FIGURE 4. Profile of Stratigraphic Pollen Sequence from the Deposit on the Shore of Silver Lake.

Trends in the Holocene History of Plant Use in the Fort Rock Basin

Botanical resources in the Northern Great Basin are diverse and varied (Couture et al., 1986, Fowler 1986). In order to characterize plant diversity in the Fort Rock Basin, Housley (1994) divides the region into four biotic communities: Dry Lowland; Wet Lowland; General Upland; and Lithosol Upland. Plants within these communities consist of a mosaic of species which provided fuel (sagebrush, juniper, mountain mahogany), construction material (juniper, pine, mountain mahogany, grass), edible roots (lomatium, yampa, bitterroot), small seeds (goosefoot, juniper, bunchgrass, waada, saltsage), and fruit (serviceberry, chokecherry) (Stenholm 1994).

Ethnographic studies of Great Basin peoples have contributed enormously to our understanding of the use and processing of many of these plant resources (Colville 1897, Kelly 1964, Fowler 1986,1989, 1990a, Riddell 1978, Yanovsky 1936). Grasses such as Great Basin Wild Rye (Elymus) were harvested with sticks or special basketry seed beaters because the seed heads would shatter upon impact, while the seeds of cattail (Typha latifolia), bulrush (Scirpus), and Indian ricegrass (Oryzopsis hymenoides) were best collected by hand and processed using specialized grinding tools such as metates and manos (Fowler 1986). Root crops and bulbs, dug with curved and handled digging sticks, were sometimes eaten raw but often were roasted in pit ovens, such as those constructed for the processing of camas. Biscuitroot (Lomatium spp.), yampa (Perideridia spp.), bitterroot (Lewisia rediviva), and camas were particularly important in the Northern Great Basin (Fowler 1986, Prouty 1995). While exploitation and processing of fruits and berries varied depending on the group, it was common for chokecherries (Prunus virginiana) to be pulverized and made into cakes for storage and for most berries to be dried in the sun and stored. While many types of leaves could be eaten raw, others (such as Chenopodium and Amaranthus) had to be boiled to remove the bitterness (Fowler 1986, Hedrick 1972, Tilford 1997).

Archaeobotany

Early Holocene (12,000 - 7600 BP)

Archaeobotanical analyses of Early Holocene sites in the Fort Rock Basin are few. The Locality III Site (35LK3035), located on the north shore of Lunette Lake, produced two Early Holocene components, which were tested for botanical remains. In Component I, the presence of bulrush seeds, recovered from charcoal stained soil dating to 12,000 BP, suggests the presence then of a marsh-like environment at Lunette Lake (Jenkins, et.al. 1999a). Sagebrush, goosefoot, and possibly juniper were represented in a charcoal lens dating to 10,000 BP, also assigned to Component I. Processed edible tissue (PET), most likely representing charred lomatium (biscuitroot) and fruity tissue, were also recovered, suggesting that upland spring resources such as geophytic root crops and berries were transported and processed in lowland settings during early Holocene times (Prouty 1995b). Prouty argues that as lomatium and other geophytic roots do not grow in the highly alkaline soils associated with the typical lowland setting of Locality III, these resources were probably procured from the nearby Connley Hills, where thin, rocky lithosols provide the preferred habitat of geophytes of the Apiaceae family (Prouty 1995b). Component II of Locality III was dated between 8580 and 7000 BP. Botanical remains from this component include sagebrush, knotweed, waada, chenopodium, and possibly lomatium. Pollen and starch analysis of sediments washed from a flat grinding slab produced evidence of grass seed and possibly camas bulb processing (Jenkins1999a).

Early Middle Holocene (7600 - 5600 BP)

Jenkins et al. (2000a) refers to the Early-Middle Holocene in the Fort Rock Basin as a transitional period represented by temporary foraging campsites with no significant evidence of storage. The paleobotanical evidence in the third component at Locality III and at the nearby Bowling Dune site produced scattered occurrences of goosefoot, bulrush, waada, knotweed, grass seed, sagebrush, and juniper charcoal (Jenkins 1999a). Of the thirteen flotation samples analyzed by Prouty (1995b) for macrobotanical remains from the Locality III site, a total of only 1 gm of archaeobotanical material was recovered. Prouty (1995b) argues that this paucity of organic remains could be related to the churning up of soil by small rodents or insects (bioturbation), or by the re-deposition or deflation of wind-blown sediments at the site.

Late Middle Holocene (5600 - 3000 BP)

Evidence for Late Middle Holocene settlement patterns in the Fort Rock Basin suggest gradual increase in population density and intensified harvesting of resources, such as small seeds and fish, in the region (Jenkins et. al. 1999a). The appearance of houses, storage facilities, diverse artifact assemblages, and an increase in the numbers of sites during the Late Middle Holocene support this view. Paleoethnobotanical research on the Late-Middle Holocene components at Bowling Dune, DJ Ranch (35LK2758), GP-2 (35LK2778), Sage (35LK1003), Big M , Claim A1 (35LK 3176) and Bergen (35LK3175) collectively point to the variety of resources exploited during this time in the Fort Rock Basin lowlands. It also illuminates areas of the data that are scanty and in need of further study.

The DJ Ranch and Bowling Dune sites, located along the Silver Lake/Fort Rock channel system, include habitations which would have existed in extremely rich wetlands/grasslands ecotone environments. Prouty (1995c)

Paiute, Klamath/Modoc, and Southern Columbia Plateau cultures with analysis of aerial photography, ground truthing, and macro and micro-ethnobotanical studies in an effort to better understand adaptive strategies employed by early peoples in upland Fort Rock Basin environments. His study suggests that the storing of roots and seeds, and the placement of camps and villages near geophytic root grounds, has a long antiquity in the Northern Great Basin. Charred plant food remains from 57 macrofloral samples, along with pollen, phytoliths, and starch grains from five soil samples, all selected from cache pits, houses, and hearths in Boulder Village Upland sites, indicate reliance on a diversity of species. In particular, roots and seeds were an important part of the diet. Prouty (1995a:243) notes that "biscuitroot material is present in 19.51% of the samples analyzed, whereas unidentified root materials [processed edible tissue] are present in over 12% of the samples. Seeds, especially juniper seeds are present in nearly 40% of the samples. Waada (Suaeda) seeds are present in over 12% of the samples, followed by chenopods, goosefoot, grass, and saltbush seeds." A comparison of taxa by weight indicates that Apiaceae (biscuitroot or yampah) material accounts for nearly 60% and specimens are found in 50% of the features and structures analyzed at Boulder Village (Prouty 1995a).

Carlon Village is located on the shore of Silver Lake, at the foot of Egli Rim escarpment, atop which the Boulder Village sites are located (Wingard

2001). The site, whose main occupation has been radiocarbon dated between 600 BP and 2300 BP, is a lowland site in close proximity to the upland environments. Paleoethnobotanical evidence points to a wetlands adaptation with a diversified diet of plant food resources. Food remains recovered in nine flotation samples taken from the site include Allium (onion) bulbs, Cheno-am (Goosefoot and Amaranth) seeds and greens, Cyperaceae (Sedge family) seeds and shoots, Galium (Cleaver's Bedstraw) seeds and shoots, Prunus (Chokecherry) fruit, Rosa petals, hips, and roots, Rumex (Dock Sorrel) seeds, leaves, and stem, and Amelanchier (Serviceberry) berries. The most common charcoal types recovered include Cercoparpus, *Artemisia, Juniperus,* Sarcobatus, Chrysothamnus, and Pinus; while Atriplex, Prunus, Amelanchier, Rosaceae, Purshia, Populus, and Salix were also represented (Puseman and Ruggiero 2001).

Archaeobotanical assemblages recovered from features such as hearths, house floors, and cache pits associated with early occupations in the Fort Rock Basin indicate that the aboriginal diet was rich and diverse. Lowland sites occupied during the Early and Late Middle Holocene tend to be associated with wetlands and/or wetlands-grasslands ecotonal settings. Houses and storage facilities appear in the Late Middle Holocene, suggesting increased population densities and intensification of resources. The archaeobotanical remains from a number of these sites, however, are rather scanty due to poor reports the presence of many bulrush seeds in flotation samples at DJ Ranch. An attempt to show supporting evidence with twenty pollen samples from the two sites, however, was inconclusive due to contamination from modern pollens (Cummings 1995). The remainder of the macrobotanical assemblage recovered from ten hearth, housefill, and cache pit features from the DJ Ranch and Bowling Dune sites include sagebrush, juniper, grasses, and chenopod/amaranth seeds (Prouty 1994b). These samples are C-14 dated between 4900 and 2830 BP. At the Bowling Dune site diversity of plant remains was extremely low.

Prouty (1995b) conducted analysis on one soil flotation sample from the Sage site and six samples from the GP-2 site. An undated feature (probable cache pit) at the Sage site produced evidence of sagebrush (Artemisia tridentata), used as a fuel source. At the GP-2 site only a trace of sagebrush wood fuel was recovered in the samples, along with one fragmentary charred goosefoot (Chenopodium) seed and a few uncharred rodent bones. The yield of ethnobotancial materials from all six samples totaled only a disappointing .05 grams. Prouty attributes the paucity to problems of deflation, age of the cultural materials, and the limited number of samples submitted. Further, at the GP-2 site, "...that only part of the house floor was excavated and most of the floor's depositional archaeobotanical matrixes were mixed during testing (Prouty 1995b:20)."

The Big M site, located along the Silver Lake overflow channel, represents a Middle Holocene occupation, which tool assemblages and cultural remains strongly indicate was a small village occupied much of the year (Jenkins 1994a). Unfortunately, very little can be deduced from the floral inventory from the site (Stenholm 1994). Of the eight soil samples submitted for flotation analysis, Stenholm was only able to identify traces of juniper, sagebrush, conifer, and grass stem tissue. Groundstone (manos, metates, hopper mortars, pestles, and stone bowl mortars) was abundant at the site, however, suggesting that a broad array of plant foods were being processed at the site (Jenkins 1994a). Extreme deflation at this very shallow site is the probable cause for the severely limited archaeobotanical remains recovered at Big M (Stenholm 1994).

Two flotation samples were analyzed from the Claim A1 site (35LK3176), located in the lowlands and dating to 5310 BP. Archaeobotanical assemblages suggest the utilization of saltbush and other seeds. Sagebrush, pine, greasewood, and possibly saltbush were used as fuel (Cummings 1999).

Late Holocene (3000 BP to historic times)

The most extensive paleoethnobotanical study of Late Holocene sites in the Fort Rock Basin is Prouty's (1994a,1995a) investigation of the Boulder Village Uplands. He combined ethnographic models of plant use by Northern preservation, bioturbation, or other problems. While the data from soil and charcoal samples dating to the Late Middle Holocene generally support current interpretations of diet and settlement, many samples are inadequate to yield convincing evidence. Better preservation of archaeobotanical remains is encountered at sites associated with Late Holocene occupations. The evidence for this period suggests a shift in settlement patterns characterized by more intensified use of upland resources (especially root crops and seeds).

Archaeological Evidence for Holocene Settlement Patterns

Decisions people make regarding where and how they live depend on both cultural and environmental circumstances. For indigenous people in the Fort Rock Basin, the juxtaposition of low-lying wetlands with dry, rocky uplands was critical in determining the seasonal round (Jenkins et. al 2000a). The fluctuating distribution and availability of aquatic and terrestrial resources across the landscape surely influenced cycles of mobile foraging and residential settlements throughout the Holocene.

Archaeological evidence of the Early Holocene (12,000 – 7500 BP) suggests that the earliest inhabitants of the Fort Rock Basin were primarily mobile, broad-spectrum foragers who relied on both lacustrine (lake) and terrestrial resources. Three main types of sites dating to the Early Holocene have been documented in the region: temporary foraging camps, winter residential bases, and specialized processing camps (Jenkins et al. 2000a). The Locality III site (with radiocarbon dates of 12,000 BP and 8000 BP) represents a temporary foraging camp occupied the spring and summer months. The site is located on the edge of a small lake along the Silver Lake drainage channel. The assemblage of formed tools at the site, however, is small and does not reflect evidence of a specialized subsistence strategy focused on marsh environments.

Early components at the Connley Caves (11,000 BP – 8000 BP) provide evidence for winter residential bases in which nearby Paulina Marsh was exploited for wetland resources (Bedwell 1960). Evidence for processing camps during the Early Holocene emerge on the easternmost edge of the Fort Rock Basin at Buffalo Flat. The site, dating to 8000 BP, produced abundant evidence of jackrabbit processing (Oetting 1994).

The transition from the Early Holocene into the Early Middle Holocene (7500 BP – 5600 BP) is often represented by temporary foraging campsites, such as Locality III and Bowling Dune (Jenkins et al. 2000a). It is during this time that side notched projectile points begin to appear in the archaeological record, and groundstone tools such as manos and metates appear frequently. As lowland sites such as Locality III and Bowling Dune demonstrate, however, artifact assemblages during this transitional time tend to be small and tools tend to be rough and relatively unformed, clues that point to high levels of mobility.

Archaeological sites which were occupied during the Late Middle Holocene (5600 BP – 3000 BP) also tend to be located in the lower elevations of the Fort Rock Basin, but are often associated with more sedentary living. The Big M site, downstream of Silver Lake, and DJ Ranch, located on the edge of a small pond, serve as good examples (Jenkins 1994a). The Big M site, dated from 5000 to 3500 BP, is represented by three semi-subterranean house structures and a dense surface scatter of lithic artifacts. A diversified artifact assemblage was noted, with apparent emphasis on the fishing of tui chub (Aikens and Jenkins 1994, Greenspan 1994, Jenkins 1994a). Artifacts included projectile points, knives, pestles, grinding slabs, bone gorges, net weights, bone and shell beads, and lithic debitage (flakes). Two ceramic artifacts were also found at the Big M site: a pipe bowl fragment and a small ceramic pellet (Mack 1994). Fishing equipment, fish bones, and fresh water snail shells all point to an industry reliant on the overflow channels from Silver Lake -- in a setting which is now quite arid and surrounded by sandy fields (Aikens and Jenkins 1994). The ecotonal setting of the Big M site, situated on the banks of these overflow channels and in close proximity to the base of the upland resource zone, provided a broad resource base for the human occupants of the site (Jenkins 1994a). A similar pattern is expressed at DJ Ranch (5600 BP- 3000

Ranch (5600 BP- 3000 BP), where a substantial increase in fishing technology, formed groundstone tools, house pits, and storage pits were discovered (Aikens and Jenkins 1994a, Greenspan 1994).

Climatic changes in the Late Holocene, beginning at about 3000 BP, may have triggered a time when water resources became more ephemeral than in the previous time period. The Zane Church site, dating to this time, is located across the Silver Lake/Big M overflow channel. While the ancient inhabitants at Zane Church also relied on wet conditions in the Fort Rock Basin, the site represents a temporary fishing camp rather than the more sedentary situation represented in the earlier period (Jenkins 1994a).

In contrast, the Carlon Village site, located on the east shore of Silver Lake, represents a more permanent village settlement occupied periodically throughout the Late Holocene (Jenkins 1994a, Wingard 2001). Recent archaeological investigations point to the exploitation of the wetland environment with a reliance on nearby upland resources. The large stone rings at the site indicate the presence of substantial house structures, leading Wingard (2001) to conclude that the occupants must have enjoyed high social status.

The changes in adaptive strategies that led to increasing reliance on upland environments in the Late Holocene times is best represented in the Boulder Village Uplands (1500 BP – historic times), east of Silver Lake (Byram

1994). At Boulder Village, a total of 122 houses and 48 cache pits have been recorded on the edge of a flow of large lava boulders (Jenkins and Brashear 1994).

The gradual increase of upland sites during the late Middle Holocene which culminated in the Late Holocene Boulder Village dwellings is also evidenced by smaller upland sites with comparable artifact (Byram 1994, Prouty 1995, Brashear 1994, O'Grady 1999). These include Teri's House, Scott's Village, and Playa 9 (Aikens and Jenkins 1994). Although not as substantial as Boulder Village, these sites produced similar evidence for intensified harvesting of root crops, particularly biscuitroot (Lomatium canbyi). Temporary plant processing camps were located in rocky scabrock flats, where geophytic roots are most prolific. Villages, hamlets, and caches are found further up the slopes above the root grounds. Here, juniper, mahogany and other species can be exploited for tools and firewood, while house structures are more sheltered from the elements. Prouty suggests that this type of adaptive strategy was made possible because geophytic roots tended to be a stable resource through time. They grow best in upland rocky slopes where water is trapped under rocks and provides the necessary moisture to support these plants. Geophytic roots are also high in calories and complex carbohydrates, and, therefore, provide an excellent resource for indigenous populations adapting to an unstable environment. It is further suggested that population stress and rapid climate changes during the Late Holocene may have influenced the shift to an intensified lifeway of semi-sedentism in the Boulder Village Uplands (Brashear 1994, Prouty 1995).

Surveys in the Boulder Village Upland Area produced evidence that Late Holocene hunter/gatherer populations relied on xeric species of plants. Certain distinctive characteristics of the Boulder Village Uplands facilitated the development of substantial settlements are closely related to the local environment. Upland playas provided basins in which water could accumulate during the spring (Byram 1994). Edible roots and tubers abundant on the slopes of the Boulder Village Uplands are thought to have been a stable resource over the last 5000 years (Housley 1994). Human presence in these uplands is not unknown during the Early and early Middle Archaic periods (as corroborated in other upland settings in the Northern Great Basin), but it is not until the later periods that intensified adaptations attested by boulder-ring architecture constructions and rich artifact assemblages emerge (Brashear 1994, Byram 1994).

The Boulder Village house rings probably supported the bases of domed mat structures similar to those of ethnographically known Klamath and Modoc (Jenkins and Brashear 1994). Evidence suggests that subsistence was focused on the exploitation of geophytic roots, seeds, and fish obtained elsewhere. Excavations in some of these house structures indicate that three phases of occupation occurred at Boulder Village. Between 1500 BP and 900 BP, large houses with excavated floors were situated near modern perennial water sources. Hunting game does not appear to have been as important at this time. Somewhat smaller and shallower houses appear between 600 and 500 BP (Jenkins and Brashear 1994). Sites are more widely distributed on the landscape and animal meat becomes a more significant part of the diet. The third phase dates from about 200 BP to historic times, when Northern Paiutes were removed to reservation life. The trend to smaller and shallower houses continued through this period and suggest change in social or economic adaptations (Jenkins and Brashear 1994).

Jenkins (1994a) believes that general changes in adaptive strategies evidenced in the Fort Rock Basin must be viewed in the larger context of the Northern Great Basin. For instance, rising local populations may be the result of population movement from one basin to another. Oetting (1994) notes that the neighboring Christmas Valley was occupied throughout the Holocene, but that this portion of the Fort Rock Basin did not hold water during most of this period. It is conceivable that people moved from one basin to another to take advantage of available resources as needed.

On Adjusting the Investigative Lens: From Inter-Site to Intra-site Research

As just reviewed, a substantial corpus of research into the indigenous human occupation that spanned the Holocene in the Fort Rock Basin has been developed over the past twelve years. The emphasis of this research has been on the study of changing subsistence, land use, and settlement patterns on the regional scale. The primary analyses have focused on how site function, proximity to plant and animal resources, and availability of water relate to regional patterns of settlement on the landscape over time. Although this type of research has been essential for understanding general (coarse-grained) patterns of early history in the Fort Rock Basin, there has been a significant lack of attention paid to fine-grained patterns, such as "household archaeology" at the intra-site scale.

In this study I am launching an effort to address this neglected perspective by shifting the investigative lens from coarse-grained to fine-grained questions at the Bergen site. Intensive analysis at the Bergen site involved excavating two Middle Holocene house floors with special attention to refined provenience and recovery methods in order to investigate human patterns at the scale of a single family dwelling unit. Special reference to the role of plant resources and the distribution of plant remains across the house floors was key to the study. While previous studies in the Fort Rock Basin have provided the context within which to interpret the archaeology at the Bergen site, the research outlined in this dissertation demonstrates how the fine-grained analyses involved in household archaeology can significantly enhance our understanding of ancient human settlement patterns generally.

CHAPTER III

BERGEN SITE EXCAVATIONS AND CULTURAL ASSEMBLAGES

The Bergen site (35LK3175) is located in the Fort Rock Basin of south-central Oregon (Fig. 5). The site dates to the Middle Holocene and is situated on the southeast end of the Bergen Lunette Dune, adjacent to paleolake Beasley (Fig. 6). The dune is roughly 1,600 m long and 200 m wide, oriented along a northwest/southeast axis. Currently sagebrush and greasewood dominate the vegetation, where wetland plants once flourished. A dense scatter of obsidian waste flakes (debitage) covers much of the dune surface. Investigation of the site was conducted by the University of Oregon Archaeological Field School during three summer field seasons, 1998 to 2000. Auger test probes, excavated at 50 meter intervals from the southeastern end of the dune northwest for a distance of more than 1,200 meters, verified a continuous distribution of cultural materials along this dune feature. Fourteen radiocarbon dates associated with cultural deposits at the site range from 3660 BP to 5930 BP. In this account, the dates of cultural features at the Bergen site are given in radiocarbon years before present (BP).

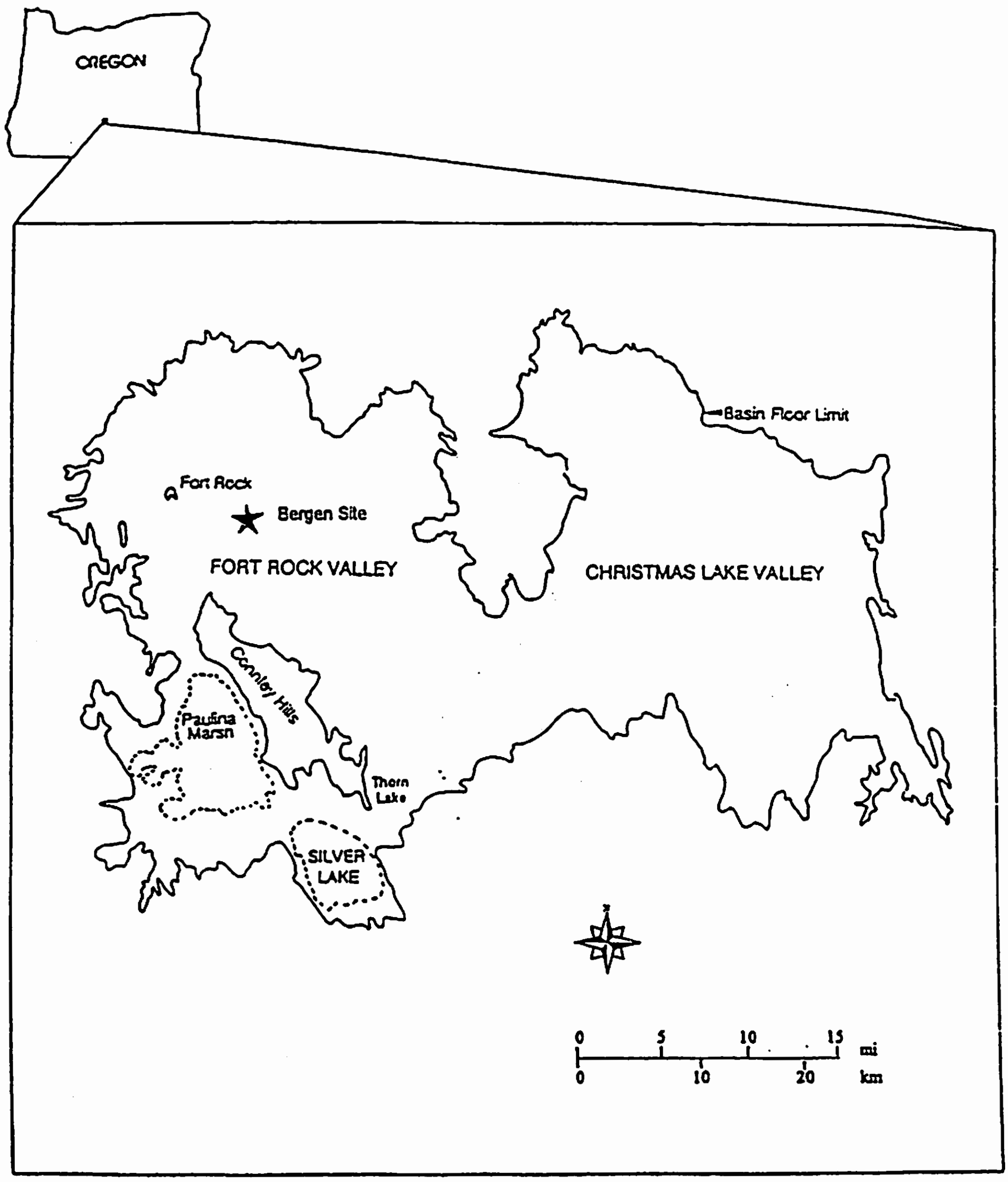


FIGURE 5. Bergen Site Location.

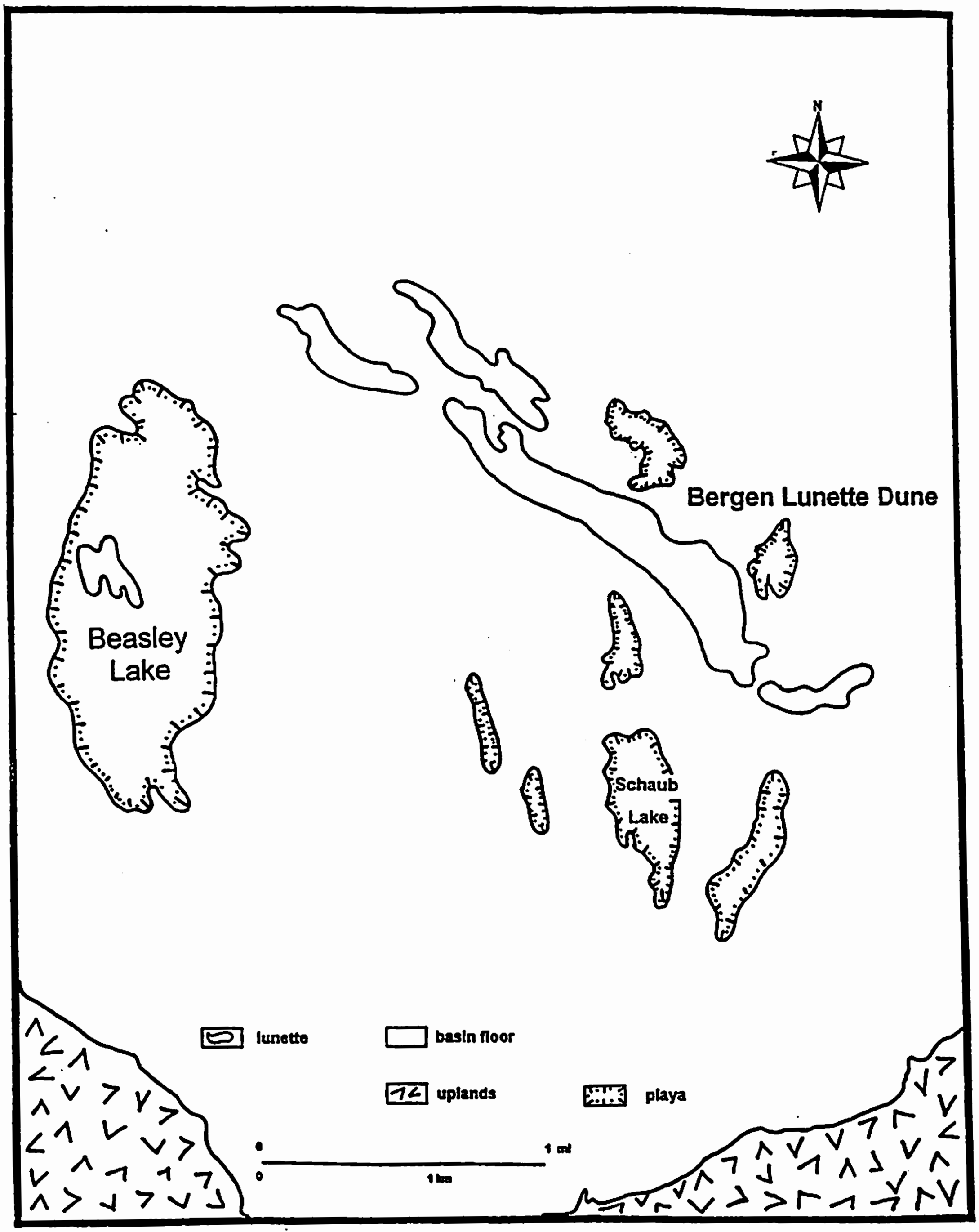


FIGURE 6. Bergen Site Vicinity. (From Droz and Jenkins 1999)

University of Oregon archaeologists first learned of the Bergen site from officials at the Burke Museum in Seattle, which had received a large collection of artifacts donated by Dr. Harold Bergen. Personal communications and accompanying notes indicated that a portion of this collection was obtained from a large dune site in the Fort Rock Basin. The site was chosen for excavation by the University of Oregon field school for two main reasons. First, the geographic expanse and density of obsidian flakes, tools, and ground stone fragments across the dune surface represented what looked to be the largest lowland site in the Fort Rock Basin. From the abundance and diversity of artifacts visible on the surface, the site appeared to represent a sedentary or semi-sedentary village settlement. Projectile point time markers suggested an occupation dating to the Middle Holocene. It was thus recognized that the Bergen site could offer significant insight into our progressively developing understanding of mobility and sedentism of Middle Holocene hunter-gatherers in the Fort Rock Basin.

Second, there was substantial evidence of disturbance at the site by artifact collectors. Large deflated "blow-outs" near the crest of the dune resulted from wind erosion of loosened soil in partially dug cultural deposits. It was clear that archaeological investigations were necessary to assess the cultural significance of the site and to ensure protection from further disturbance. As the Bergen site is located on Bureau of Land Management

(BLM) property, the University of Oregon worked closely with the BLM Lakeview District Office to conduct the investigations. Because it lies within the traditional territory of the Klamath Tribes, the guidance and collaboration of tribal representatives was also sought.

Formation of the Bergen Lunette Dune

Lunettes are typically crescent shaped dunes that form on the leeward side of ephemeral lakes. Silts from the periodically dry lake bottom are blown into the vegetation on the shore on the lake. Water returns to the lake, new silts are deposited, and the dune building process is repeated over and over as the lake cycles between wet and dry. Clues to the formation of the Bergen Lunette Dune were obtained from analyses of backhoe trenches and manually excavated auger holes during the 1998 and 1999 field seasons, coupled with previous studies in the region (Jenkins et al 2000a). The Bergen Lunette Dune is composed of fine-grained sandy silts overlain by redeposited Mazama tephra and silts (Droz and Jenkins 1999). The underlying dune was formed during the cyclical wetting and drying phases associated with the shrinking of Pleistocene Lake Fort Rock between about 15,000 and 12,000 years ago.

Paleo Lake Beasley, a late remnant of the larger Pleistocene Fort Rock Lake, provided fine-grained sediments which eroded off the playa during Holocene wetting and drying phases and were deposited along its eastern edge to further build up the Bergen lunette during the time of human occupation. The dune was covered with volcanic ash (tephra) after the eruption of Mount Mazama about 7500 years ago. Sharp wave-cut features along the dune's edge, identified in backhoe trenches, suggest that high water was present in Lake Beasley after the time of eruption (Droz and Jenkins, personal communication). The identification of wave cut and fill sequences in trench wall profiles, well sorted beach sands, and well rounded Mazama tephra indicate high energy water levels in Lake Beasley that may have reached 3 to 4 meters in depth. Deep water with expansive surfaces open to the wind leads to high energy waves that move and sort sediments in lakes.

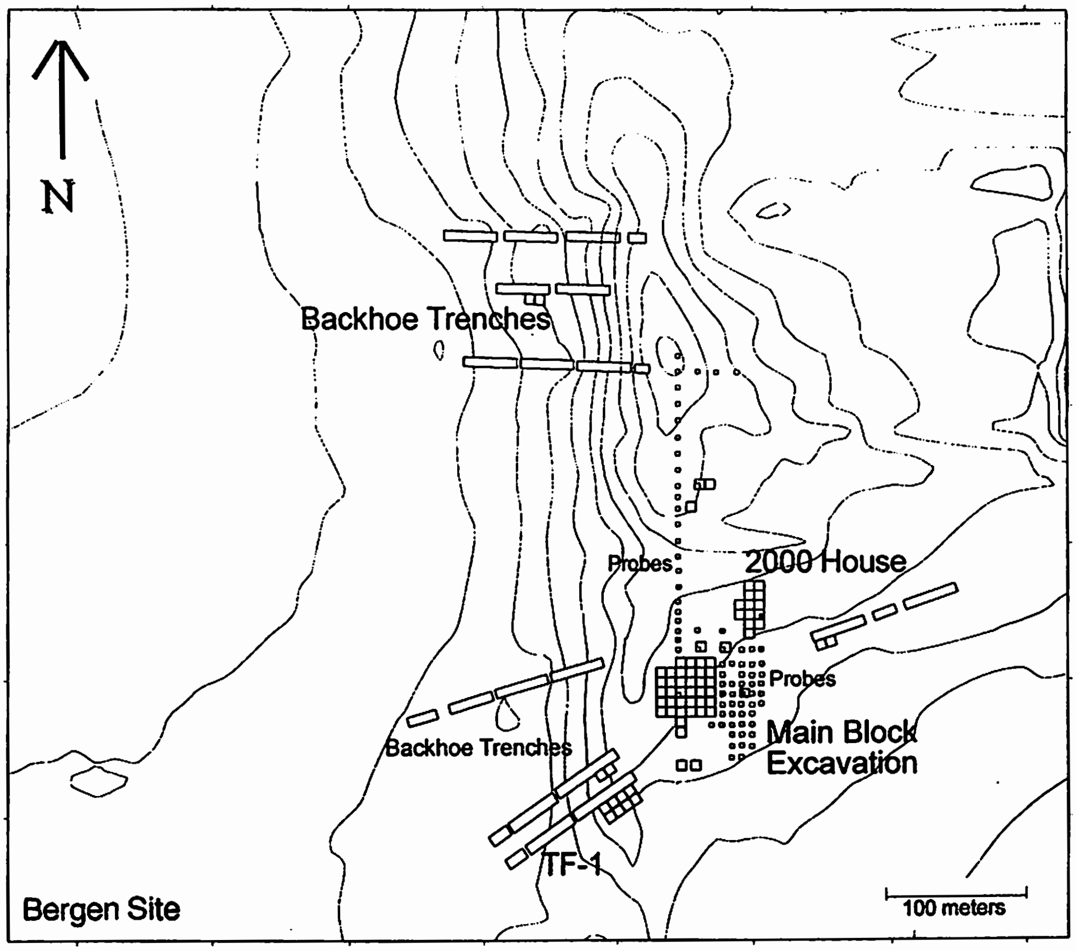


FIGURE 7. Contour Map of the Bergen Site, Showing the Southern End Where Archaeological Investigation was Concentrated.

Excavations and Excavation Units

The University of Oregon Archaeological Field School excavated 75 probes, 10 test units, and 3 block excavations at the Bergen site during the 1998, 1999, and 2000 field seasons (Fig 7). In total, 81 cubic meters of soil were excavated. Artifacts recovered include 375,725 pieces of obsidian debitage, 150,925 bone fragments, 244 projectile points, 219 bifaces, 59 pieces of ground stone, and 64 beads. These numbers attest to the rich cultural deposits associated with intensive human occupation of the site during the Middle Holocene. The archaeological evidence upon which this chapter is based is presented in the following sections. Probes were dug to obtain the overall lay of the site, trenches were dug for stratigraphic analysis, and block excavations were conducted in order to sample and explore cultural features in the site.

Test probes in 1998 were set up at 10 meter intervals on a north/south axis along the crest of the dune near its southern end, where Dr. Bergen's early excavations had been placed, to assess the cultural and depositional stratigraphy at the site (Fig. 7). Test probes consisted of 50cm by 50cm shovel cuts and 20 centimeter auger cuts. Each of the probes was excavated in 10 cm arbitrary levels. Artifacts and other cultural material were collected in labeled bags. Debitage counts, tools, and soil descriptions of each level were recorded on probe sheets. Test probes conducted during the 1999 field season were set up on a five meter grid adjacent to a Middle Holocene house occupation discovered during the previous season. The purpose of these probes was to seek other house structures and possible food storage facilities associated with the known house, which came to be called the "Main House." While no food storage facilities were successfully identified, concentrations of artifacts and bones in probes 35, 39, 40, 41, 46, 49, and 59 (distributed for some 30 meters along the dune north and east of the excavated area) suggested that remains of at least seven additional ancient houses are scattered across the crest of the lunette (Table 1, Fig. 7). Each of these probes produced dark soil with charcoal flecks and burned bone between the depths of 50 to 80 cm below the surface.

Test units measuring 1x1 meters were dug to further investigate cultural deposits encountered in probes. Units measuring 2x2 meters were dug in series to form the block excavations at the site. The 2x2 meter units were divided into four quadrants, referred to as Quads A, B, C, and D (northwest, northeast, southeast, and southwest). All test units were excavated in 5 centimeter levels. Debitage (flakes), bone, tools, shell, and ochre were removed from the screens, counted, and recorded on level records in the field. The block excavations are referred to as the "Main House," the "2000 House," and the Trench TF-1 Butchering Area.

TABLE 1. Number of Debitage, Bone, and Tools from Seven Probes at the Bergen Site, by 10cm Levels.

	Probe 35			Probe 39			Probe 40			Probe 41			Probe 46			Probe 49			Probe 59		
Level	Deb	Bone	Tools	Deb	Bone	Tools	Deb	Bone	Tools	Deb	Bone	Tools	Deb	Bone	Tools	Deb	Bone	Tools	Deb	Bone	Tools
1	342	30	0	737	370	3	747	706	0	366	51	0	17	11	0	0	0	1	0	0	0
2	78	10	0	77	32	0	187	152	0	35	4	0	5	12	0	64	25	0	46	17	0
3	38	13	0	52	36	0	48	21	0	61	6	0	24	4	1	53	25	0	44	6	0
4	82	28	0	80	60	0	75	53	0	57	7	0	16	8	0	49	23	0	64	21	0
5	81	12	0	61	59	0	64	56	0	69	8	1	23	16	0	58	17	0	57	27	0
6	206	31	0	44	85	0	67	65	0	45	5	0	61	20	0	70	32	0	35	8	0
7	61	10	0	90	53	0	77	100	1	39	12	0	27	98	0	72	23	0	24	5	0
8	57	7	0	65	27	1	60	34	0	59	11	1	9	13	0	85	19	0	23	8	0
9	29	16	0	45	18	0	17	37	0	31	10	0	0	0	0	32	20	0	16	3	0
10	11	2	0	30	9	0	16	12	0	47	6	0	0	0	0	55	15	0	0	0	0
11	4	1	0	0	0	0	10	8	0	19	5	0	0	0	0	31	24	0	0	0	0
12	0	0	0	0	0	0	11	5	0	12	1	0	0	0	0	28	1	0	0	0	0
13	0	0	0	0	0	0	0	0	0	6	3	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	6	1	0	0	0	0	0	0	0	0	0	0
Total	989	160	0	1281	749	4	1379	1249	1	852	130	2	182	182	1	597	224	1	309	95	0

Screening techniques employed at the Bergen site highlight important methodological issues regarding cost-effectiveness of sampling procedures. During the 1998 field season, all excavated soil was passed through 1/8thinch screens. Due to the abundance of debitage and bone in the deposits, however, units excavated in 1999 and 2000 were screened in a different manner. The adjustment in screening techniques was made to speed up the excavation process, improving cost-effectiveness without compromising archaeological data. Screens with 1/4 inch mesh openings were inserted in the sifters over the standard 1/8th inch screens. Soil was passed through both screens. All cultural material in the 1/4 inch screen was collected, while 1/8th inch screens were rapidly inspected for any fragments of tools, beads, and diagnostic bone. Very few cultural materials were recovered from the 1/8 inch screens. As most of the bone fragments and stone flakes in the 1/8th inch screens were too small to be of analytical use, the 1/4 inch inserts proved to be quite effective in isolating important cultural remains while operating within the limited time constraints of fieldwork. The 1/4 inch inserts were used for Quads B, C, and D in each unit. In order to maintain comparable data with units previously excavated at the site, all cultural material from Quad A was removed from the 1/8th inch screen.

Excavations gave evidence of stratification of human occupation levels in the Bergen site deposits. Initially, a total of 75 probes were excavated, 47 as 50x50cm shovel probes, and 24 as 20cm diameter auger probes. Cultural material was consistently present to a depth of one meter in the probes, and level records gave evidence of two primary levels of artifact concentration at the site. These occurred at depths of approximately 40cm to 50cm and 60cm to 80cm below the surface.

The probes also offered an initial view of the site deposits themselves. The top 30cm of sediment consisted of loose, gray sand mixed with Mt. Mazama tephra. Brown silt, which became progressively darker at lower depths, was present from approximately 30cm to 50cm below the surface. From a depth of 50cm to 80cm, the deposit consisted of very dark silts, often laden with charcoal flecks. Also at this depth, obsidian debitage and bone fragments significantly increased in number. Sediment between 80cm and 110cm below the surface consisted of yellowish coarse sand, which contained little to no cultural material. The stratification of cultural deposits indicated by the probes was subsequently corroborated by evidence from test units and block excavations, discussed in the following sections.

Three block excavations were conducted at the Bergen site (Fig. 7). They include the Main House Excavation, the 2000 House, and the Butchering Area in Trench TF-1. The main block was excavated in 1998 and 1999. The 2000 house was excavated in 1999 and 2000 (Fig. 8). The TF-1 Butchering Area was excavated in 1999.

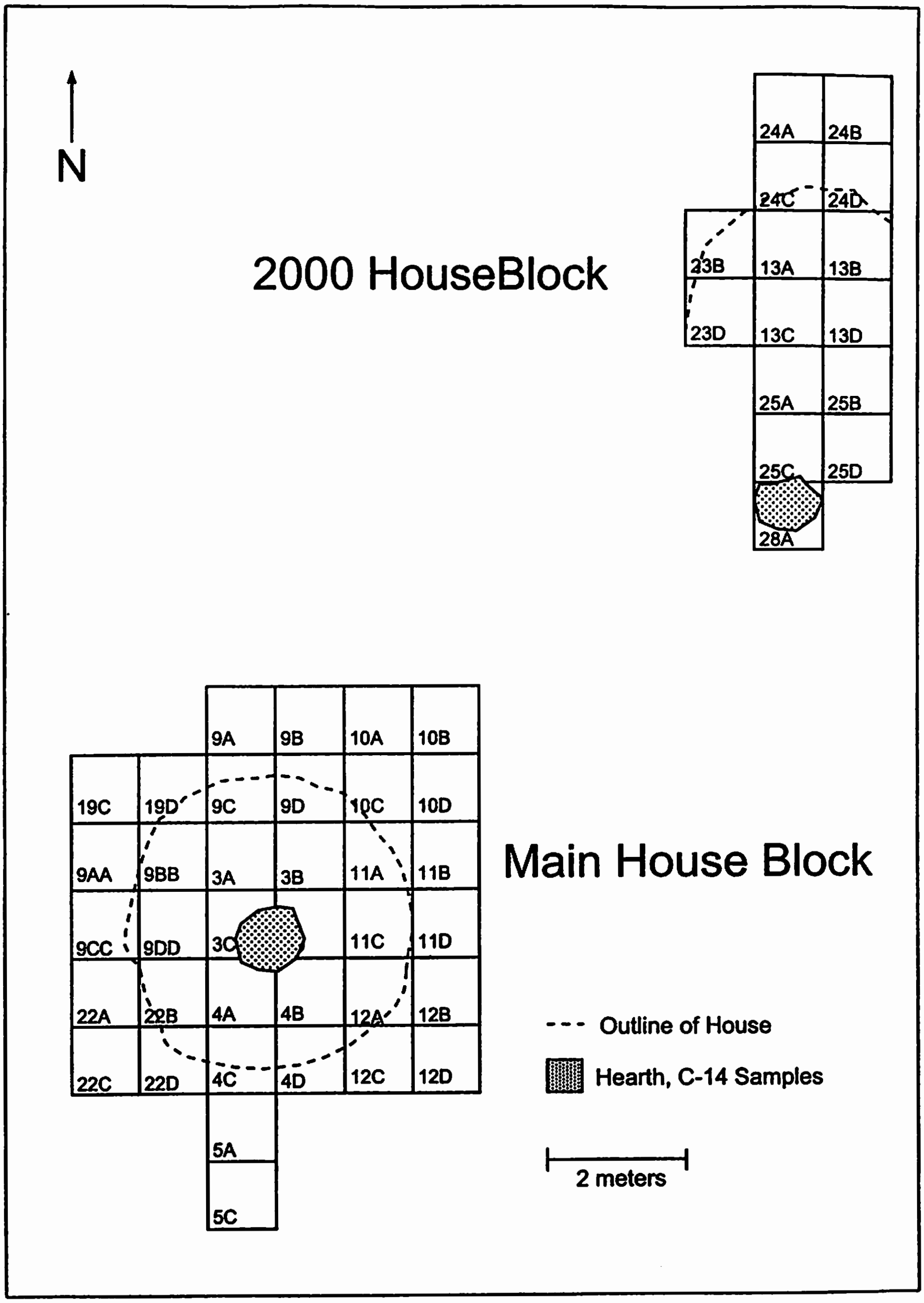


FIGURE 8. Excavation Units at the Bergen: Main House and 2000 House Blocks. Two-meter Units Divided into One-meter Quads.

Main House Excavation Block

The Main House excavation block was located on the crest of the Bergen lunette between the TF-1 Butchering Area to the west and the 2000 House to the east (Fig. 7). Radiocarbon dates (discussed in a following section) and other evidence suggest early inhabitants repeatedly visited the site, and two cultural occupations were identified in the Main House excavation. The deposits resembled those previously encountered in the probes. The upper occupation was located in levels 1 through 8, the top 40 centimeters of the deposits. The first two levels of the excavation consisted primarily of reworked Mazama ash and wind blown sediments. The sediments in levels 3 through 8 were medium to dark brown, fine-grained silts with a dense accumulation of cultural material including projectile points, bifaces, ground stone, shell beads, and fire-cracked rock. This upper deposit represents accumulation of cultural material associated with later occupations that postdate the Main House floor deposit in the lower occupation. A distinctive house floor associated with the upper occupation was not identified in the field perhaps because the fill was too soft and disturbed to show clear evidence of a floor.

The lower occupation was encountered in levels 9 through 19 in the central part of the block, where a definite cultural accumulation of artifacts and bone was identified. Underneath this rich cultural layer was a compact deposit of yellow blonde sediment that contained essentially no artifacts. This culturally sterile yellow soil formed the house floor of the lower occupation, upon which people walked, slept, and ate. Rich overlying deposit was formed by an accumulation of refuse from food, mats, and assorted human activities. It was from this fill above the house floor that soil samples were taken for macrobotanical analysis.

Units in the center of the block produced deeper cultural deposits than the units on the periphery. Units 3D and 4B, in the center, were excavated to 105 cm, while Units 10 and 12, on the periphery, were terminated at 75 cm due to encountering sterile soil. A cross-section of the overall house floor depression in the lower occupation is depicted in Figure 9. This is the feature referred to throughout this report as the Main House.

The house floor of the lower occupation zone within the Main House measured about a meter below the surface in the central part of the block, but sloped gently upward toward the perimeters. The house was roughly circular in shape and measured about 4 meters in diameter. A large fire hearth was dug into the floor in the central portion of the house, evidenced primarily in Units 3 and 4 by dark, greasy soil (suggestive of animal fat) and abundant charcoal. A profile of the east wall of Units 4A and 4C illustrates the main deposits, including the hearth fill and the sloping house floor (Fig. 10). One posthole was identified in Unit 9C.

A separate cultural feature was identified in Units 9A and 9C, just two meters to the north and west of the central hearth. It appears to represent a shallow pit, originating at a depth of 35 cm below the surface, which was filled in with artifacts including elk antler billets, a large biface, Olivella shell beads, and pieces of abalone shell. The finding of abalone at the Bergen site is a first, in that it represents the only example of abalone shell, most likely from the California coast, yet discovered in the Fort Rock Basin of Oregon (Largaespada 2001).

While two different radiocarbon dates obtained from the central hearth in the lower occupation suggest possible reoccupation of the same housepit, the evidence does not indicate that the later date was associated with the upper occupation. The dates from the upper occupation were obtained from different locations (the east side and the west side of the block), and the soft nature of the upper sediments may be the result of shifting or mixing from later occupations rather than re-occupations.

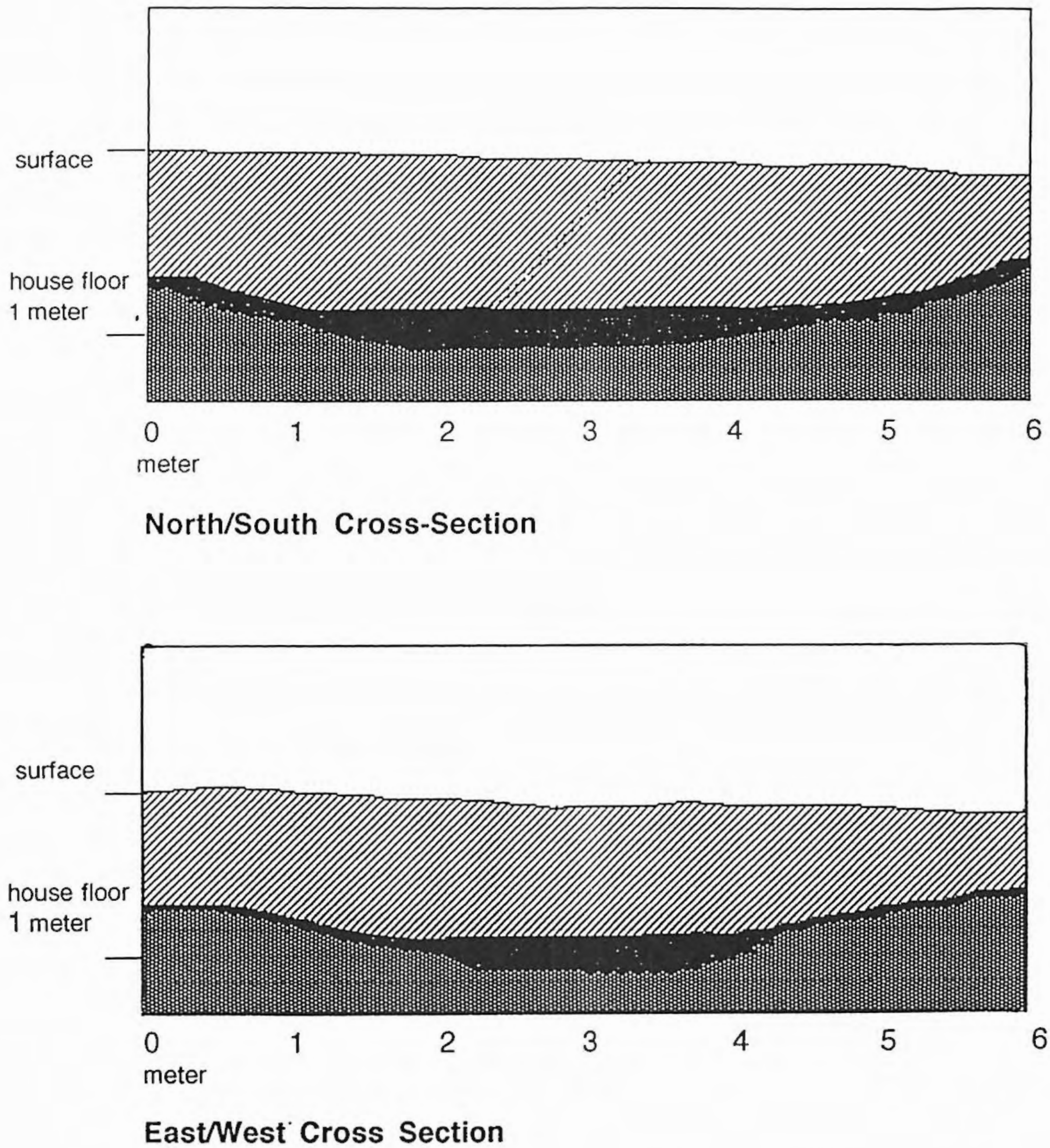


FIGURE 9. Depression Contour of Main House Floor at the Bergen Site, Showing Central Hearth in Lower Occupation.

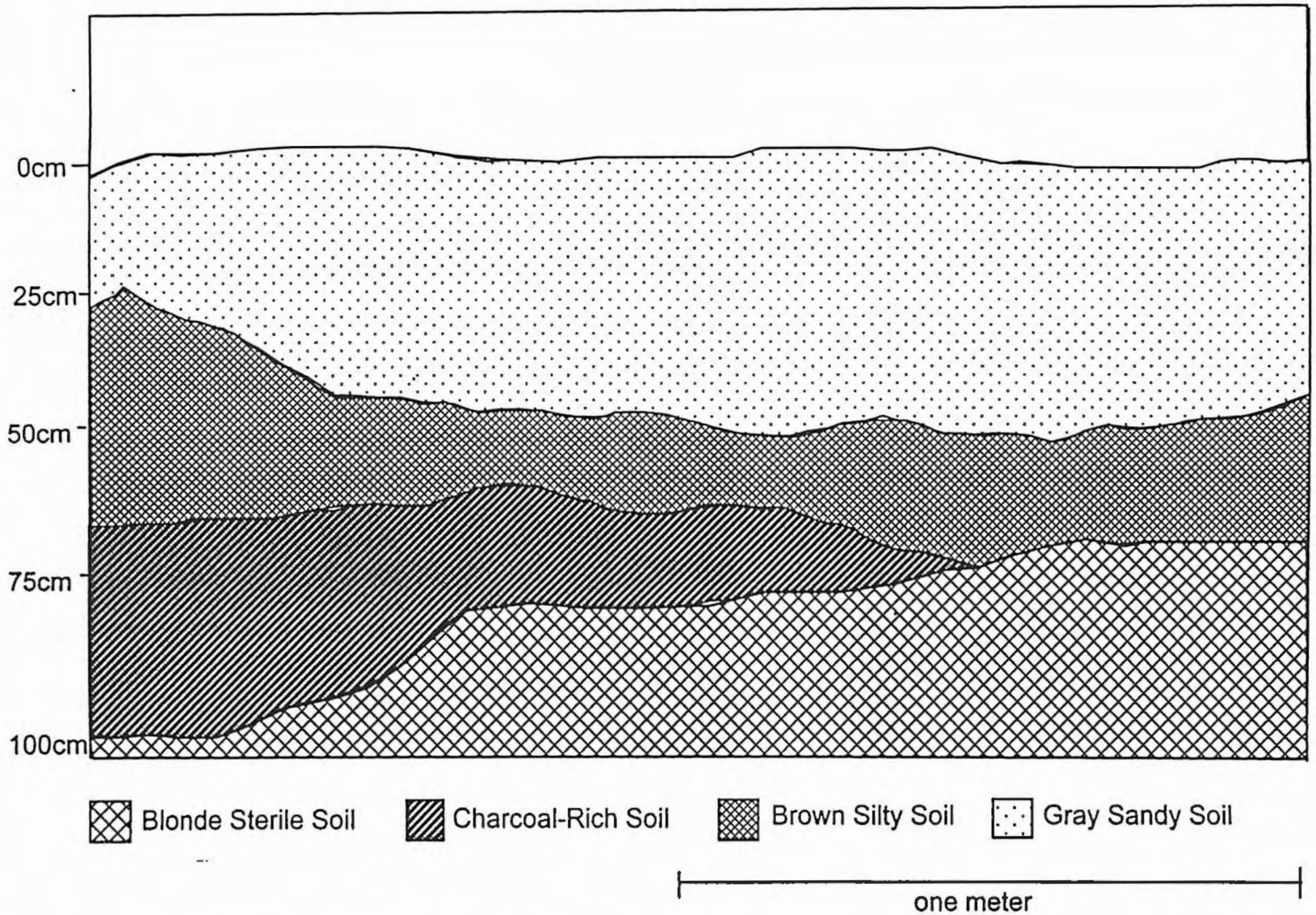


FIGURE 10. Profile: East Wall of Units 4A and 4C in Main House Excavation.

The two cultural levels visually identified in the main block excavation are corroborated by the distribution of artifacts through the deposits (Figs. 11 and 12). Figure 11 shows the number of projectile points and the total number of formed artifacts by level in the block excavation. Both the projectile points, considered separately, and all formed artifacts, considered together, follow a similar pattern, highlighting an upper zone of concentration in levels 1-8, and a lower zone in levels 9-19. This is also shown in Figure 12, a composite profile sketch depicting the distribution of projectile point types through the deposits. In this illustration, a separation between the upper and lower occupation zones follows a dish-shaped contour in the sediments that is associated with the lower occupation. A chart showing the tabulation of artifact types by level in the main block excavation is presented in Table 2.

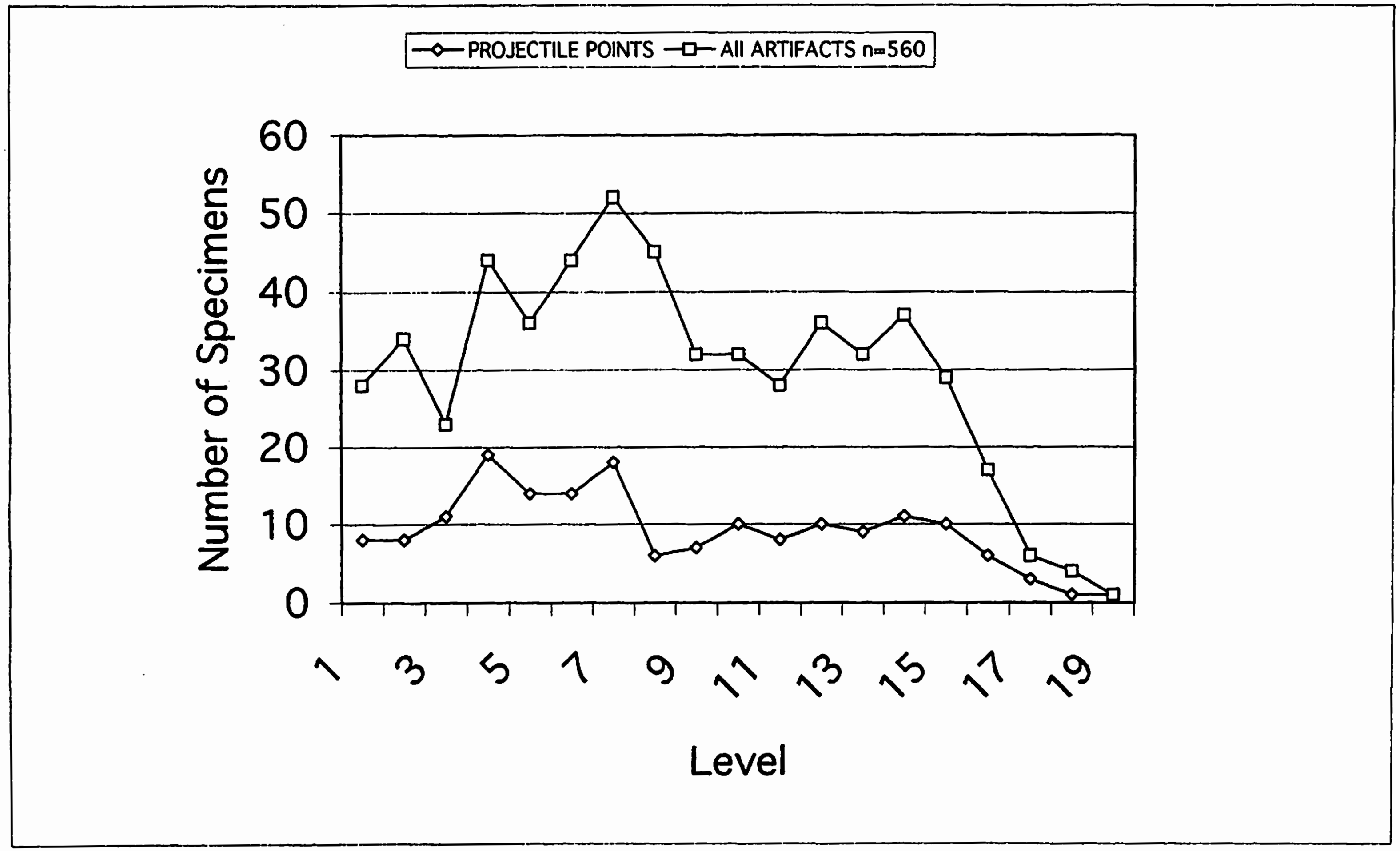


FIGURE 11. Number of Artifacts from the Main Block Excavation. Above, Projectile Points; Below All Artifacts. Two Main Peaks of Artifact Concentration Indicated Between Levels 1-8 and 9-19. (Data from Table 2).

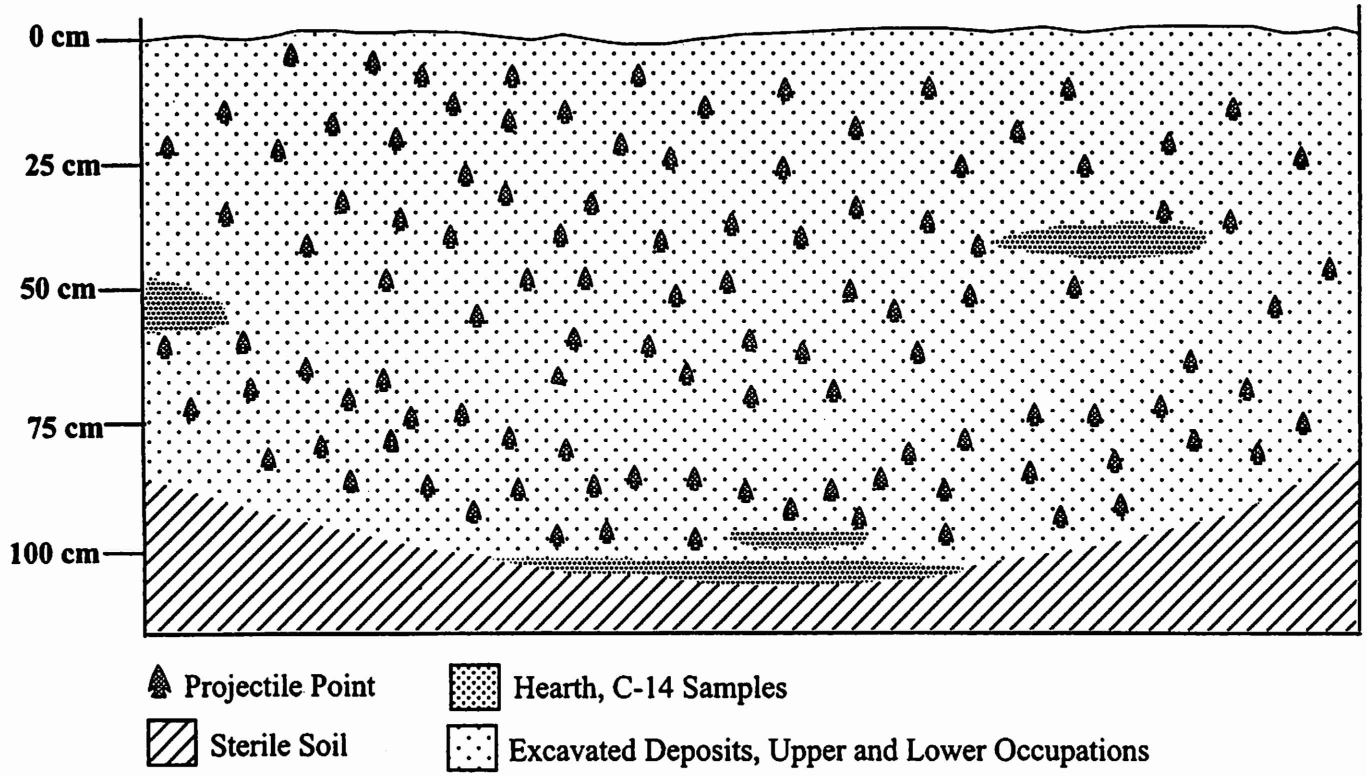


FIGURE 12. East/West Composite Profile of the Main House Excavation, Showing Vertical and Horizontal Distribution of Projectile Points Found in Upper and Lower Occupation. Based on Field Notes and Excavation Level Records.

TABLE 2. Number of Artifacts Found in the Main House Excavation, by 5cm Levels, All Excavation Units.

Level	Proj. Point	Biface	Utilized Flake	Scra-per	Core	Drill	Ground Stone	Abra-der	Bone Tool	Fish Gorge	Bead	Net Weight	Total
1	8	9	6	0	0	1	5	0	0	0	1	2	32
2	9	8	11	0	1	0	3	2	0	0	1	0	36
3	11	5	4	1	1	0	2	0	1	0	0	0	25
4	18	9	10	0	1	1	2	1	0	2	0	0	44
5	12	6	7	0	0	1	2	0	1	1	5	0	35
6	13	12	10	0	1	0	4	0	5	0	2	0	47
7	15	12	10	0	2	0	2	0	3	2	4	1	51
8	5	16	10	0	2	0	1	0	1	0	7	1	43
9	7	6	11	0	2	0	1	0	3	2	3	1	36
10	10	13	7	0	0	0	0	0	2	0	4	0	39
11	8	3	11	0	0	0	1	1	1	1	2	0	28
12	11	8	10	0	0	0	0	0	3	0	3	0	35
13	7	5	6	1	0	2	0	0	1	1	0	0	23
14	10	6	6	1	1	2	3	0	3	0	6	0	38
15	8	8	5	0	0	1	1	0	4	0	2	0	29
16	3	4	5	0	0	0	2	0	0	0	3	0	17
17	1	0	2	0	0	0	1	0	0	0	2	0	6
18	1	0	0	0	0	0	0	0	0	0	0	0	1
19	0	0	1	0	0	0	0	0	0	0	0	0	1
20	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	140	130	132	3	11	8	30	4	27	9	45	5	544

TF-1 Butchering Area Excavations

The block excavation in Trench TF-1 produced evidence of a work station where animals were butchered and processed, and bone tools were manufactured. Trench TF-1 was located approximately 50 meters southwest of the Main House excavation (Fig 7). The backhoe trench was initially dug to explore the geomorphological characteristics of the southwest edge of the Bergen dune facing the ancient Beasley Lake system, but yielded important cultural evidence as well. Upon examination of the trench, a dark charcoal stained deposit was observed at a depth of about 80cm below the surface along the south wall, two meters from the headwall of the trench. A block excavation was laid out along the trench, consisting of two excavation units measuring 2x2 meters each (Fig 13).

The upper 35 centimeters of these excavated deposits consisted of a brownish-gray sandy silt made up of re-deposited Mazama pumice and loose sands. A dark compact silt, representing the primary cultural deposit, was encountered between levels 7 and 14. This 40cm thick accumulation of humus-rich silt was rich in bone and lithic artifacts, and obsidian flakes were large in comparison to those found in the top 35cm of sediment. A total of 17 bifaces, 4 Northern Side-Notched projectile points, 4 Elko Series points, 7 large ground stone tools, 3 tabular net weights, and 7 bone tools were loosely scattered around a concentration of bone in the primary cultural feature. A chart reporting the number of formed tools from the Butchering Area by level is presented in Table 3.

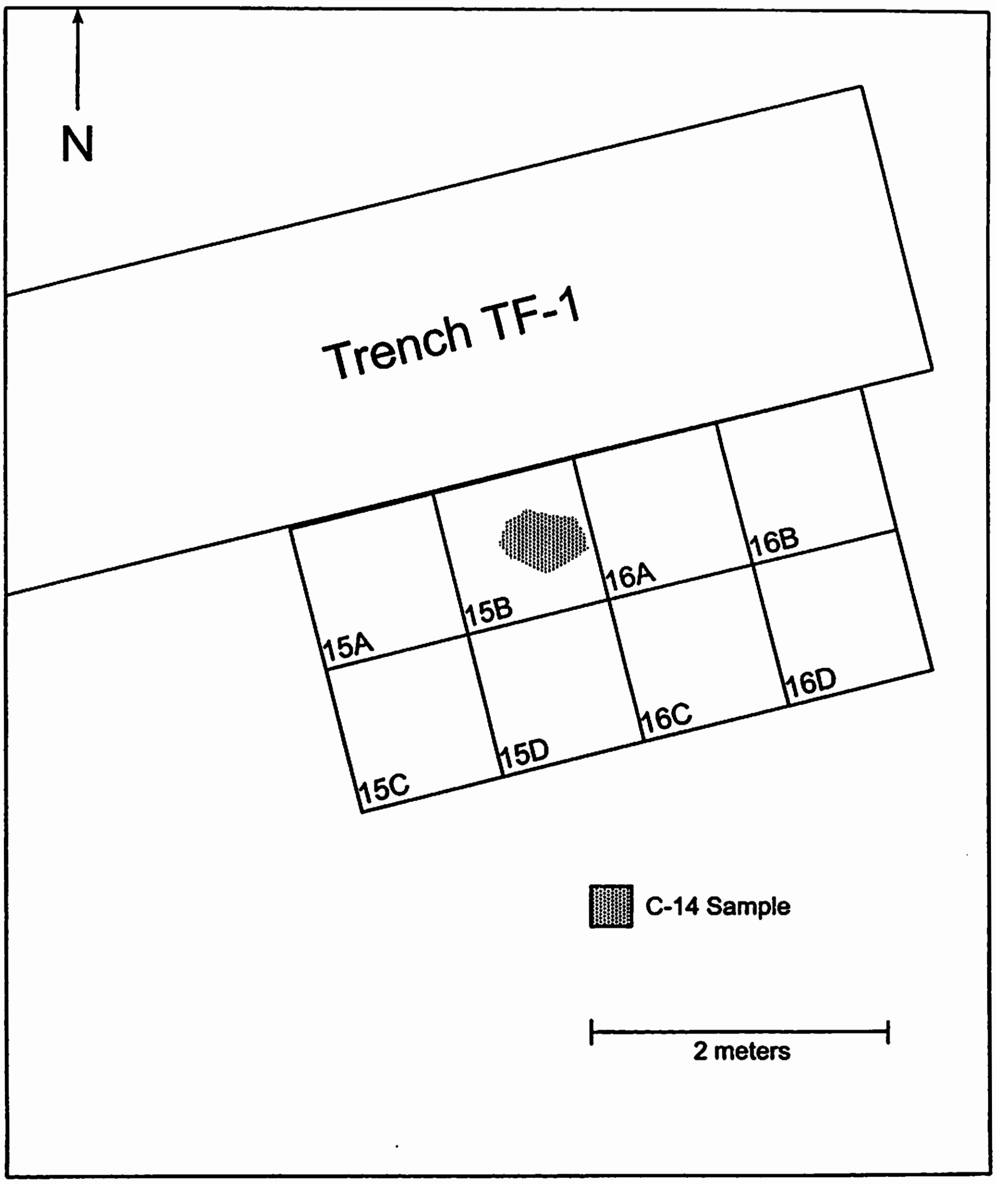


FIGURE 13. TF-1 Butchering Area Block Excavation.

TABLE 3. Number of Artifacts Found in TF-1 Butchering Area, by 5cm Levels, All Excavation Units.

Level	Proj. Point	Biface	Utilized Flake	Core	Drill	Ground Stone	Abrader	Bone Tool	Burin	Net Weight	Total
1	0	1	0	0	0	0	0	0	0	0	1
2	0	1	0	0	0	0	0	0	0	0	1
3	0	0	2	0	0	0	0	0	0	0	2
4	0	1	0	0	0	0	0	0	0	0	1
5	0	1	0	0	0	0	0	0	0	0	1
6	0	1	1	0	0	0	0	0	0	0	2
7	0	1	0	0	0	0	0	0	0	2	3
8	0	0	0	1	1	1	0	1	0	0	4
9	1	0	1	0	0	1	0	1	0	2	6
10	3	3	2	0	0	4	0	0	1	0	13
11	0	3	0	0	0	1	1	1	0	0	6
12	0	1	0	0	0	0	0	1	0	0	2
13	0	0	2	0	0	1	0	0	0	0	3
14	0	0	0	0	0	0	0	0	0	0	0
15	1	1	0	0	0	0	0	1	0	0	3
16	0	1	1	0	0	0	0	0	0	0	2
17	2	1	2	0	0	0	0	3	0	0	8
18	1	1	2	0	0	0	0	0	0	0	4
Total	8	17	13	1	1	8	1	8	1	4	72

Patrick O'Grady, a Ph.D. student at the University of Oregon, analyzed 3147 pieces of bone from this feature. Although much of the bone was highly fragmented, O'Grady was able to identify the remains of 1 mountain sheep, 1 elk, 3 mule deer, 3 pronghorn antelope, 5 jackrabbits, and at least 15 birds. The birds represent various waterfowl including American coot, eared grebes, Canada geese, mergansers, and a tundra swan (O'Grady 2000).

Bone and stone artifacts found with faunal remains in the feature lend credence to O'Grady's interpretation that it represents an animal processing area. The high degree of bone fragmentation suggests that large mammal long-bones may have been broken open for marrow extraction. The finding of a cluster of 7 bone gorges and a striated abrader within a 3 square meter area suggests a tool manufacturing spot. Striations on the abrader may have resulted from sharpening and rounding the gorges.

Radiocarbon analysis (presented in a following section) indicates that the TF-1 Butchering Area was contemporaneous with the Main House and the 2000 House occupations some 50 meters away. It is likely that the people who kept their residence on the crest of the dune walked down to the water's edge to process animals for meat, marrow, and tools. Identification of this activity area significantly enhances our understanding of how people lived and acted at the Bergen site ca. 6000 years ago. A detailed account of the Butchering Area is in preparation by O'Grady for later publication.

The 2000 House Excavation Block

The 2000 House excavation is located five meters northeast of the Main House excavation (Figs. 7 and 8). The identification of a hearth on the southern edge of the excavation, a cache of artifacts on the northern edge of the block, and a rich deposit of artifacts underlain by a compact sterile surface combined to provide evidence of an ancient house floor at this location.

Two cultural occupations were identified in the 2000 House excavation block. The upper occupation was represented in levels 1 through 7 (Table 4 and Fig. 14). The accumulation of artifacts and bone in the soft sediments of the upper 35 cm of deposit provides the main source of evidence for the upper occupation at this location. The lower occupation was represented in levels 8 through 15. The sediment associated with the lower occupation consisted of finely textured dark silt.

In the central portion of the excavated block, Unit 13 produced 5 projectile points, 2 shell beads, 4 antler tools, 10 bifaces, 1 utilized flake, and a mano fragment. On the western edge of the block (Unit 23), a compact yellow deposit representing a house floor was encountered at depth of 60cm. The surface represented by the yellow deposit was comparable to the house floor identified in the Main House excavation. It sloped up toward the west, suggesting a basin-shaped floor for the 2000 House (Fig 8).

TABLE 4. Artifacts from the 2000 House Excavation by 5 cm Levels, All Excavation Units.

Level	Proj. Point	Bi-face	Utilized Flake	Scra-per	Core	Gound Stone	Abrad -er	Bead	Bone Tool	Tot-al
1	2	2	3	0	0	3	0	1	0	11
2	3	6	0	0	0	0	0	1	0	10
3	4	0	4	0	0	0	1	1	0	10
4	2	2	6	0	0	1	0	0	4	15
5	1	4	3	0	0	0	0	1	0	9
6	0	1	3	0	0	0	0	0	0	4
7	2	4	0	0	0	0	0	0	0	6
8	2	3	2	0	0	0	0	1	0	8
9	5	4	0	2	0	1	0	0	0	12
10	4	3	6	4	1	1	1	0	0	20
11	0	2	3	0	2	0	0	0	0	7
12	1	1	0	1	0	0	0	0	0	3
13	0	1	0	2	1	0	0	0	0	4
14	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0
16	0	0	2	0	0	1	0	0	0	3
17	0	0	1	0	0	0	0	0	0	1
18	0	0	1	0	0	0	0	0	0	1
19	0	0	0	0	0	0	0	0	0	0
20	0	0	1	0	0	0	0	0	0	1
Tota	26	33	35	9	4	7	2	5	4	125

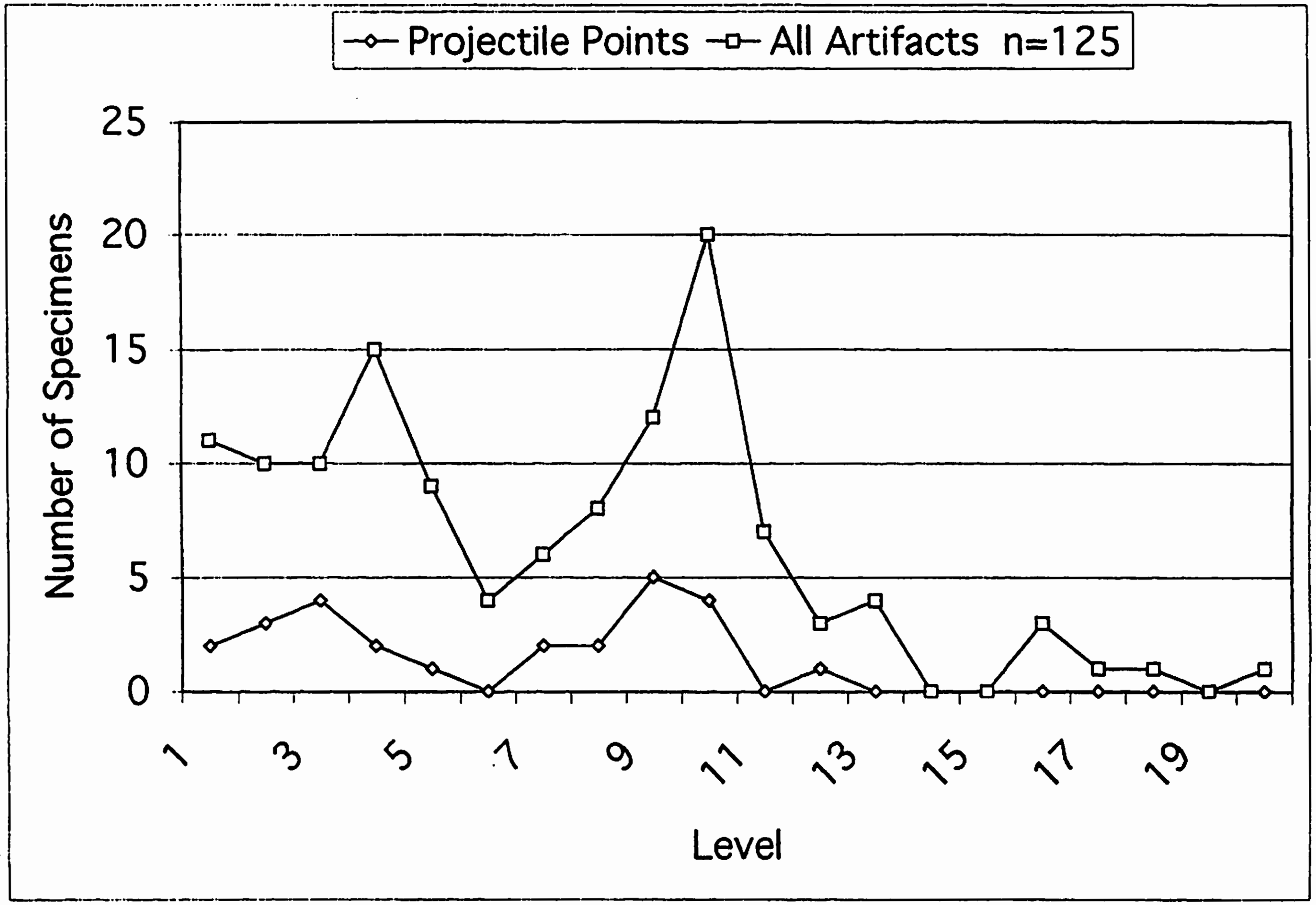


FIGURE 14. Number of Projectile Points (lower) and Combined Total of All Artifacts (upper) in the 2000 House Block by Level. Two Peaks of Artfiact Density Clearly Indicated Between Levels 1-7 and 8-15. (Data from Table 4).

A fire hearth was identified in Unit 28, at the southern edge of the block. It was represented by very dark soil with abundant charcoal, and extended into a pit dug into the surface of the yellow floor deposit. A cache of artifacts was discovered on the northern edge of the block in Unit 24A at a depth of 45cm. This cluster of artifacts included two manos, two large biface blades, two projectile points, and one abrader. A biface and large projectile point were found in Unit 24C at the same depth just one meter to the south.

In contrast to the Main House, only a portion of the 2000 House was exposed in the block excavation. The location of cultural features in the deposit, however, does suggest evidence for a circular house floor 4 to 5 meters in diameter, with a central hearth. The cache of artifacts on the northern edge of the block was likely located outside the house structure, and the hearth encountered in the southern part of the block represented the central hearth.

A list of artifact types by level in the 2000 House block excavation is presented in Table 4. Analysis of artifact and projectile point quantities distributed through the deposits by level in the 2000 House block suggest the presence of two separate occupations (Fig.14). In this graph, the periods of occupational intensity are clearly indicated, between levels 1-7 and levels 8-15. Cultural features and deposits were comparable to those identified in the Main Block excavation. Projectile points, shell beads, bone tools, and groundstone were associated with a sloping house floor in the lower occupation at approximately 60cm below the surface.

Two radiocarbon dates were obtained from the 2000 House excavation. A fire hearth located in the lower levels of Unit 28, at the southern tip of the block, produced a date of 5090+/-100 BP. This date is associated with the lower occupation. A second date of 4780+/-90 BP came from a bulk soil sample at 45cm below the surface in Unit 13, on the eastern edge of the block. This date may date the upper occupation.

Excavations in the eastern Units of 13B, 13D, 25B, and 25D produced evidence of disturbance by looters. The deposits were visibly mixed, with dark and light striations. Fine rootlets were abundant, and the sediment was extremely soft and loose. Plastic cigarette filters and other contemporary materials were recovered at depths of 60-70 cm. The disturbance encompassed nearly the entire eastern portion of the excavation block.

Radiocarbon Dating of the Bergen Site

In instances where associations between datable charcoal samples and artifacts are clear, radiocarbon (C-14) analyses provide invaluable information on dating archaeological deposits. A total of 14 radiocarbon dates on cultural features at the Bergen site (Table 5) show that it was repeatedly occupied between 6000 and 4000 years ago.

TABLE 5. Radiocarbon Dates Associated with Cultural Material at the Bergen Site. *Calibrated to 2 sigma. Shells Calibrated by the National Ocean Science Accelerator Mass Spectrometry at the Woods Hole Oceanographic Institution, Massachusetts.

Sample No.	Calendar Years BP* (Stuvier and Reimer 1993)	C-14 Dates (RCYBP)	Unit/Quad /Level	Material
OS-28990	3950 (3820) 3680	4090+/-40	13-D-2	Shell bead
Beta 134688	4220 (3965) 3725	3660+/-70	11-C-13	Charcoal
Beta 134687	4785 (4420) 4180	3990+/-70	9C-C-10	Bulk Soil
OS-28993	4950 (4830) 4780	4850+/-40	17-B-14	Shell bead
Beta 125651	5280 (4864) 4588	4330+/-90	3-C-19	Bulk Soil
OS-28989	5450 (5300) 5210	5200+/-50	22-A-1	Shell bead
OS-28987	5460 (5320) 5260	5230+/-40	9-A-7	Shell bead
OS-28986	5570 (5450) 5300	5310+/-45	12-A-15	Shell bead
Beta 134689	5710 (5510) 5305	4780+/-90	13-B-10	Soil, hearth
Beta 134684	5710 (5600) 5495	4880+/-40	TF-1-9	Soil, hearth
OS-28988	5890 (5740) 5630	5620+/-45	12-C-PH	Shell bead
Beta 148611	6170 (5820) 5610	5090+/-100	28-A-17	Soil, hearth
Beta 153979	6000 (5930) 5900	5190+/-40	3-D-17	Charcoal
OS-28996	6265 (6110) 5929	5930+/-60	3-A-10	Shell bead

Seven of the dates were taken from individual pieces of charcoal, or from bulk samples of charcoal-laden soil associated with rich cultural deposits in the block excavations. These samples were specifically selected because they were associated with hearth-like features. The remaining dates were obtained directly from shell beads recovered in the Main House excavation.

Four radiocarbon dates from charcoal or charcoal-laden soil were obtained from cultural features in the Main House excavation block (Fig. 15). A single piece of Artemisia (sagebrush) from the central hearth in the lower occupation produced a date of 5190+/-40 BP. Three additional dates from the excavation reflect overlying occupations: 4330+/-90 BP, 3990+/-70 BP, and 3660+/-70 BP. Student's t-tests (Thomas 1979) indicate that these four dates from the Main House excavation are all statistically different from one another, providing evidence for repeated use at this location during the Middle Holocene.

Radiocarbon dates obtained directly from seven shell beads in the Main House excavation provide corroborating evidence for periodic use of the site through the Middle Holocene. The radiocarbon dates from shell beads range between 5930+/-60 BP and 4090+/-40 BP.

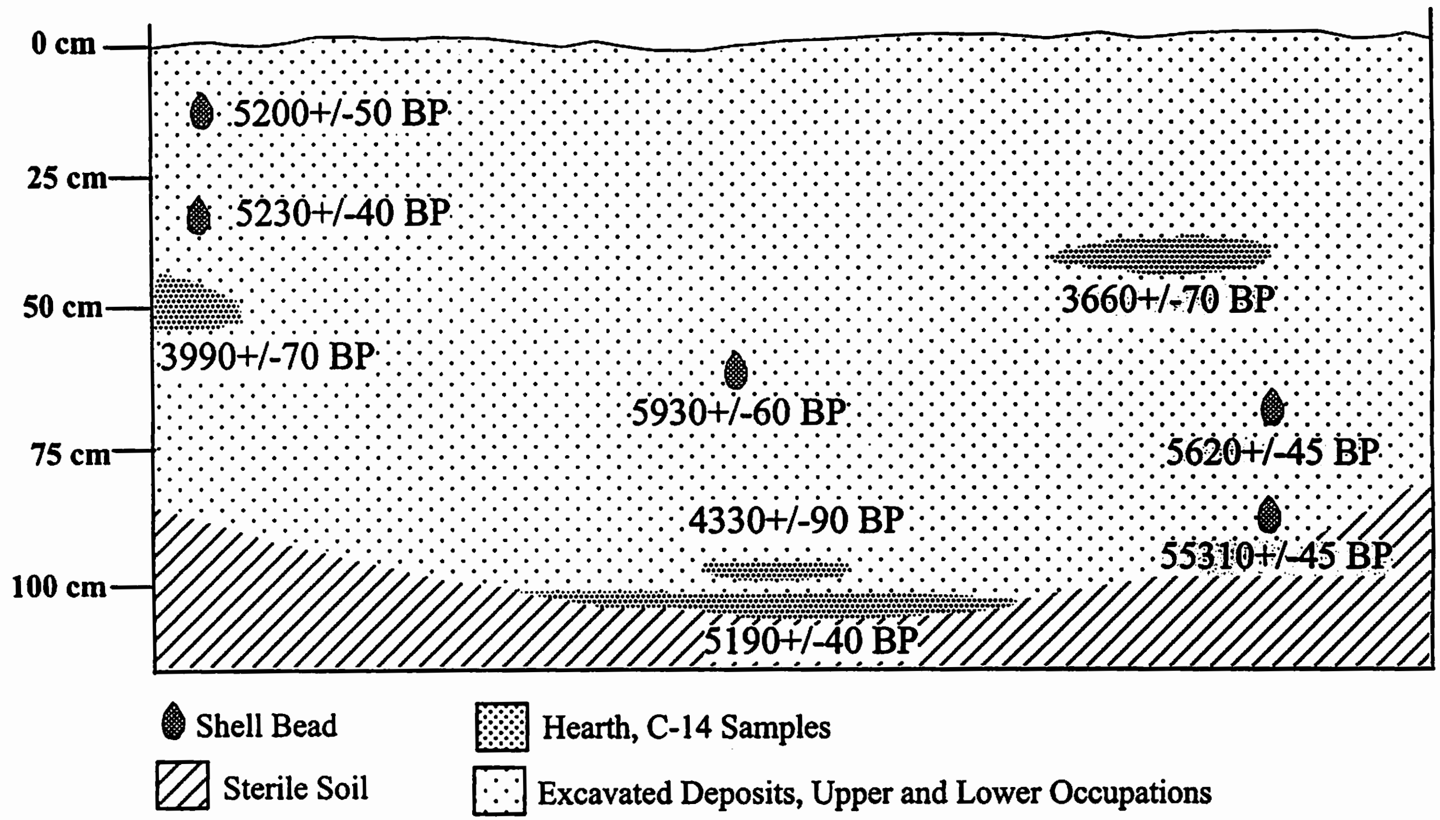


FIGURE 15. East/West Composite Profile of Main House Excavation, Showing Locations of Hearth and Deposits With Radiocarbon Dates.

Two radiocarbon dates were obtained from excavations in the 2000 House. The hearth, on the southern end of the block, was dated to 5090+/-100 BP. A bulk soil sample, obtained from a charcoal-laden deposit most likely representing another hearth four meters to the northeast, produced a date of 4780+/-90 BP.

The TF-1 Butchering Area was dated to 4880+/-40 BP by a single sample that came from a hearth like feature in Unit 15B. A student's t-test indicates that, at the 95% confidence level, the dates of the Butchering Area and the 2000 House are statistically the same. A student's t-test also indicates that, at the 95% confidence level, the date of the 2000 House is statistically similar to the date of the lower occupation in the Main House.

Thus, analyses of radiocarbon dates from the block excavations at the Bergen site suggest that the Main House, the 2000 House, and the Butchering Area were occupied at essentially the same time in the past. They also suggest that people returned to occupy the site repeatedly during the Middle Holocene.

Artifacts from the Bergen Site

A total of 956 formed tools were recovered from all excavations at the Bergen site. Projectile points, bifaces, and utilized flakes are the most prevalent (Fig 16). Projectile points represent 25% of the formed tools collected from the site. Bifaces account for 24% of the artifacts, and utilized flakes constitute 23% of the tools. Other artifact types found at the site include cores, drills, beads, groundstone, net weights, and bone tools (Table 6).

TABLE 6. Artifacts Found at the Bergen Site, by Excavation Units.

Artifact Type	Main House Excavation	2000 House Excavation	Butchering Area	Test Units and Probes	Total
Projectile Points	176	25	9	34	244
Bifaces	136	42	17	34	229
Utilized Flakes	119	35	12	52	218
Beads	52	5	0	7	64
Ground-stone	30	7	8	14	59
Bone Tools	39	4	8	14	48
Cores	11	4	2	8	24
Net Sinkers	6	3	4	8	21
Abraders	5	2	1	1	9
Drills	8	0	1	0	9
Tinklers	5	0	0	2	7
Hammer-stones	1	0	4	0	5
Spoke shaves	0	0	1	1	2

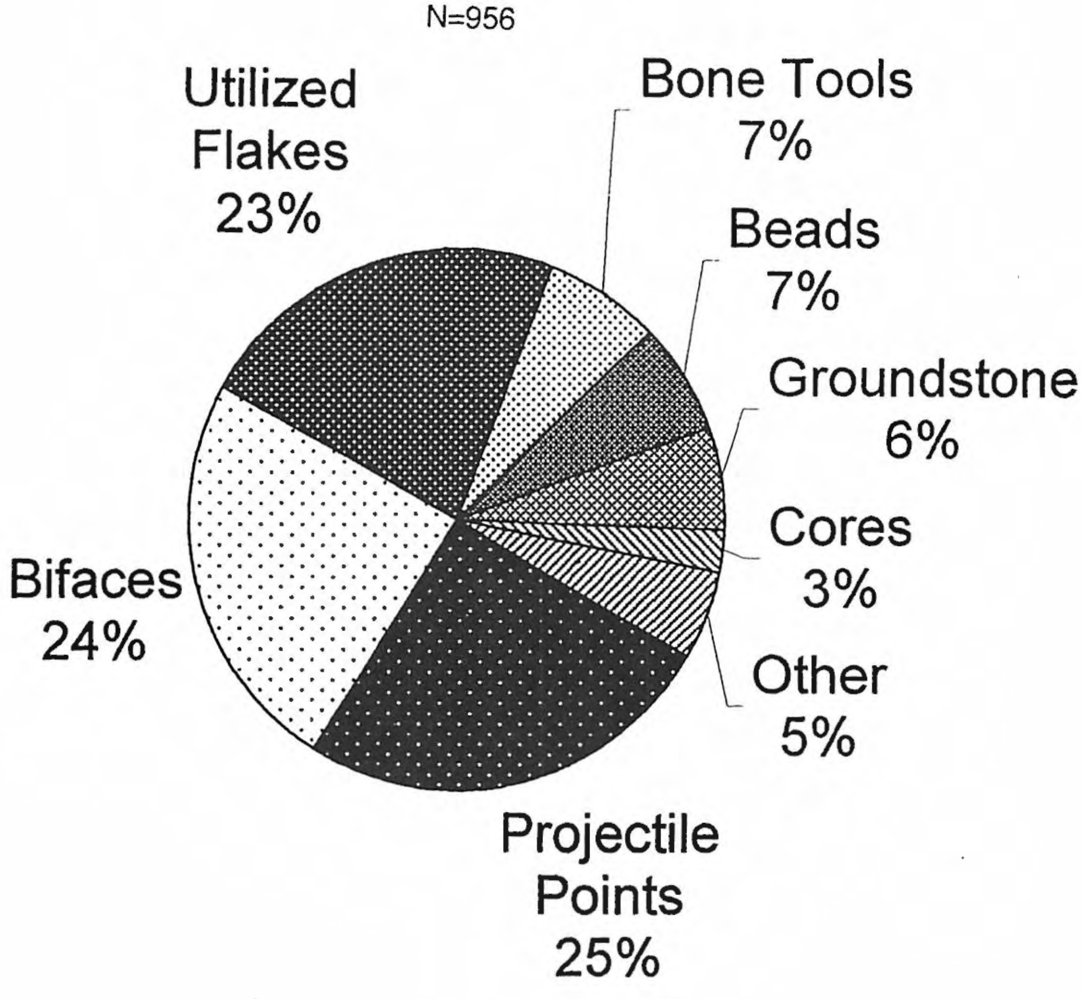


FIGURE 16. Formed Tools Recovered from the Bergen Site, All Excavations. (Data fromTable 6).

Projectile points are particularly valuable as archaeological evidence because they can serve as rough time markers of human occupations, especially in circumstances where no radiocarbon dates are available. The two most common projectile point types at the Bergen site are the Northern Side-notched and Elko series points (Fig. 17), which were used with atlatls. A chronology of projectile point types in the Northern Great Basin outlined by Oetting (1994) suggests that Northern Side-notched points range from 6000 BP to 4000 BP, and Elko series points range from 4000 BP to 1000 BP.

In the Main House excavation block, Elko series and Northern Side-notched points combined represent 79% of the projectile point types identified from that location (Fig. 18). Gatecliff series points are the next most prevalent point type in the Main House, representing 8% of the sample. Oetting (1994) places the time range of Gatecliff series points between 5000 BP and 2200 BP. Humboldt points constitute 4% of the sample, but are not considered good time markers due to their extended range from 8000 BP to 1000 BP in the Northern Great Basin (Oetting 1994). One Cascade point was recovered from the Main House. Cascade points are commonly found together with Northern Side-notched points (Aikens 1993). A single Windust point was also found in the deposit. Windust points clearly date to the Early Holocene (10,000 BP to 7500 BP) (Willig 1988), making it evident that this specimen was most likely brought to the site by its Middle Holocene occupants. This conclusion was reached because no other evidence suggesting an Early Holocene occupation was encountered in the Bergen site.

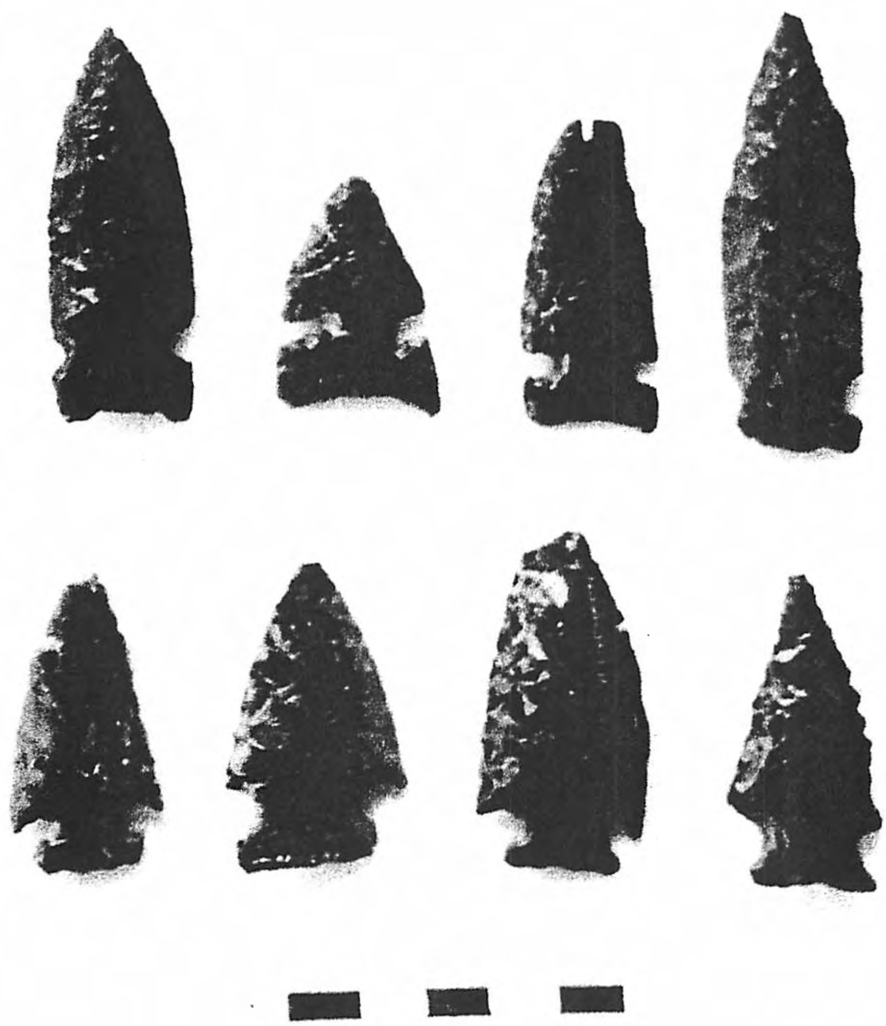


FIGURE 17. Projectile Points from the Bergen Site. Top Row: Northern Side-Notched (22-B-11-1, 22-A-7-1, 12-A-17-1, 12-B-11-1)
Bottom Row: Elko (12-D-7-1, 9D-D-3-1, 15-B-17-1, 12-C-8-1).

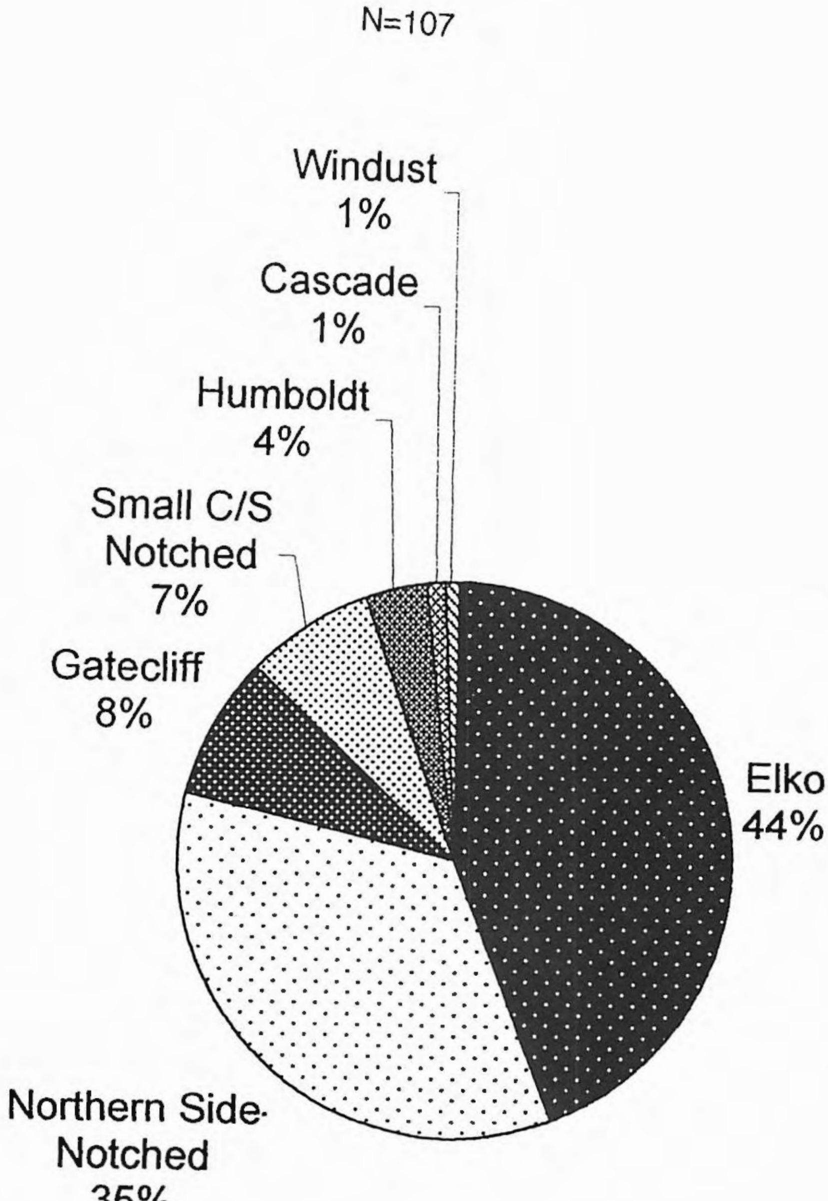


FIGURE 18. Projectile Point Types from the Upper and Lower Occupations In the Main House Excavation (Data from Table 7).

Later projectile point types recovered from the Main House excavation at the Bergen site include Small Corner-notched and Small Side-notched points such as Rose Spring types. These points are relatively good time markers because they are associated with the bow and arrow and don't appear in the archaeological record until about the last 3000 years (Aikens 1993). Rose Spring points represent 7% of the sample in the Main House excavation. While Northern Side-notched and Elko series points are both found throughout the deposits in the Main House, Rose Spring points are found only in the upper occupation. Table 7 shows that, with this exception, most artifact types are represented about equally in both the upper and lower occupations within the Main House excavation.The 2000 House and TF-1 excavation blocks produced simialr projectile points types (Table 7).

TABLE 7. Projectile Point Types from House Block Excavations at the Bergen Site.

Projectile Point Type	Main House Excavation	2000 House Excavation	TF-1 Butchering Area	Total
Elko	47	4	4	55
Northern Side-notched	37	7	4	48
Gatecliff	9	1	0	10
RoseSpring	8	0	0	8
Humboldt	4	0	0	4
Cascade	1	1	0	2
Windust	1	0	0	1

Bifaces are the next most common tool at the Bergen site (Table 6). A total of 229 bifaces were recovered from the probes, test units, and block excavations. The category of biface can include a wide variety of tools, including knives, scrapers, and fragments of unidentified chipped stone tools. Tools that are categorized as bifaces have flakes removed from both sides of the artifact. They can be roughly formed, suggesting expedient manufacture and use, or they can exhibit patterned flake scars of refined tools. Bifaces from the Bergen site are pictured in Figure 19.

TABLE 8. Artifacts in Upper and Lower Occupations of the Main House Block Excavation.

ARTIFACT TYPE	UPPER	LOWER
Projectile Points	Levels 1-8	Levels 9-19
Elko Series	27	20
Northern Side-notched	18	19
Humboldt	4	0
Cascade	1	0
Windust	0	1
Gatecliff Contracting Stem	4	2
Gatecliff Split Stem	3	0
Small Corner-notched	7	0
Small Side-notched	1	0
Undiagnostic Fragments	45	24
bifaces	79	54
utilized flakes	69	50
cores	8	3
scraper	1	2
drills	3	5
tinklers	5	0
hammerstone	1	0
tabular net weights	6	0
abraders	3	2
bone tools	8	18
fish gorges	5	5
antler billets	0	3
beads	20	32

FIGURE 19. Bifaces from Upper and Lower Occupations in Unit 11 in the Main House Excavation. (11-A-2-1, 11-A-16-2, 11-A-7-1, 11-A-12-1, 11-B-15-1, 11-A-8-1).

Utilized flakes were encountered throughout the excavations. A total of 218 utilized flakes were recovered from the site. Unlike bifaces, utilized flakes do not generally show evidence of intentional flaking on both sides of the artifact to form a tool. Instead, these tools exhibit flaking along a thin edge caused by use, such as cutting or slicing. The patterns of use wear on utilized flakes are concentrated on the edge of the tool and are thought to represent expedient use and discard.

Other chipped stone tools recovered at the Bergen site include cores, drills, spokeshaves, and tinklers. Cores vary in size, depending on the stage of reduction. They represent the stone block, or core, from which flakes are removed and used as tools. A total of 24 cores were identified from the Bergen site. Drills are specialized chipped stone tools used for punches and perforators. Eight drills were found at the Bergen site. They vary in size, but often exhibit a bulbous shape on one end for hafting and narrow to a long point at the tip (Fig. 20). Spokeshaves are used for scraping, shaving, and shaping wood and bone implements. Tinklers are long, narrow obsidian blades with dulled, or rounded, edges. Seven tinklers were recovered from the Bergen site. They are thought to have been used as ornamentation, tied in clusters from clothing where they would dangle and cause a "tinkling" sound as they touched.

Groundstone artifacts are often associated with food processing. The tools are shaped from basalt or other volcanic rock by pecking and dispay smooth edges from grinding. A total of 59 pieces of groundstone were collected from the excavations at the Bergen site. The category of groundstone includes a variety of implements, such as grinding slabs, mortars, and pestles. At the Bergen site groundstone is represented primarily by manos and metates. Manos are hand held stones used for grinding. A photograph of a mano found in the 2000 House cache appears in Figure 21. Metates are the slabs upon which the grinding and crushing occurs. They are typically represented as large, flat stones. Groundstone fragments are scattered across the crest of the dune at the Bergen site, suggesting the importance of plant food processing.

Bone tools constitute 7% of the formed tools at the Bergen site. Sharpened and polished bone implements were used as punches and awls for activities such as leatherworking and basketry. Antler billets, such as those recovered in a cache of artifacts in the Main House (Fig. 22), were probably used for percussion or hammering. Bone tools also includes fish gorges (Fig. 23), fashioned from splintered bone and shaped with stone abraders. A total of 14 fish gorges were recovered from excavations at the Bergen site. They measure about 3 to 4 centimeters in length, tend to be rounded like a toothpick, and are pointed at both ends. These tools attest to the importance of fishing during the Middle Holocene in the Fort Rock Basin.

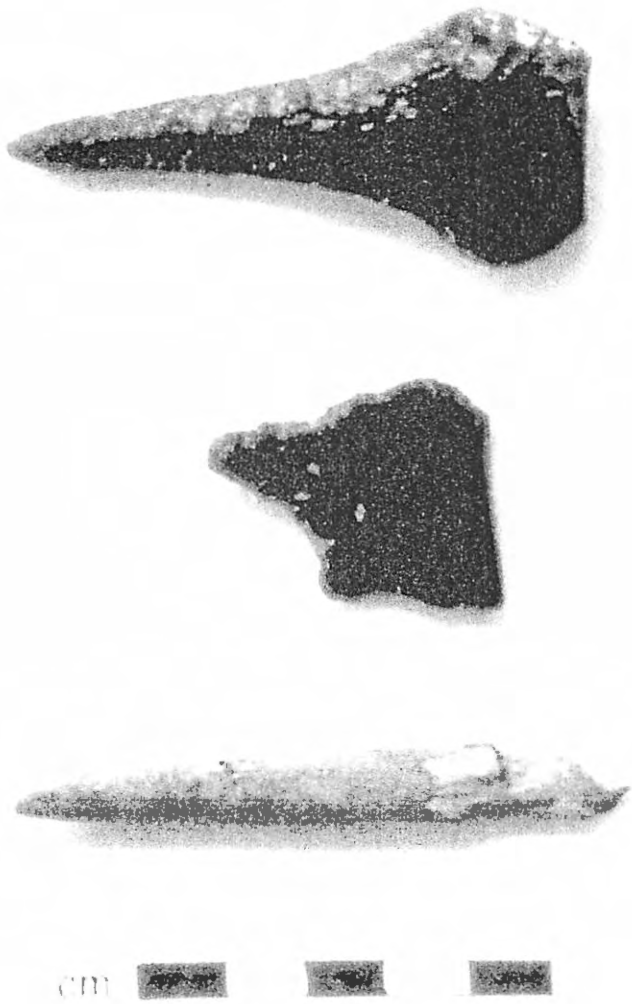


FIGURE 20. Drills and Bone Tool from the Bergen Site.
(10-D-5-1, 9-C-14-1, 16-C-9-1).

FIGURE 21. Mano and Abrader from Artifact Cache in Northwest Corner of Unit 24 in the 2000 House.

FIGURE 22. Elk Antler Billets from the Artifact Cache in the Lower Occupation of the Main House Excavation.

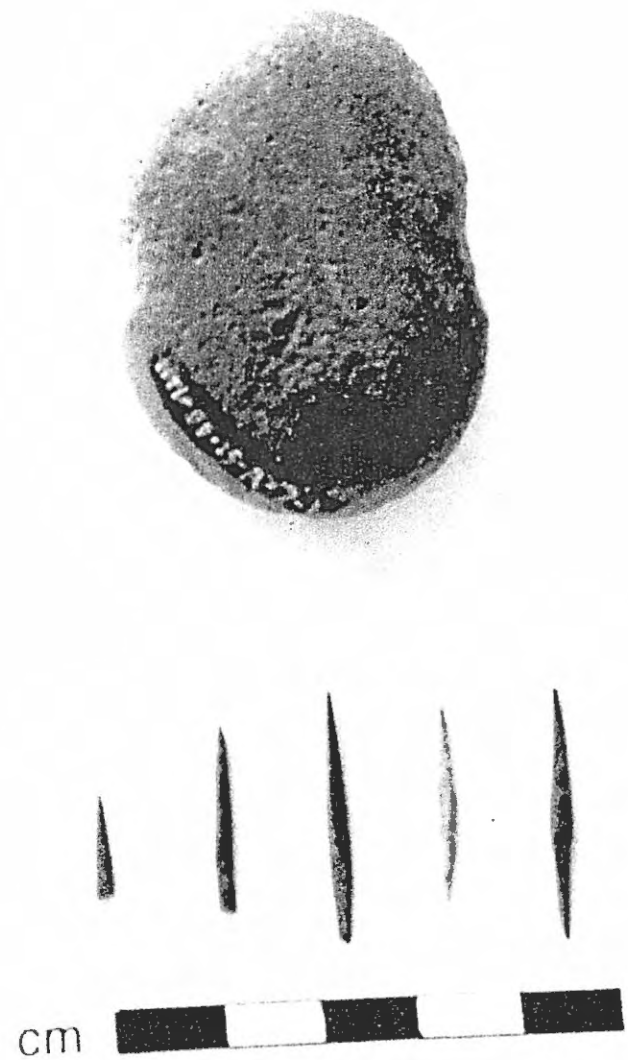


FIGURE 23. Net Weight and Fish Gorges from the TF-1 Butchering Area at the Bergen Site.

Tabular net weights provide another line of evidence for fishing at the site. There were 21 tabular net weights, or net sinkers, collected from the Bergen site. The thin flat stones typically measure 6 to 7 centimeters across, are oval to square in shape, and are often notched on two sides. These stones were most likely tied to a line and used to weight down fishnets in a lake. One tabular net weight and five fish gorges from the Bergen site are shown in Figure 23.

Beads made from shell and bone are common in archaeological sites in the Northern Great Basin during the Middle Holocene (Jenkins and Wimmers 1994). A total of 64 beads were recovered from the excavations at the Bergen site. Marine shells are of particular interest because they provide evidence of long-distance trade of items from the Pacific Coast. The genus Olivella represents the most abundant type of marine shell recovered at the Bergen site, totaling 57%. Olivella shell beads from the Main House are shown in Figure 24. Marine shell from the site, identified to genus and species where possible, is summarized in Table 9. The shell beads from the Bergen site have been studied and reported in more detail by Largaespada (2001).

FIGURE 24. Olivella Shell Beads from Unit 9 in the Main House Excavation at the Bergen Site (9-A-6-3, 9-A-6-2, 9-A-14-2, 9-A-5-2).

TABLE 9. Marine Shell from the Bergen Site. (Largaespada 2001).

Specimen Number	Length (mm)	Diameter (mm)	Thickness (mm)	Drill Hole Diameter & Shape (mm)	Genus	Species	Type	Comments
1136-BE-1-C-8-1	20.38	13.08	.74	---	*Olivella*	*biplicata*	A1c	
1136-BE-3-A-10-3	7.82	1.12	.68	---	*Olivella*	---	A2	detritus, fits with 1136-BE-9-B-18-3
1136-BE-3-A-12-5	8.60	6.34	.54	---	*Olivella*	*biplicata*	B1a	ground both ends, diagonal grinding at aperture
1136-BE-3-A-14-2	6.12	6.98	.68	---	*Olivella*	---	B3b	ground both ends
1136-BE-3-C-3-5	---	---	---	---	*Haliotis*	---	---	nacre fragment
1136-BE-4-C-12-4	14.86	7.94	.62	---	*Olivella*	*biplicata*	A1b	broken near aperture
1136-BE-4-C-15-1	7.86	8.74	.58	---	*Olivella*	---	---	fragment
1136-BE-5-C-1-3	---	---	---	---	*Haliotis*	---	---	nacre fragments
1136-BE-5-C-10-1	7.62	6.42	.56	---	*Olivella*	---	---	both ends broken
1136-BE-7-C-7-2	7.32	5.94	.32	---	*Olivella*	*biplicata*	B2a	ground top and slightly on bottom
1136-BE-8-A-10-2	6.02	4.48	.56	---	*Alia*	*carinata*	A2	
1171-BE-22-D-10-3	10.00	7.84	.62	---	*Olivella*	—	A1	spire and wall fragment burned
1171-BE-23-D-1-1	4.44	8.82	1.24	---	*Olivella*	—	A2	frag w/spire
1171-BE-P33-10-1	7.46	6.56	.56	---	*Olivella*	*immature biplicata*	A2b	spire ground
1195-BE-29-D-4-3	---	6.30	1.36	1.58 biconical	*Tivela*	*stultorum*	—	clam disc

TABLE 9. (Cont.) Marine Shell from the Bergen Site. (Largaespada 2001).

1136-BE-10-C-8-1D	11.98	8.92	.38	—	*Olivella*	---	A2	spire lop, burned, broken at end
1136-BE-10-C-8-5	—	—	—	—	*Haliotis*	---	---	fragments
1136-BE-10-C-9-3	—	—	—	—	*Haliotis*	*rufescens*	---	fragments
1136-BE-10-C-10-4	—	—	—	—	---	---	---	nacre
1136-BE-P23-1-3	7.04	5.92	.52	—	*Olivella*	*dama*	A1a	no central lirae but aperture ½ way
1136-BE-DJ3	16.56	9.82	.64	—	*Olivella*	*biplicata*	A1c	spire ground
1136-BE-DJ4	4.24	2.70	.58	—	*Alia*	*carinata*	---	broken near spire
1136-BE-MD1	12.42	7.04	.48	—	*Olivella*	*dama*	A1b	no central lirae, but aperture ½ way
1171-BE-3-B-4-5	7.58	3.64	.48	—	*Olivella*	—	—	fragment
1171-BE-3-B-5-2	8.78	6.44	.56	—	*Olivella*	*biplicata*	A1a	spire lopped
1171-BE-3-B-16-3	9.14	6.48	.48	—	*Olivella*	*biplicata*	A1b	spire lopped
1171-BE-3-B-16-8	9.86	5.46	.48	—	*Olivella*	*biplicata*	A1a	spire lopped
1171-BE-3-D-15-1	7.64	5.34	.38	—	*Olivella*	*biplicata*	---	spire broken
1171-BE-4-D-1-4	5.54	4.14	.56	—	*Alia*	*carinata*	A2	spire lopped
1171-BE-9-A-3-4	5.06	4.90	.42	—	*Alia*	*carinata*	A2	detritus/breakage (4) & 1 whole shell
1171-BE-9-A-4-5	---	---	---	---	*Olivella*	---	---	detritus or breakage
1171-BE-10-A-7-3	4.50	3.62	.54	---	*Astysis*	*gausapata*	A2	spire lopped
1171-BE-10-A-9-1	14.92	8.86	.58	—	*Olivella*	*biplicata*	A1a	spire ground

TABLE 9. (Cont.) Marine Shell from the Bergen Site. (Largaespada 2001).

1171-BE-11-A-2-4	—	—	—	—	—	—	---	nacre of either muscle or abalone
1171-BE-11-A-9-7	4.68	3.54	.56	—	*Alia*	*carinata*	A1	
1171-BE-11-A-14-4	8.72	5.18	.52	—	*Olivella*	*biplicata*	A1a	spire ground
1171-BE-11-A-17-1	3.94	4.74	—	—	*Olivella*	—	—	fragment
1171-BE-11-B-1-1	7.12	5.34	.38	—	*Olivella*	*biplicata*	A2a	
1171-BE-11-C-7-5	—	—	---	—	*Haliotis*	—	---	fragment
1171-BE-11-C-10-3	—	—	----	—	*Olivella*	—	—	fragments (detritus)
1171-BE-11-C-12-1	11.80	6.40	.56	—	*Olivella*	*baetica*	A2a	
1171-BE-11-C-18-5	—	—	—	—	*Haliotis*	—	—	fragments
1171-BE-12-A-15-1	4.80	3.22	.24	—	*Alia*	*carinata*	A2	spire ground
1171-BE-12-A-17-3	6.78	5.24	.66	—	*Olivella*	—	—	fragment
1171-BE-12-B-12-1	17.58	12.62	1.86	—	*Olivella*	*biplicata*	A1c	in 3 pieces - put back together
1171-BE-12-C-PH-6	10.32	6.92	.56	—	*Olivella*	*biplicata*	A1b	spire ground
1171-BE-12-C-PH-7	8.42	17.32	.68	1.73 one hole and 1.1 other hole both conical	*Haliotis*	—	—	rectangular, drill hole either end, green nacre w/ pink streaks
1171-BE-12-D-8-2	9.88	6.18	.56	—	*Olivella*	*biplicata*	A2a	
1171-BE-12-D-11-1	9.94	7.62	.58	—	*Olivella*	*biplicata*	—	both ends broken
1171-BE-13-D-2-2	---	9.92	1.58	1.68 conical	*Tivela*	*stultorum*	---	disc bead
1171-BE-13-D-3-2	—	3.54	1.24	1.24 biconical	*Olivella*	—	K2	

TABLE 9. (Cont.) Marine Shell from the Bergen Site. (Largaespada 2001).

1136-BE-9-A-5-2	14.08	7.72	.50	---	*Olivella*	*biplicata*	A1b	broken near aperture
1136-BE-9-A-6-2	21.82	13.84	1.14	---	*Olivella*	*biplicata*	A1c	burned
1136-BE-9-A-7-7	---	---	---	---	*Haliotis*	---	---	fragment
1136-BE-9-A-8-3	---	---	---	---	*Haliotis*	---	---	fragment
1136-BE-9-A-6-3	24.26	12.46	1.12	---	*Olivella*	*biplicata*	A1c	burned
1136-BE-9-A-10-4	---	---	---	---	*Haliotis*	*rufescens*	---	fragment
1136-BE-9-A-14-2	21.82	12.88	.68	---	*Olivella*	*biplicata*	A1c	
1136-BE-9-A-14-3	6.06	4.38	.58	---	*Alia*	*carinata*	A1	burned
1136-BE-9-B-8-5	---	---	---	---	*Haliotis*	---	---	nacre fragments
1136-BE-9-B-18-3	9.08	8.44	.70	---	*Olivella*	---	A2	detritus, wall cut, polishing
1136-BE-10-C-4-4	---	---	---	---	*Haliotis*	---	---	fragments
1136-BE-10-C-5-4	---	---	---	---	*Haliotis*	---	---	fragment
1136-BE-10-C-6-4	---	---	---	---	*Haliotis*	---	---	nacre fragment
1136-BE-10-C-6(F1)-3	---	---	---	---	*Haliotis*	*rufescens*	---	fragments
1136-BE-10-C-7-3	20.92	10.46	.92	---	*Olivella*	---	A1c	burned
1136-BE-10-C-7-6	---	---	---	---	*Haliotis*	*rufescens*	---	fragment
1136-BE-10-C-8-1A	23.98	13.24	.90	---	*Olivella*	*biplicata*	B1c	burned, both ends ground, aperture ground
1136-BE-10-C-8-1B	24.92	13.06	1.02	---	*Olivella*	*biplicata*	B1c	burned, both ends ground, aperture ground
1136-BE-10-C-8-1C	21.14	13.92	.92	---	*Olivella*	*biplicata*	B1c	burned, both ends ground, aperture groun

TABLE 9. (Cont.) Marine Shell from the Bergen Site. (Largaespada 2001).

1171-BE-15-A-12-13	—	—	—	—	*Haliotis*	—	—	fragments
1171-BE-14-D-8-1	6.56	5.80	.42	—	*Olivella*	—	—	fragment
1171-BE-16-C-12-3	11.64	7.60	.52	—	*Olivella*	*biplicata*	A1b	spire ground
1171-BE-17-B-9-1	12.38	12.96	.58	—	*Olivella*	*biplicata*	A1c	
1171-BE-17-B-14-1	13.66	13.88	.86	2.41 conical	*Olivella*	—	C2	drilled from inside
1171-BE-18-D-8-1	8.62	4.68	1.06	2.97 conical	*Tivela*	*stultorum*	---	disc bead fragment
1171-BE-19-C-3-4	—	—	—	—	*Haliotis*	—	—	fragments
1171-BE-19-C-5-1	4.56	3.22	.34	—	*Olivella*	*immature biplicata*	A1a	spire ground
1171-BE-19-C-7-3	—	—	—	—	*Haliotis*	—	—	fragments
1171-BE-20-A-18-3	—	—	—	—	*Haliotis*	—	—	fragments
1171-BE-21-D-4-3	—	—	—	—	—	—	—	fragment (too small to identify)
1171-BE-21-D-5-3	4.54	3.86	.44	---	*Alia*	*carinata*	A2	
1171-BE-22-A-8-4	—	—	—	—	*Haliotis*	*cracherodii*	—	
1171-BE-22-A-10-4	—	—	—	—	*Haliotis*	—	—	Mixed fragments
1171-BE-22-A-11-3	—	—	—	—	—	—	—	nacre (too small to positively identify)
1171-BE-22-C-8-1	8.84	4.52	.42	—	*Olivella*	*immature biplicata*	A1a	
1171-BE-22-A-1-3	6.72	4.92	.44	—	*Olivella*	*immature dama*	A1a	central lirae spire lopped
1171-BE-22-D-9-3	9.38	8.42	.72	---	*Olivella*		A1b	

Chemical analyses of 92 obsidian artifacts were conducted by Craig Skinner of Northwest Research Laboratories in order to determine the source of the raw material fashioned into tools at the site (Appendix B). Results from the Bergen site fit well with the evidence obtained from other archaeological sites in the Fort Rock Basin. Artifacts from the Bergen site were geochemically characterized a total of 19 sources, both within the region and beyond. Cougar Mountain, located about 10 km from the site, was most abundantly represented, at 42.3% of the sample. Silver Lake/Sycan Marsh, located 50 km to the south, constituted 14% of the sample, while Spodue Mountain, 82 km away, represented 13% of the sample. Other sources of obsidian include Glass Buttes, Newberry Volcano, McComb Butte, and Quartz Mountain, all within 100 km of the site. More distant sources, such as Beatys Butte about 180 km to the southeast, were also represented. These data corroborate previous studies, which indicate that people in the Fort Rock Basin maintained a high level of mobility (O'Grady 1999, Jenkins et. al. 1999b). A full discussion of obsidian source characterization and hydration analysis at the Bergen site is (Jenkins and Skinner, nd).

Faunal Remains from the Bergen Site

Faunal remains in archaeological sites provide evidence of ancient human diets. They can also help researchers reconstruct the seasons in which sites were occupied. A particularly rich collection of faunal remains has been recovered from the Bergen site. Excavations produced over 150,000 pieces of bone. Table 10 presents the total number of bone fragments recovered from each level in the Main House, the 2000 House, and the TF-1 Butchering Area. These data are reflected in Figure 25, in which the percentages of bone in each level of the block excavations are compared.

Although much of the sample awaits further study, two faunal analyses have been conducted. Bone from Unit 3A in the Main House excavation was analyzed by the U.S. Fish and Game Wildlife Forensics Laboratory in Ashland, Oregon. This work was conducted as a training session for laboratory employees. It was completed at no cost to the University of Oregon, but was limited by staff and budgetary constraints. Unit 3A was selected for analysis due to its central location in the Main House. It was thought that this unit would provide a representative sample of the faunal remains through the deposits.

TABLE 10. Number of Bone Specimens in Bergen Site Block Excavations, by Level.

Level (5cm)	Main House	2000 House	Butchering Area
1	5296	1537	1
2	6064	1027	21
3	5325	1094	35
4	5580	1015	12
5	5852	898	33
6	6604	944	123
7	6965	1141	156
8	8087	2396	209
9	8149	1838	251
10	9321	2370	386
11	8025	1399	462
12	9140	800	398
13	8503	491	353
14	7701	124	160
15	5905	87	218
16	5234	171	296
17	4240	116	322
18	322	63	228
19	1270	46	73
20	66	45	32
21	379	29	0
22	63	30	0
Total	118,091	17,661	3760

A total of 9,659 pieces of bone were analyzed by the U.S. Fish and Game Wildlife Forensics Laboratory. The identified bone constituted 4.9% of the sample, or 478 a specimens. Diagnostic bone was classified into family sub-groups (Table 11).

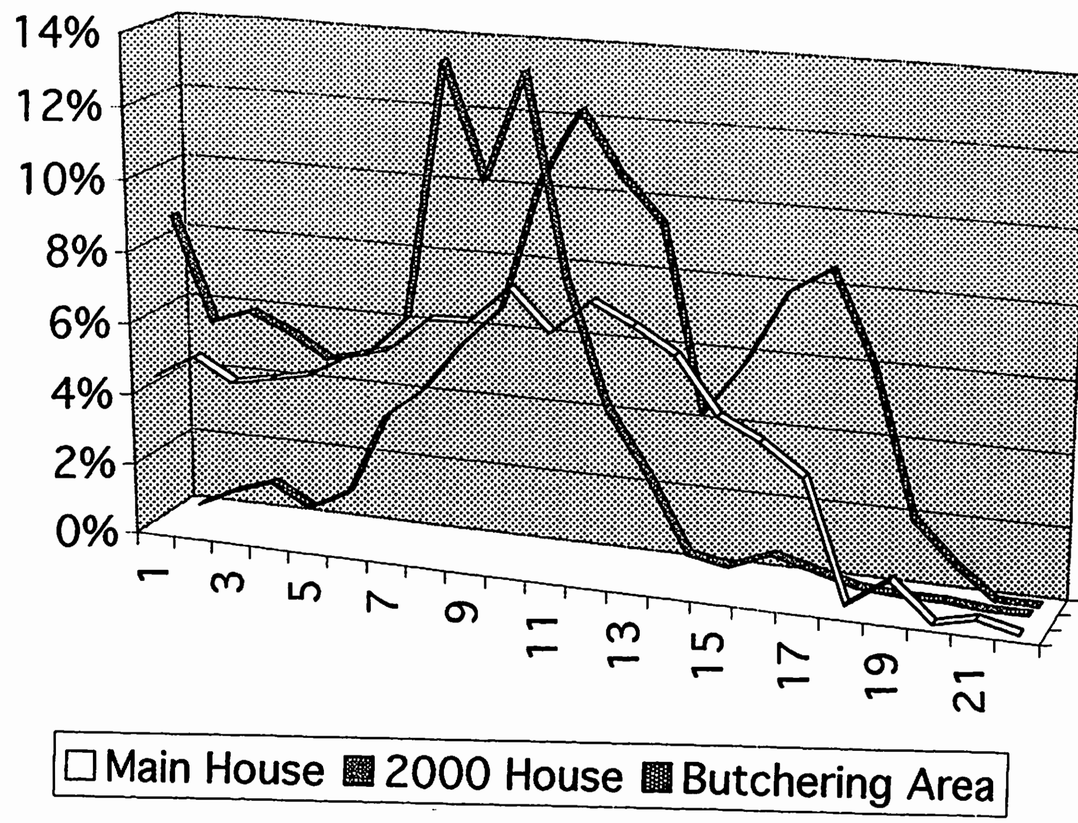


FIGURE 25. Percentage of Bone Specimens Represented in the Main House, 2000 House, and the TF-1 Butchering Area by 5 cm Level.

TABLE 11. Number of Faunal Elements from Main House Excavation, By 5cm Levels.

Level	# of Specimens Analyzed	Class	# of Elements Identified
1	446	Fish Lagomorpha (rabbit/hare) vertebrate	1 2 1
2	174	Fish Aves (bird)	1 1
3	450	Aves Lagomorpha Mammalia	13 6 1
4	220	Fish Aves Leporid *Microtus* Mammalia Carnivora Rodentia	2 3 1 4 3 1 2
5	430	Fish Aves Lagomorpha Mammalia (small)	4 4 5 1
6	662	Aves Lagomorpha Mammalia (small) Mammalia (medium) Artiodactyla *Antilocarpa americana* Anuran (frog/toad)	4 2 1 1 3 1 2
7	715	Fish Aves Mammalia (small) Rodentia	4 21 7 2
8	575	Fish Aves Lagomorpha Mammalia (small)	1 5 6 7

TABLE 11. (Cont.) Number of Faunal Elements from Main House Excavation, by 5cm Levels.

Level	# of Specimens Analyzed	Class	# of Elements Identified
9	707	Fish	12
		Aves	25
		Lagomorpha	1
		Leporid	16
		Grebe	1
		Mammalia	3
		Rodentia	4
10	1088	Fish	12
		Aves	45
		Leporid	24
		<u>Microtus</u>	1
		Mammalia	3
		Mammalia (large)	2
		Artiodactyla	1
		Black Crowned Night Heron	1
11	1400	Fish	6
		Aves	26
		Lagomorpha	21
		<u>Lepus</u>	1
		Mammalia (small)	4
		Vole	1
12	1451	Fish	5
		Aves	22
		Lagomorpha	10
		Leporid	8
		Mammalia	1
		Amphibian	6

TABLE 11. (Cont.) Number of Faunal Elements from the Main House Excavation, By 5cm Levels.

Level	# of Specimens Analyzed	Class	# of Elements Identified
13	910	Aves Lagomorpha Mammalia Mammalia (large) Artiodactyla Canis Carnivore	15 7 8 16 2 1 6
14	1269	Not available	
15	431	Fish Aves Lagomorpha Mammalia Artiodactyla Carnivora Rodentia	2 4 21 9 1 1 1

Bird accounted for 41% of the elements identified in the sample (Fig. 26). Rabbit was represented in 27% of the sample, while mammal constituted 15% of the identified elements. Fish, rodent, carnivore, and amphibian combined to represent the remaining 17% of the sample. These results indicate that birds, jackrabbits, and mammals were important resources for Bergen site occupants, while fish and other rodents were less well represented. The percentages reflected in the chart change significantly, however, when fish bone from the macrobotanical samples are added, as discussed below.

Similar results were encountered in O'Grady's analysis of bone from the TF-1 Butchering Area excavation block, where he identified the presence of migratory waterfowl, jackrabbits, and large mammals, including mountain sheep, elk, mule deer, and pronghorn antelope (O'Grady 2000). An abundance of large mammal and waterfowl bone in both of the identified faunal samples from the Bergen site indicates that both migratory birds and large game were important resources in ancient times.

Fish remains recovered from screens in the field were extremely few when compared to the number of bird and mammal bones identified by O'Grady (Jenkins et al. 1999b) and the U.S. Fish and Game Wildlife Forensics Laboratory. However, the flotation process employed for macrobotanical analyses at the site produced abundant evidence of small minnows in the deposits. Data on bone collected from the screens indicate that fish remains constituted only 10% of the identified bone in Unit 3A of the Main House at the Bergen site (Fig 26). When the number of fish bones recovered from four macrobotanical samples in a single 5 cm level from the house floor (Level 15) are added to these data, however, the percentage of fish remains jumps to 43% (Fig. 27). This shift in representation of fish in the sample from 10% to 43% is extremely significant. Data collected from the 1/8th inch screens in the field suggested that occupants of the site consumed a relatively small amount of fish. Data collected from the 1mm and 2mm screens used in the macrobotanical sampling process indicate that fish were a very important part of the indigenous diet. This example demonstrates the importance of micro-analysis in archaeological investigations. Without these additional analyses, erroneous interpretations about past lifeways may be generated.

n=478

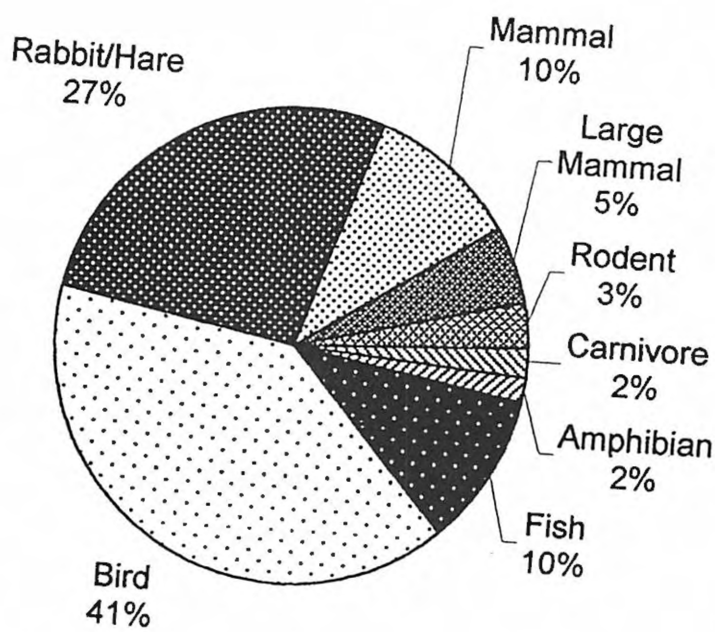


FIGURE 26. Faunal Remains from Main House Excavation, Unit 3A. Elements Identified by U.S. Fish and Game Wildlife Forensics Laboratory in Ashland, Oregon.

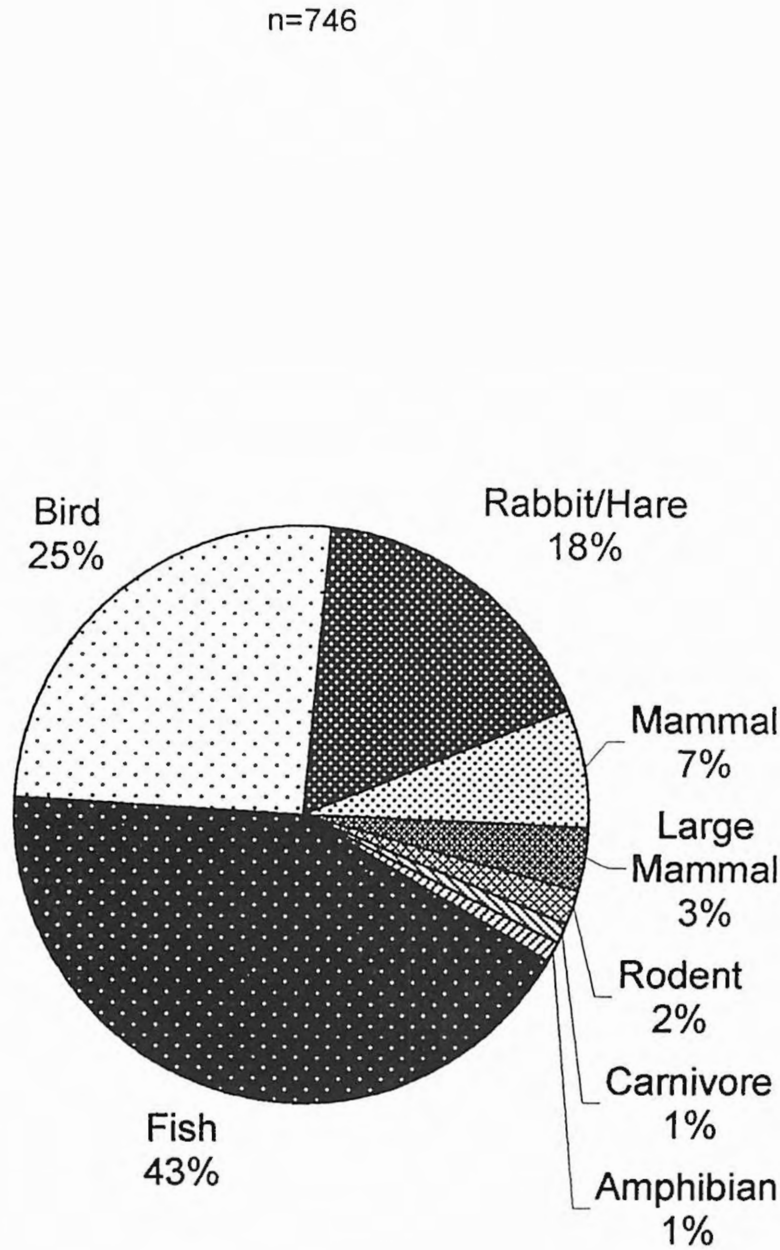


FIGURE 27. Faunal Remains from Main House Excavation, Unit 3A. Fish Bone from Macrobotanical Samples in Level 15 added To Number of Elements Identified by U.S. Fish and Game Wildlife Forensics Laboratory in Ashland, Oregon.

Settlement and Subsistence at the Bergen Site

During the time the Bergen site was occupied, about 6000 to 4000 BP, the Northern Great Basin was experiencing increased effective moisture, causing lakes to fill and marshes to expand (Wigand 1987, Mehringer 1985, Droz 1997, Cummings 2001). During the wettest times, Silver Lake, on the southern boundary of the Fort Rock Valley, would have filled and water would have overflowed into the Silver Lake/Fort Rock channel system. From there, water would have filled Thorn Lake and flowed north as far as Beasley Lake, near which the Bergen site is located.

During the Middle Holocene people took up semi-permanent residence on the Bergen dune. They built houses, made tools, and relied on plant and animal resources associated with the adjacent Beasley and Schaub lakes and their associated marshes (Fig. 4). Animal bones attested in the site include deer, pronghorn antelope, mountain sheep, jackrabbits, a large variety of waterfowl, and small minnows. Plants such as goosefoot, waada, and bulrush were exploited for their small seeds (Chapter IV). The seeds were probably collected in winnowing baskets, then parched over a fire, and ground into flour used in cakes and gruels.

Several lines of evidence suggest that these occupations were focused in the fall and winter months. Studies of the faunal remains recovered at the site indicate that large game, such as deer and antelope, were heavily exploited for both meat and marrow (O'Grady 2000, Jenkins et. al. 2000b). A wildlife biologist (Hedrick, person communication, 2001) has indicated that the area around the Bergen site currently constitutes a wintering-over range for large game, and she reported seeing up to 17,000 deer in the region during the winter. These animals vacate the region in the spring and summer. Biologists have also learned that deer now tend to return to their over-wintering locations each year, and it is reasonable to assume they did so in ancient times (Zulvunardo 1965). In contrast, small rodents, which typically characterize a percentage of the faunal assemblages from other archaeological sites in the region, were virtually absent at the Bergen site. O'Grady (2000) suggests the site was occupied in the winter, when small rodents would have been deeply burrowed and unavailable as food.

Further evidence for a fall/winter occupation at the site is suggested by macrobotanical studies of house floor samples (see Chapter IV, following). Small seeds, such as waada (Suaeda) and bulrush (Scirpus), are ready for harvest in late summer or fall and constitute most of the plant remains in the houses. In addition, very little egg shell and bones of immature birds were recovered from the .5 mm and 1 mm mesh screens used in the macrobotanical process. As a large assemblage of waterfowl bone was collected at the site, the absence of egg shell and juvenile birds is significant, and argues against a spring or summer occupation.

The houses constructed at the Bergen site were likely conical structures made from bent willow branches and covered with bulrush (Scirpus). The floor of the Main House spanned approximately 4 meters in diameter, was roughly circular in shape, and contained a central hearth. No internal postholes were identified, suggesting the structures had onlly perimeter support. Similar house structures, with a central hearth and a smoke hole in the roof, are reported in the ethnographic record in the Northern Great Basin (Ray 1963, Jenkins et al. 2000).

Specialized activity areas outside the house structures, such as the TF-1 Butchering Area, represented animal food processing and tool manufacture. Although no storage pits were identified at the Bergen site, perhaps due to limited sampling, it is likely that village members stored winter foods in nearby locations.

Studies of shell and obsidian artifacts suggest that people who lived at the Bergen site had far reaching connections with others outside the region. Marine shells from the Pacific Ocean were found at the site. Olivella biplcata, the most common species represented, originates along the Pacific Coast. However, Olivella dama, also represented at the site, is most common in the waters of Baja, California. It may indicate that trade relations extended as far south as Mexico (Jenkins et. al. 1999b; Largaespada 2001). Geochemical analysis of obsidian artifacts indicate that Fort Rock Basin people obtained obsidian from a wide range of sources from within and outside the region (Skinner, Appendix B).

Summary

Archaeological and geomorphological investigations at the Bergen site indicate that indigenous people in the Fort Rock Basin set up fall/winter villages at the site throughout much of the Middle Holocene, from about 6000 BP to 4000 BP. These lake-side encampments fit well within the known settlement patterns of the region in that they were strategically located near wetland adapted resources. Several characteristics of the Bergen site, however, also make it unique to the region (Jenkins et. al. 2000b). The site stretches for over 1200 meters along the crest of the Bergen Lunette Dune. Probes and test units across the length of the dune suggest that house structures, similar to those reported in this chapter, were probably scattered along the crest during times in the past. A Middle Holocene village of this size has not been found anywhere else in the Fort Rock Basin. The faunal assemblage suggests that exploitation of waterfowl and large game were extremely important activities at the site.

During the time the Bergen site was most intensively occupied, the water level in adjacent Lake Beasley was high (3 to 4 meters). Various food resources were available in the fall months, including small fish, migratory waterfowl, deer and pronghorn, and the small seeds of wetland-adapted plants. Fire hearths were located in the central part of the houses, although some food processing surely took place in specialized areas outside the houses. Bone and stone tool manufacture were also important winter activities at the site.

The data presented in this chapter characterize the Bergen site within the context of early settlement patterns in the Fort Rock Basin. More can be said, however, about the life led within the houses found on the dune. Household archaeology involves intensive investigations within individual residential structures in order to learn more detail about activities and spatial patterns associated with the people who lived in the houses. The following chapter represents my attempt to conduct household archaeology on two structures at the Bergen site: the Main House floor in the Main Block excavation and the living floor discovered in the 2000 House Block excavation. The focus of the following analysis is the botanical remains distributed across the house floor, although bone and lithic material are also discussed as pertinent.

CHAPTER IV

PALEOETHNOBOTANICAL INVESTIGATIONS AT THE BERGEN SITE

Archaeological investigations during the 1998 field season at the Bergen site resulted in the exposure of a well preserved, 6000 year old house floor on the crest of the Bergen Lunette dune. This presented an excellent opportunity to combine macrobotanical studies with household archaeology. With over 12 years of research compiled on prehistoric settlement patterns in the Fort Rock Basin by the University of Oregon Archaeology Field School, detailed analyses of single dwellings were lacking.

Household Archaeology

Researchers have employed household archaeology in attempts to answer a variety of questions. Wilk and Rathje (1982) argue that households consist of three main elements: 1) social (relationships of its members), 2)material (dwellings, activity areas, and possessions), and 3) behavioral (activities and functions it performs). Archaeologists excavate dwellings, analyze material remains, and make inferences about social relations and household functions. Ames et al. (1992) used household archaeology as a frame of reference in excavating a southern Northwest Coast plank house. The authors were interested in assessing the time and labor costs that went into the construction of a plank house. They were also interested in how the household functioned as a taphonomic agent in shaping the deposits at the site. Hoffman (1999) employed household archaeology at an Agayadan village on Unimak Island, Alaska. The focus of this study was to investigate economic operations at a large, communal hunter-gatherer site in order to gain insight into levels of social complexity.

My research at the Bergen site was designed to augment previous emphases on regional settlement patterns in the Fort Rock Basin initiating movement toward more refined investigations of family households. Macrobotanical analyses of a single-family dwelling occupation at the height of the Middle Holocene involved the collection of soil samples on a 50cm grid across 34 square meters of the main excavation block. This research was undertaken for three primary reasons: 1) to learn more about the diet and environment of indigenous people at the site, 2) to test whether patterned distributions of botanical remains in a hunter-gatherer dwelling could lead to the identification of activity areas within it, and 3) to compare results with previous macrobotanical studies in the region and make recommendations for future sampling.

Research Methods

The scope of paleoethnobotanical studies is becoming broader as archaeologists and botanists engage in more intensive investigations concerning the relationship of plants and humans. A recent publication edited by Patricia Anderson (1999) reviews new experimental and ethnographic approaches in paleoethnobotany applied to the study of origins of agriculture. Studies include residue analysis of ethnographic plant-working tools from Northern Australia (Fullagar, et al. 1999), experimental root and tuber processing and analysis of resulting microwear on chipped stone tools (Sievert 1999), and genetic, pollen, and phytolith studies associated with Old World cultivars (Zohary 1999, Bottema 1999, Diot 1999, and Rosen 1999).

Paleoethnobotanical studies focusing on spatial distributions and functional activity areas are not new to archaeology. Hill and Hevly (1968), for instance, used data from a 100-room thirteenth century Pueblo ruin to show that pollen can be useful in intra-site dating and in the determination of differing functional areas within a single-component site. A total of 53 pollen samples were analyzed representing primarily floor fill in 43 separate rooms in the structure. Hill and Hevly (1968) were able to distinguish between habitation, storage, and ceremonial areas by analyzing the distribution of preserved pollen in the site. They suggest that by studying the spatial distribution of pollen types in other sites, researchers should be able to gain a better understanding of functions and activities carried out in different areas within the site (Hill and Hevly 1968).

Anne Cully (1979) conducted a similar study involving spatial distribution of pollen within a pithouse in Chaco Canyon, New Mexico. Three rooms were extensively sampled using a 16-place grid on the floors. Grid section samples from each floor in each room, however, were lumped together for analysis and showed no distinctive variation from room to room. Comparison of data within rooms did indicate variability in spatial distribution of pollen. Cully (1979:98) concludes that, "variability within a room can be extremely high. To rely on one sample from one location could lead to mistaken interpretation of the data. A set of samples from a grid system, or a composite sample or pinch sample, should be taken to encompass the variability of a room."

Madsen and Lindsay (1977) used pollen and macrofloral analyses to investigate dietary resources and activity loci in the Sevier site of Backhoe Village in Utah. A total of 32 samples were collected from a 50 cm square grid across the floor of Structure 3. With the exception of cattail pollen (Typha latofolia), only minor variations of pollen types were evident among the samples. Cattail pollen, however, maintained a differential distribution across the floor of the structure. The highest density of cattail pollen was clustered in and around the central fire hearth, and percentages declined in samples taken further way from the central locality. Madsen and Lindsay (1977) use this and other archaeobotanical data from Backhoe Village to refute previous models concerning domesticated versus wild food resources. Further implications for this type of analysis became evident in similar studies by Cummings (1983, 1998) and Matthews (1986).

Cummings (1998) devised a sampling strategy for collection and analysis of pollen in an Anasazi housepit as part of the Delores Archaeological Project in southwestern Colorado. It involved an intensive systematic sampling of pollen collected from the floor of a pithouse which was abruptly abandoned due to fire. Cummings (1998) argued that this type of sampling strategy, when conducted on a site with good microfloral preservation, can provide evidence of activity areas across the floor. A thorough analysis of this sort may then be used as a model for sampling additional sites with the same temporal, cultural, and geographical associations. This study is discussed in more detail in the section below.

Although the above studies all involve analysis of pollen, similar investigations have also been undertaken using macrofloral evidence. Matthews (1986) was able to identify differential concentrations of macrofloral remains across the same pithouse floor analyzed by Cummings (1983). Christine Hastorf (1988) used macrobotanical analysis in her research conducted in the Peruvian Andes in an attempt to illustrate how plants can aid in interpreting activities such as production, processing, and consumption of plant resources. Hastorf analyzed 34 flotation samples from the Wanka II Period (A.D. 1300-1460) to investigate processing within a residence. The samples were examined in relation to their specific locations in the household and were obtained from four domestic contexts: hearths inside roofed structures, food storage areas against walls within the structure, work spaces in the central part of the patio, and general storage against patio walls. Results indicated that the same plants found in different contexts tend to reflect different activities; and some activities will be more easily detected in the archaeological record than others. Based on these results, Hastorf (1988) concluded that contextual information could be identified and used to determine which samples to analyze.

Although each of the examples discussed above use paleoethnobotanical analyses to investigate human activity areas in archaeological sites, they all focus on advanced horticultural or agricultural societies. It is important to investigate similar questions among hunter-gatherer societies because agriculturalists and hunter-gatherers are likely to produce different patterns of activity within households. Learning more about general activity patterns of hunter-gatherer societies may lead to more accurate sampling and interpretation of archaeobotanical remains in archaeological sites associated with hunter-gatherer populations.

As Susan Kent (1984) discovered in her analysis of activity areas among three separate cultures, some archaeologists have a tendency to project their own organizational patterns on the cultures they study. The work indicated that different cultures produce different patterns of activity within households, and this could be detected in the archaeological record. Although Kent's (1984) study focused on historic sites, her cautionary note can be as easily applied to the investigation of prehistoric hunter-gatherers. Those of us who study hunter-gatherers need to develop ways of detecting similar activity areas. This would require proceeding from the presupposition that culturally inherited ways of organizing and utilizing space may not prove consistent through time and across cultural boundaries. With this in mind, I selected an approach at the Bergen site which extensively sampled soils spatially across the house floor. In part, it is hoped that the extensive scope of this study will serve as a guard against sampling only those areas we assume will be fruitful based on our own sense of order.

Sampling Design

The strategy for sampling botanical remains at the Bergen site was modeled from a study conducted Linda Scott Cummings (1983, 1998) of an Anasazi Pueblo I pithouse in southwestern Colorado. Cummings analyzed 89 pollen samples collected on a quarter-meter grid across the house floor.

Distributions of pollen remains in the site were analyzed in the context of excavated floor features and ethnographic studies. Results indicated that the distributions reflected activity areas within the house. Cummings (1998) offers the data from this intensively sampled pithouse as a model to guide future sampling of other pithouses. There are two primary reasons that a similar research design involving intensive sampling of macrofloral remains was undertaken on the house floor at the Bergen site.

First, although Cummings' (1998) study has broad application for many archaeobotanical investigations, the Bergen site is geographically, temporally, and culturally distant from the Anasazi pithouse at the center of that study. The Bergen site represented an excellent opportunity to test whether activity areas may be detected from distributions of macrofloral remains recovered from a house floor associated with prehistoric hunter-gatherers in the Great Basin. The research was based on the assumption that distribution patterns of seeds and charcoal at one site may be offered as a model for sampling comparable sites in the future. This is significant because it has the potential for greatly improving the methodology associated with macrobotanical analysis in hunter-gatherer sites worldwide.

The second reason for extensively sampling the house floor at the Bergen site was to evaluate our current understanding of settlement patterns and subsistence strategies in the Fort Rock Basin. Archaeological and geomorphological evidence suggest that the people who occupied the Fort Rock Valley during the Late-Middle Holocene were intensively exploiting wetland resources, storing food, and living in semi-sedentary residences (Jenkins et al.1999). The appearance of house floors and cache pits at sites associated with this time period provides the main evidence for this interpretation. Toward the end of the Late-Middle Holocene, upland resources were being more intensively exploited. It has been theorized that fluctuations in climate and an increase in human populations in the region precipitated this shift toward upland resources (Jenkins et al. 1999, Jenkins 1994b, Prouty 1995).

Jenkins et al. (1999) propose a possible alternative explanation for the shift from lowland seed exploitation to upland root crops. They rely on an evolutionary perspective, which focuses on the effect of changing temperature and climatic regimes on settlement patterns in the Fort Rock Basin. This interpretation links early cultural developments (5600-4500 BP) with summer producers, such as small seeds and fish, and later developments (3800-3000 BP) with spring producers, such as geophytic roots. A shift from colder winters to milder springs between these periods may have given selective advantage to families that process spring roots more intensively. The results are represented as a gradual shift to a more Plateau-like subsistence pattern in the Northern Great Basin (Jenkins et al. 1999).

If this hypothesis is correct, greater percentages of seeds would be expected in soil samples from the early period, with an increasing percentage of root crops evident from later samples. Although paleoethnobotanical evidence tends to support this interpretation, more evidence is needed. Many of the soil samples conducted on Middle Holocene sites in the Fort Rock Basin have produced scanty archaeobotanical assemblages (Prouty 1995b, Stenholm 1994). This fact may be related to biological or geological processes that occurred after the site had been abandoned and caused sediments to be moved around and through the deposits (i.e., bioturbation or deflation). Prouty (1995b) notes, however, that low percentages of botanical remains may also be related to problematic sampling of the site. In other words, the contents of some samples may not accurately reflect the botanical remains preserved in the site because they were taken from areas within the site that contained fewer plant remains.

My research at the Bergen site was designed to help address this problem. It was assumed that if botanical remains were preserved in this prehistoric house, they would be represented in the 215 samples collected and analyzed. If there emerged a pattern to the distribution of archaeobotanical remains, as was expected, the results would help improve our sampling of comparable sites in the future.

The extensive sampling at the Bergen site was also expected to provide a more complete database from which current understandings of Late-Middle Holocene occupations in the Fort Rock Basin could be tested and improved. The sheer number of samples analyzed contributes substantially to our knowledge of the vegetable diet associated with human groups during the late Middle Holocene. In addition to enhancing our understanding of settlement patterns broadly speaking in the Northern Great Basin, this research at the Bergen site was designed to provide a slightly different perspective, one focused on the investigation of patterns and activities within a single prehistoric occupation.

Sampling of the Main House Floor at the Bergen Site

At the Bergen site an intensive macrobotanical sampling strategy was undertaken during the 1999 summer field session of the University of Oregon Field School. The house floor was sampled on a 50 cm grid. Each one-meter unit was divided into four quadrants, and a one-liter soil sample was collected from the center of each segment. Samples were collected in five-centimeter intervals as excavators approached the floor of the house. This sampling strategy for macrobotanical remains was not in place at the time of initial excavations during the 1998 field season. Therefore, comparable data from the L-shaped trench through the center of the block were unavailable for analysis.

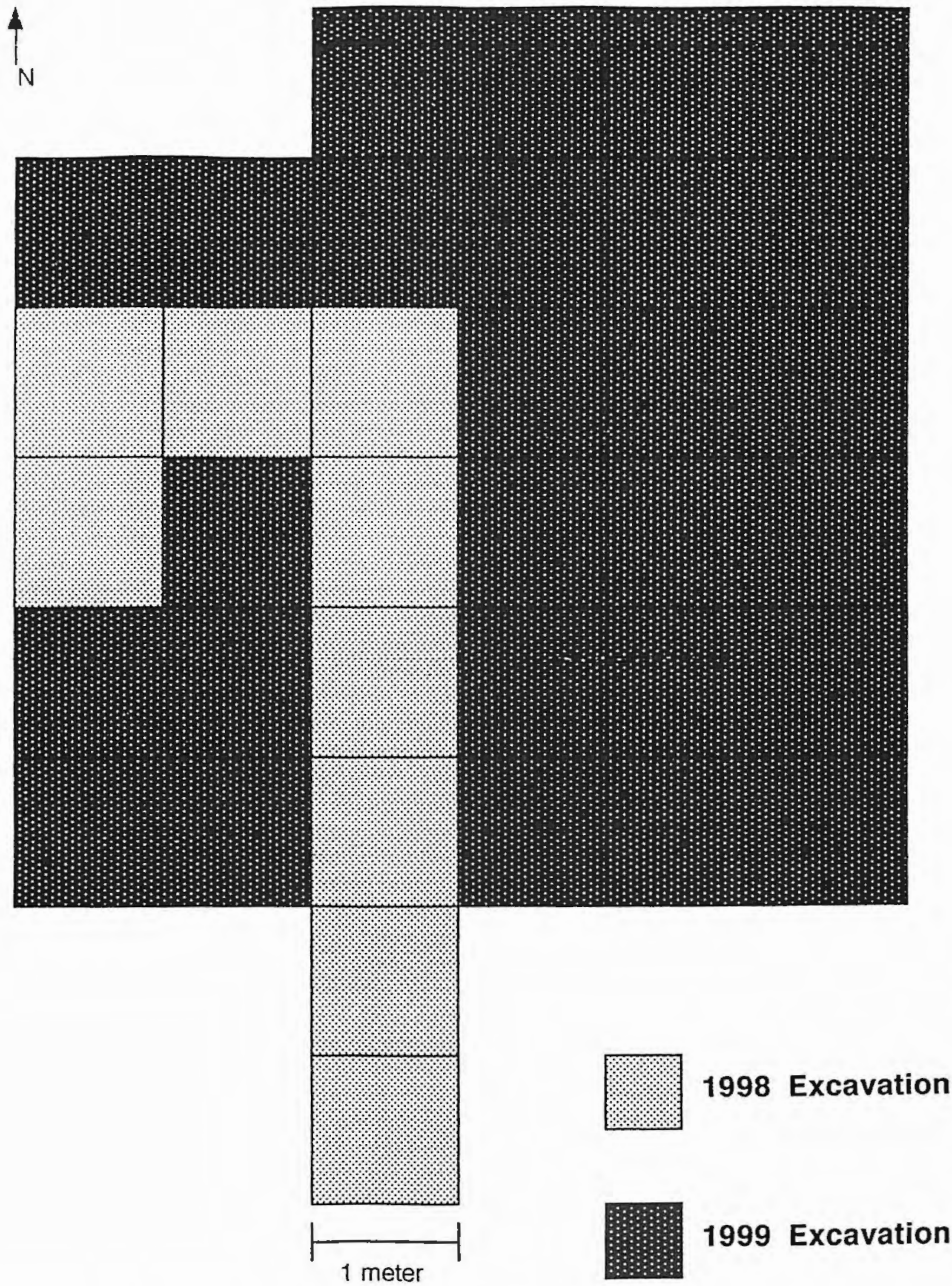


FIGURE 28. Main Block Excavation at Bergen, 1998 and 1999 Units.

Figure 28 represents a diagram of the main block excavation and indicates which units were sampled in 1998 and 1999. Four soil samples from the 1998 excavation were chosen for analysis and added to the data collected in 1999. A total of 215 soil samples associated with ten centimeters of fill above the house floor were processed and analyzed for macrofloral remains.Soil samples were also systematically taken throughout the multi-component deposits of the main block at the Bergen site. Artifact assemblages and radiocarbon dates obtained from the block indicated that there were at least two overlapping occupations represented in the deposits. Future analysis of the plant remains through the deposits may serve to strengthen interpretations of the stratigraphic components at the site. Decisions in the field regarding sampling reflected the sentiment expressed by Asch and Sidell (1988:95): "Speaking as archaeological botanists, we are committed to the development of botanical profiles since this technique provides an independent means of verifying stratigraphic conclusions with our own data sets...Field archaeologists should be urged to collect finely sampled botanical columns. Even if few are analyzed immediately, the samples can be held in reserve should stratigraphic questions arise for which a botanical analysis might prove illuminating."

Sampling in the 2000 House at the Bergen Site

A second, smaller block excavation at the Bergen site was also sampled for macrobotanical remains. Excavations at the 2000 House discovered at this location began during the 1999 field season when a probe located five meters northeast of the main block produced evidence of another possible house floor. Testing in 1999 was expanded during the year 2000 season to include a 15-meter square block excavation (Figure 29). Soil samples were collected from the 2000 house on the same quarter-meter grid design in order to maintain comparable data units.

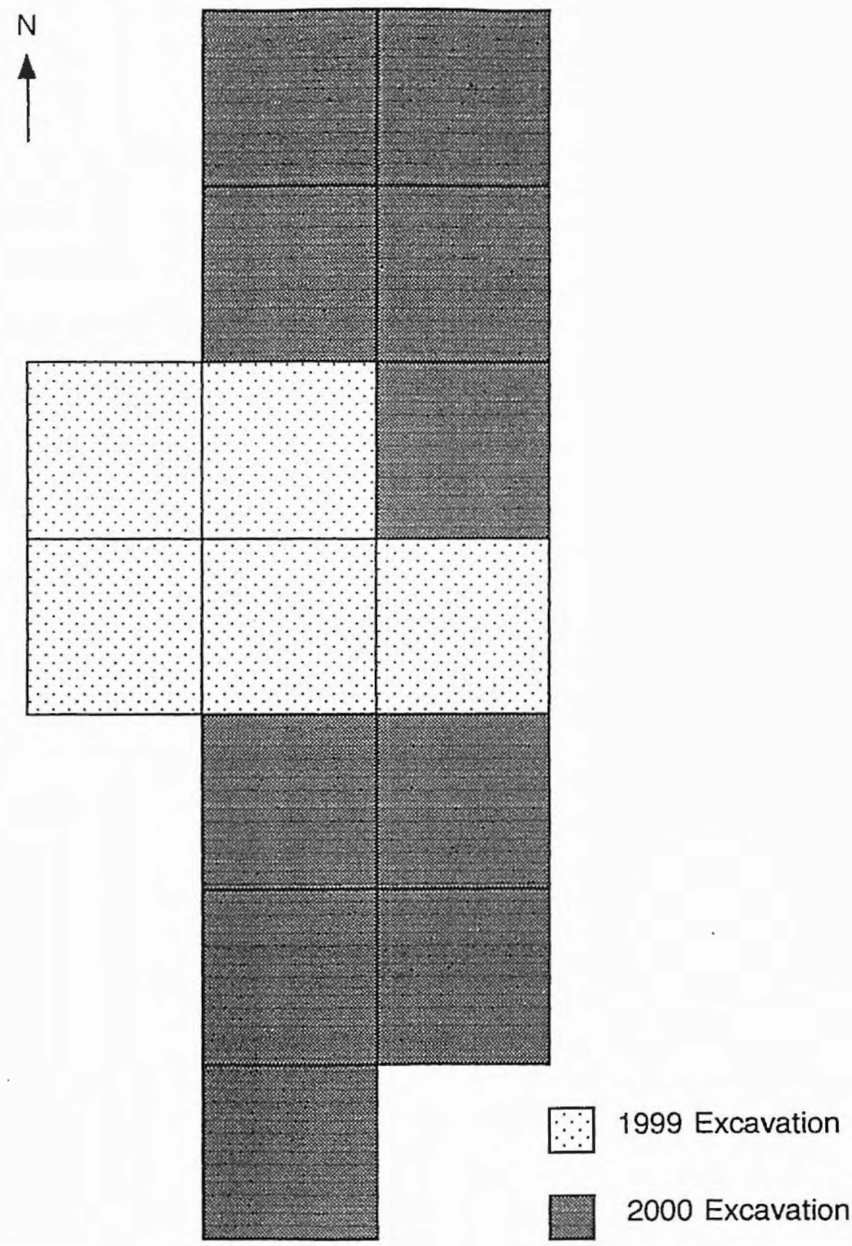


FIGURE 29. Block Excavation of 2000 House, 1999 and 2000 Units.

Macrobotanical Analysis and Procedures

Basic procedures for macrobotanical analysis have been adopted from PaleoResearch Institute (Cummings 1989). Soil flotation analyses at PaleoResearch are conducted using a modification of the procedures outlined by Matthews (1979).

The steps for soil flotation and identification of seeds, charcoal, and other plant material conducted in this research are outlined below.

1. Soil samples collected in the field were labeled with provenience information and transported to the laboratory at the University of Oregon. Each sample designated for analysis was measured. One cup of soil was bagged, labeled, and reserved for the possibility of future pollen analyses. One liter of soil was added to approximately three gallons of water in a five-gallon bucket. The water was stirred vigorously by hand until a strong vortex was formed and botanical remains floated to the surface. The decision to standardize the sample size was made to facilitate easier comparisons of the data.

2. The material that floats to the surface of the water is called the light fraction. The light fraction was poured out of the bucket through a 150 micron (.25 mm) mesh sieve. More water was then added to the bucket and mixing continued. This process was repeated 3 to 5 times until no visible light fraction was floating on the surface and the water turned relatively clear (i.e., clays and silts were washed through the screen).

3. The remaining sediment that sinks to the bottom of the bucket is called the heavy fraction. After all the light fraction was caught in the .25 mm screen, the heavy fraction was poured through a 250 micron (.5 mm) mesh sieve. Any remaining clays or silts were rinsed through the screen. Sediments and artifacts larger than .5 mm were captured in the screen and set aside for further study.

4. Both the light fraction and the heavy fraction from each sample were transferred to newspaper and placed on a rack for air-drying. Care was taken in this step to ensure that all the remaining residue captured in the screens were transferred to the newspaper. Many of the seeds recovered in these samples were extremely small and, therefore, difficult to see with the naked eye.

5. Drying of the samples usually took a range of 24 to 48 hours. After the samples were dried, they were passed through a graduated series of dry sieves with openings of 2 mm, 1 mm, .5 mm, and .25 mm, respectively. This step was important because it resulted in the sorting of dried samples into size categories, which eased the task of removing important contents from the remaining sediment.

6. Light and heavy fractions from each sample were then scanned under a binocular stereo microscope with 10x – 40x zoom optics. Macrofloral materials,

such as seeds, seed fragments, charcoal, and PET (processed edible tissue) were removed from the sample and identified.

7. Charcoal larger than 1 mm was weighed and identified with the help of Kathryn Puseman of PaleoResearch Laboratories in Golden, Colorado. Identification of wood requires magnification up to at least 70x and is aided by the use of a fluorescent light ring attached to the microscope.

8. Identification of seeds were conducted with reference to primarily two seed manuals used by PaleoResearch Labs (Martin and Barkley 1973, and Schopmeyer 1974) and a modern reference collection in my possession.

In order to maintain quality control in the study, approximately 20% of the flotation samples were tested by the addition of common poppy (Papavar) seeds. Fifty charred poppy seeds were mixed into the bucket with the soil sample. During sorting and seed identification, the number of poppy seeds recovered from each sample was noted. Ideally, all of the 50 poppy seeds would be recovered, indicating that none were lost in the flotation process or missed in sorting. The procedure was conducted so that adjustments could be made if return rates were problematic. The techniques used in flotation and sorting were reviewed when return rates were deemed unsatisfactory. This controlled test was conducted periodically throughout the investigations of 235 soil samples analyzed in this research. It helped ensure a consistent and accurate set of macrobotanical procedures employed in this study.

Botanical Remains on Main House Floor at the Bergen Site

Seeds and Charcoal

Macrobotanical analysis was conducted on 215 soil samples obtained from the lower component of the main block excavation. The samples were taken from a 10cm thick lens of house "fill," which consisted of dark brown, humus-rich silts. This lens was located directly on top of the yellow (culturally sterile) deposit and followed the dish-shaped contour of the house floor. A total of 3191 seeds or seed fragments were recovered in all. Processed edible tissue (PET) was represented in 13 soil samples. Table 12 lists the seed types identified from the samples. A total of 3169 seeds were identified to at least the family level, while only 22 seeds could not be identified. The identified seeds were designated to three plant families (Chenopodiaceae, Cyperaceae, and Compositae) and 8 separate genera (Chenopodium, Suaeda, Atriplex, Sarcobatus, Cyperus, Scirpus, and Chrysothamnus). Cheno-ams represent 47% of the identified seeds (Figure 30). The Cheno-am category includes species from the Chenopodiaceae (Goosefoot) family and the genus Amaranthus. Some 81% of the Cheno-ams were represented by embryos

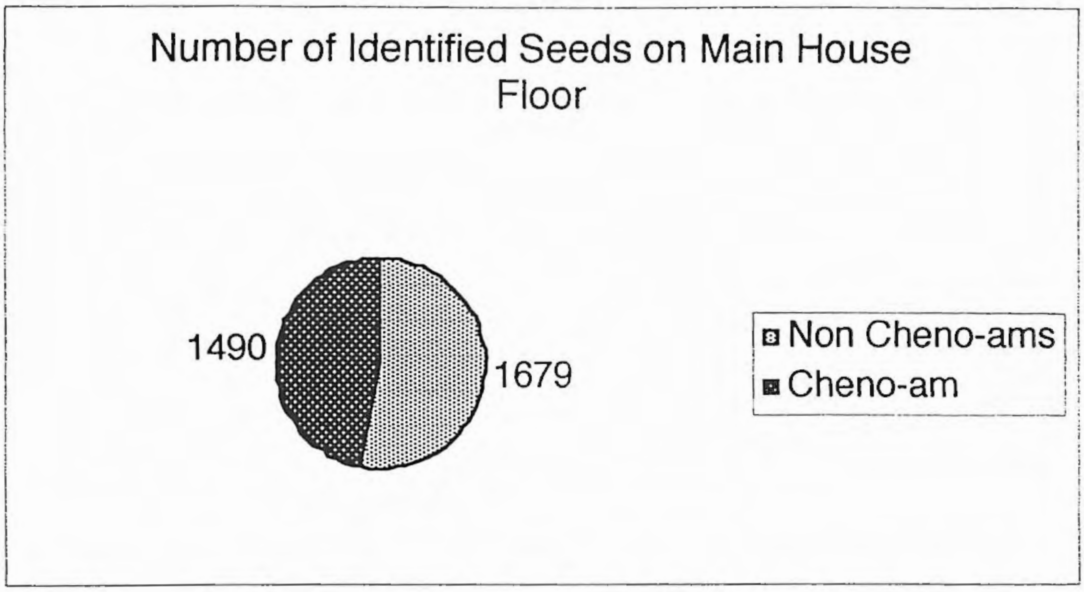


FIGURE 30. Identified Seeds on Main House Floor from the Bergen Site.

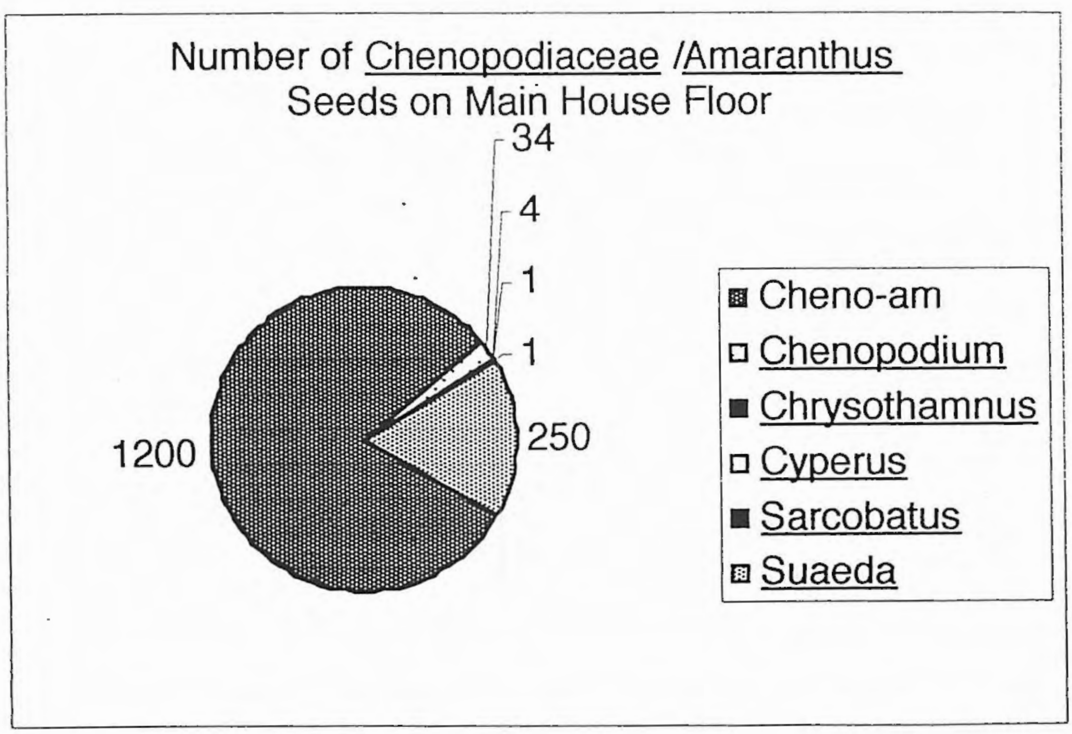


FIGURE 31. Cheno-am Seeds from Main House Floor at the Bergen Site.

TABLE 12. Seeds Recovered from Main House Floor at the Bergen Site. Data from Appendix C.

Description		Number
Total Samples Analyzed		215
Total Seeds or Seed Fragments		3191
Identified Seeds		3169
Unidentified Seeds		22
Total Cheno-ams		1490
Total Non Cheno-ams		1679
Family	Genus	Number
Cheno-am (no further ID)		1200
Chenopodiaceae	Atriplex	5
	Chenopodium	34
	Sarcobatus	1
	Suaeda	250
Compositae	Chrysothamnus	4
Cyperaceae		1
	Cyperus	1
	Scirpus	1673

(inner seeds) or fragmented seed casings and could not be confidently assigned to a more specific category (Figure 31). That is, of the total 1490 Cheno-ams recovered from the samples, only 290 were complete enough to assign to the genus level. Seeds which did not fall into the Cheno-am category belonged to two plant families: Compositae and Cyperaceae. The Compositae family was represented by 4 Chrysothamnus seeds. The Cyperaceae (sedge) family was represented by one Cyperus seed and 1673 Scirpus (bulrush) seeds.

Identification and analysis of charcoal recovered from these samples on the house floor indicate the presence of 5 plant families (Asteraceae, Chenopodiaceae, Compositae, Rosaceae, and Salicaceae) and 4 genera (Artemisia, Atriplex, Chrysothamnus, and Sarcobatus). In addition, one sample contained a piece of charcoal identified only as conifer, and another sample contained one piece of unidentified hardwood. The most predominant family is Chenopodiaceae, which was represented in 51 samples. Asteraceae, Compositae, Rosaceae, and Salicaceae all occurred in decreasing frequencies (Figure 32). Many specimens of wood in the samples were vitrified (many to the point of being unidentifiable) which suggests that the wood was burned green.

The plants most commonly represented in the macrobotanical samples from the Bergen site are illustrated in Figures 33 to 38. The figures are paired in that there is first an illustration of the plant, such as Chenopodium (Fig. 33), and then a photograph of the magnified seed from that plant (Fig. 34).

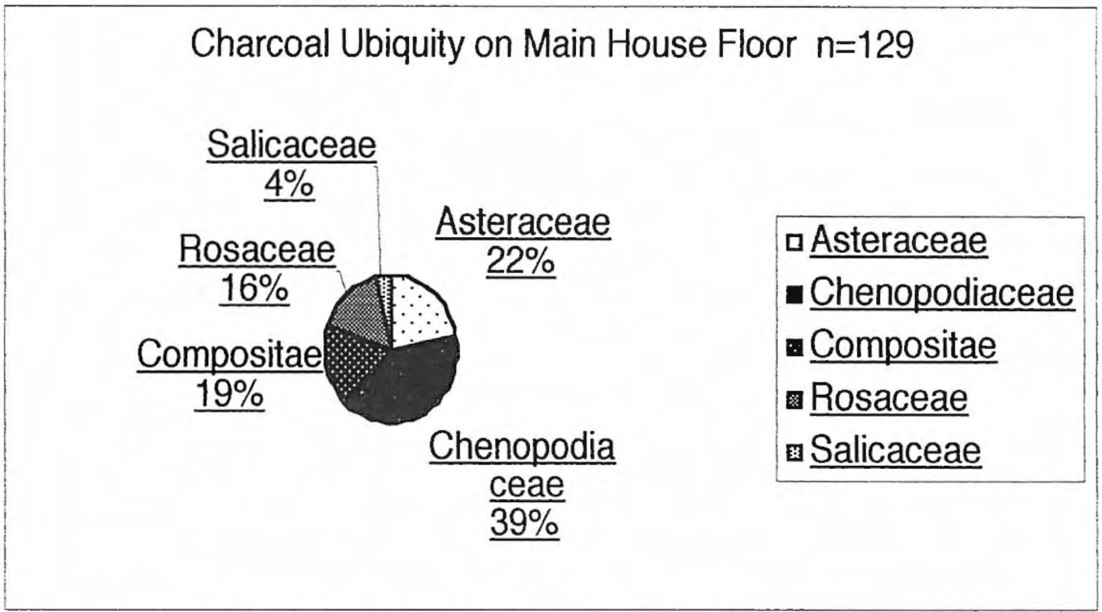


FIGURE 32. Charcoal from the Main House Floor at the Bergen Site.

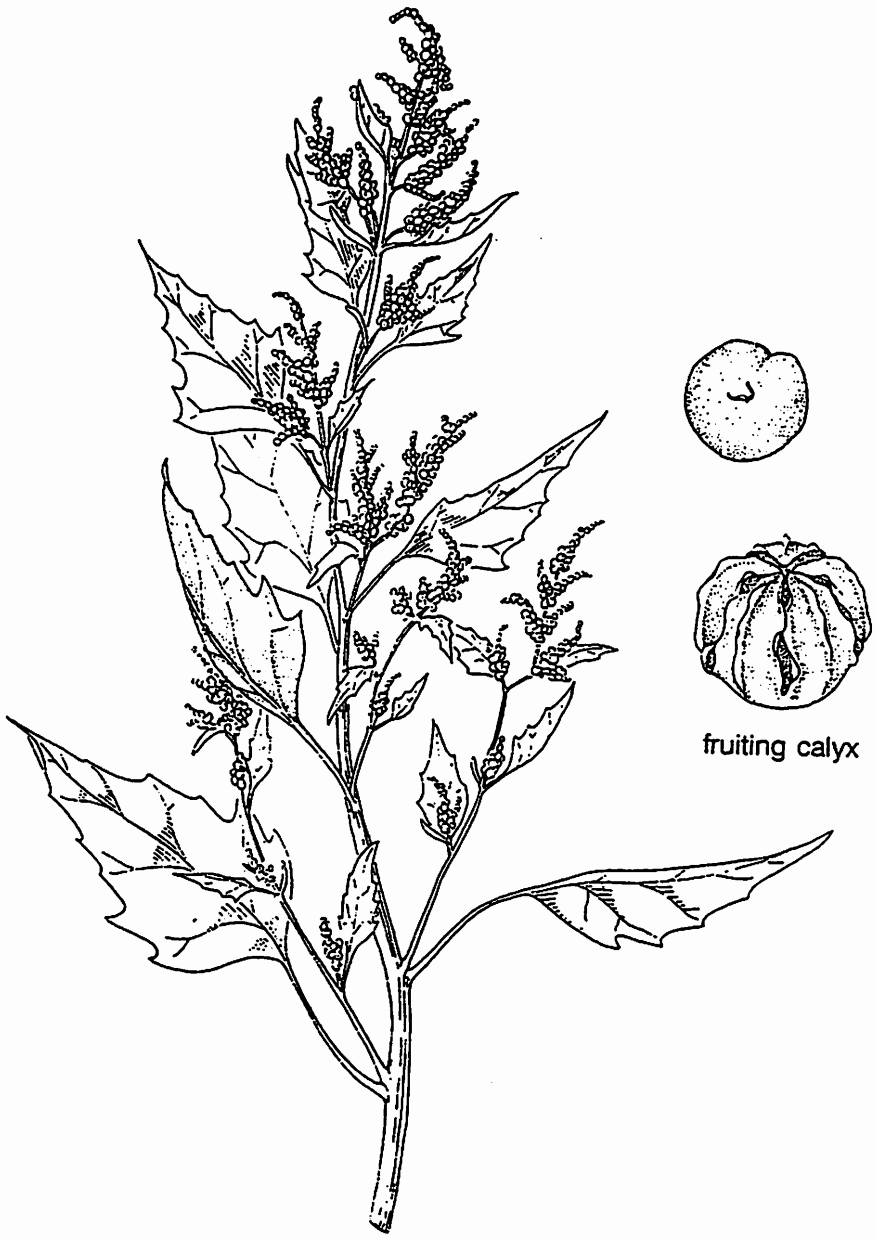


FIGURE 33. Illustration: Chenopodium (Goosefoot) (from Holmgren 1998).

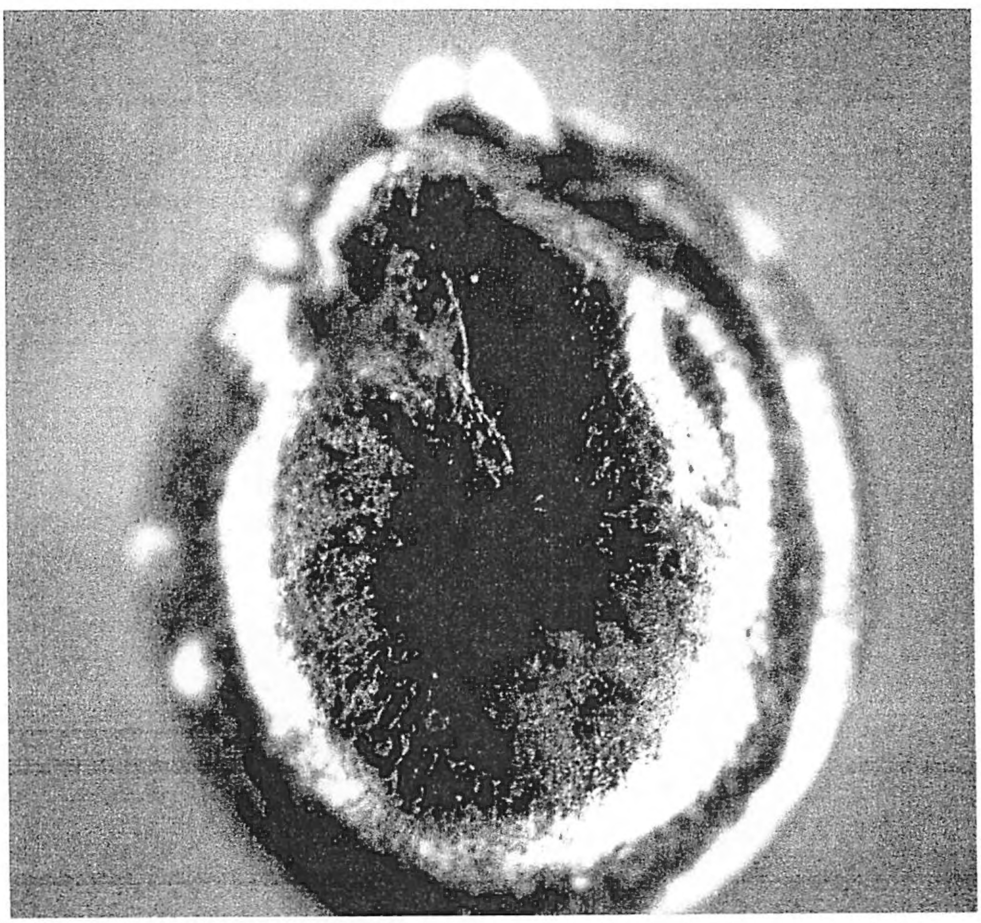
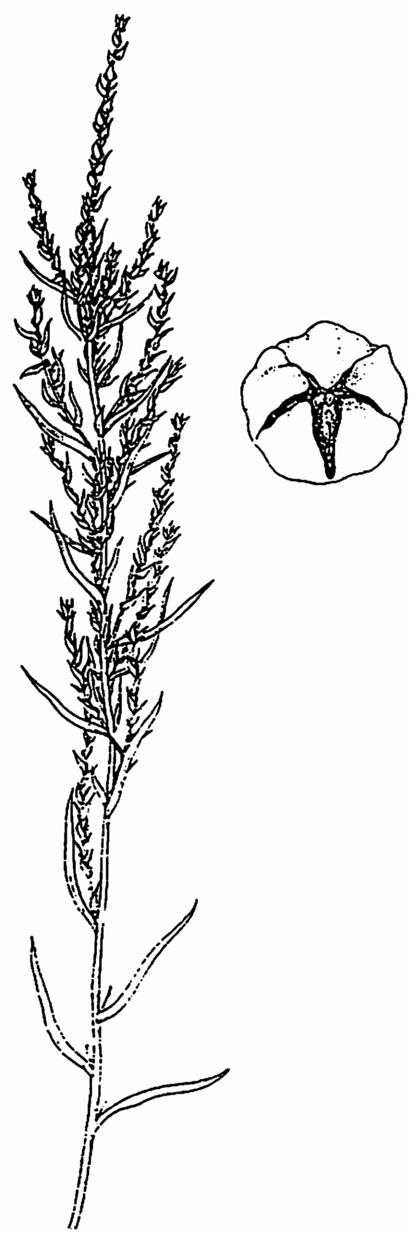


FIGURE 34. Photograph: Magnified Chenopodium (Goosefoot) Seed.



Suaeda americana

FIGURE 35. Illustration: <u>Suaeda</u> (Waada) (from Holmgren 1998).

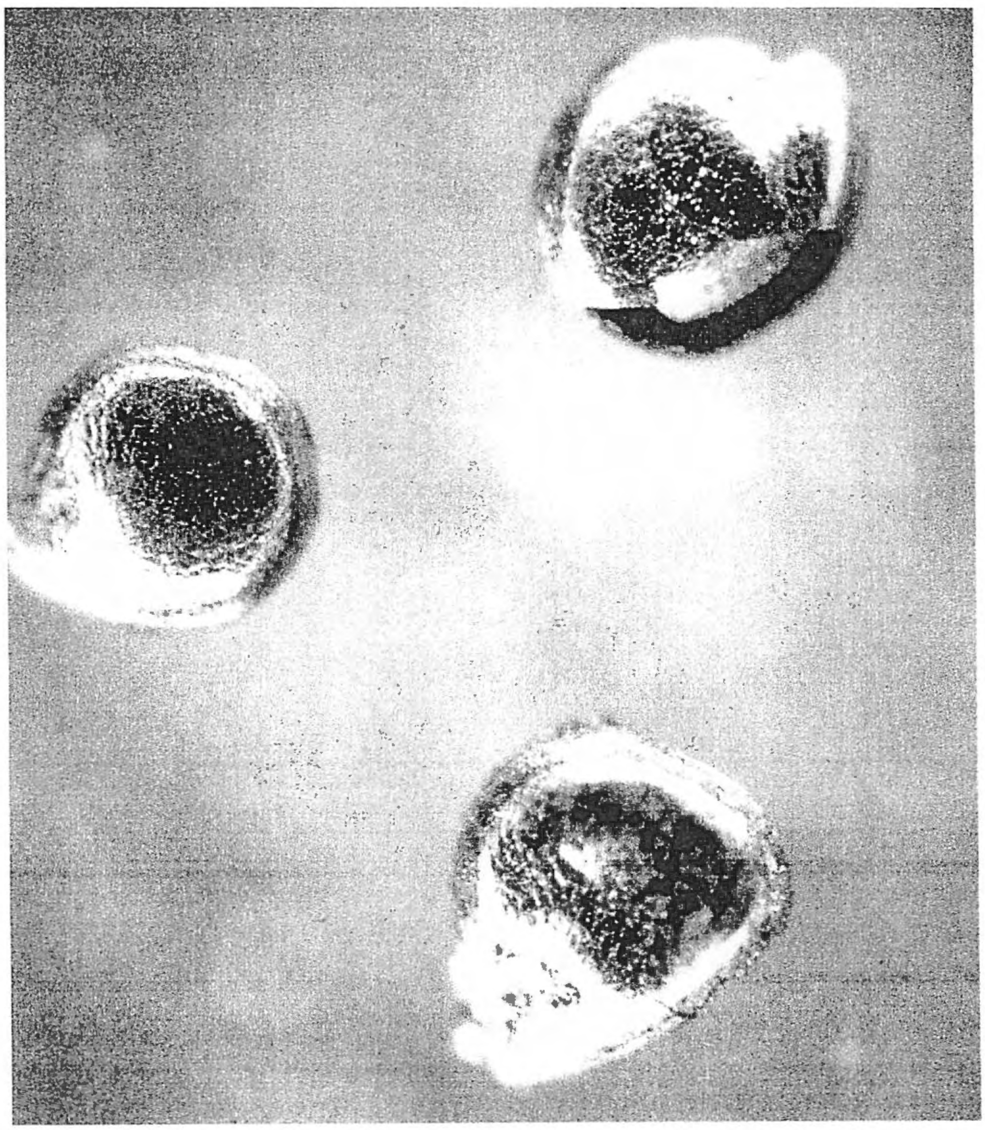


FIGURE 36. Photograph: Magnified Suaeda (Waada) Seed.

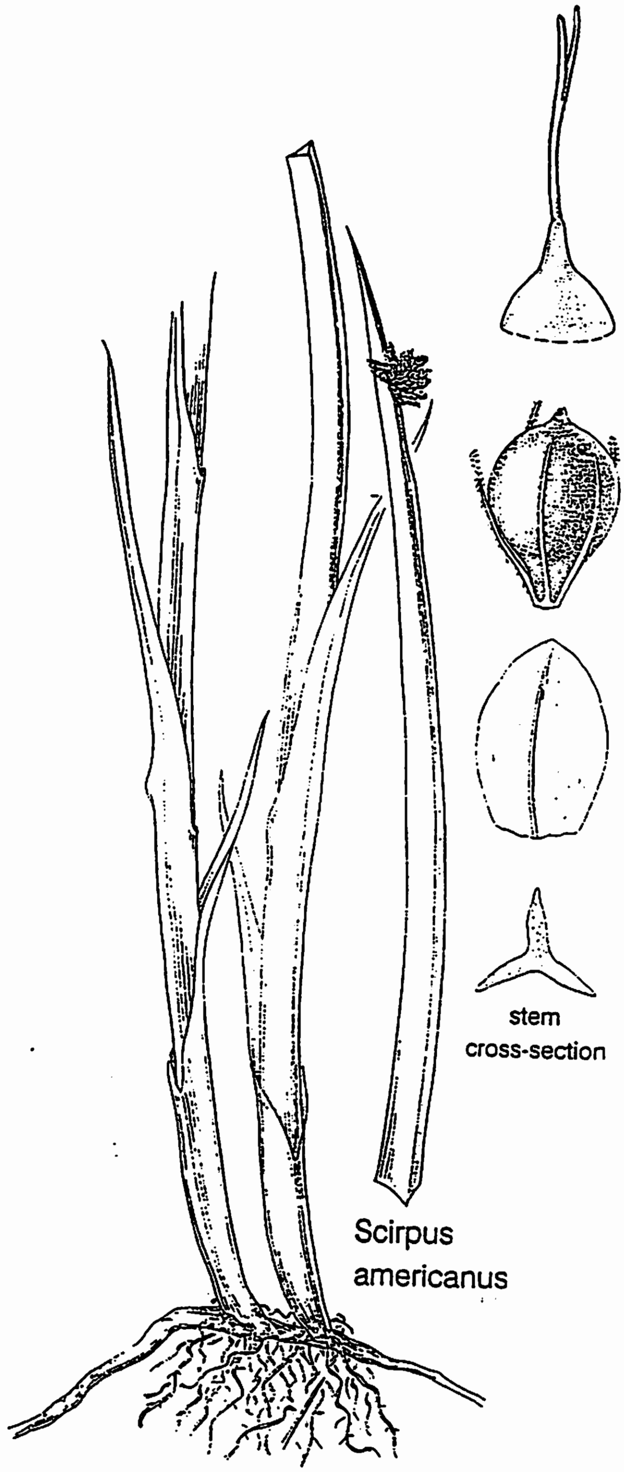


FIGURE 37. Illustration: Scirpus (Bulrush) (from Holmgren 1998).

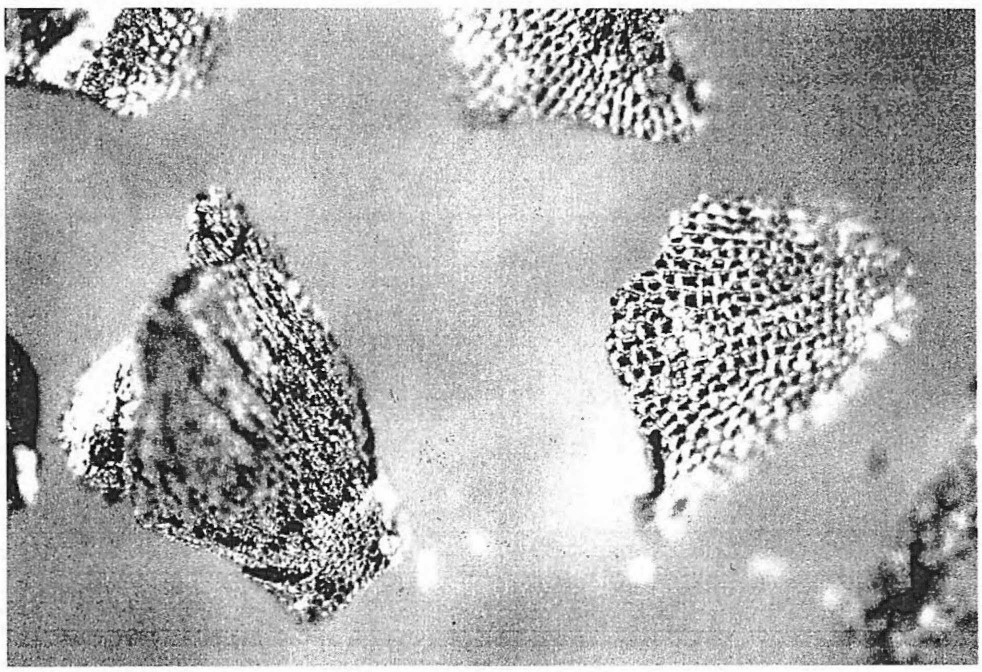


FIGURE 38. Photograph: Magnifies Scirpus (Bulrush) Seed.

Distribution of Seeds on the Main House Floor

The patterned distribution of seeds recovered from the 215 soil samples across the main block excavation at the Bergen site can be seen in Figure 39. The graphic depicts the number of seed or seed fragments per one-liter soil sample taken on a 50 cm grid across a 10 centimeter thick lens of the house fill. The darkest shade represents the highest concentration of seeds per sample, while the progressively lighter patterns represent declining numbers of seeds per sample. The interval pattern of seed counts represented by the different shades of gray exhibit an exponential relationship, which serves to simplify large quantities of data. It was chosen because it helps to illustrate graphically the distribution of seeds on the house floor. The units in white that form the L-shaped trench through the center of the block were excavated in 1998 and not sampled on the same 50cm grid. Four soil samples collected from the three separate units of the trench were available for analysis and added to the data. The pattern represented in Figure 39 suggests that seeds are concentrated in and around the hearth feature and decrease in number further away from the feature. The general shape resembles a circular house structure that measures 4 to 5 meters in diameter with a hearth in the center. Figure 40 shows seed

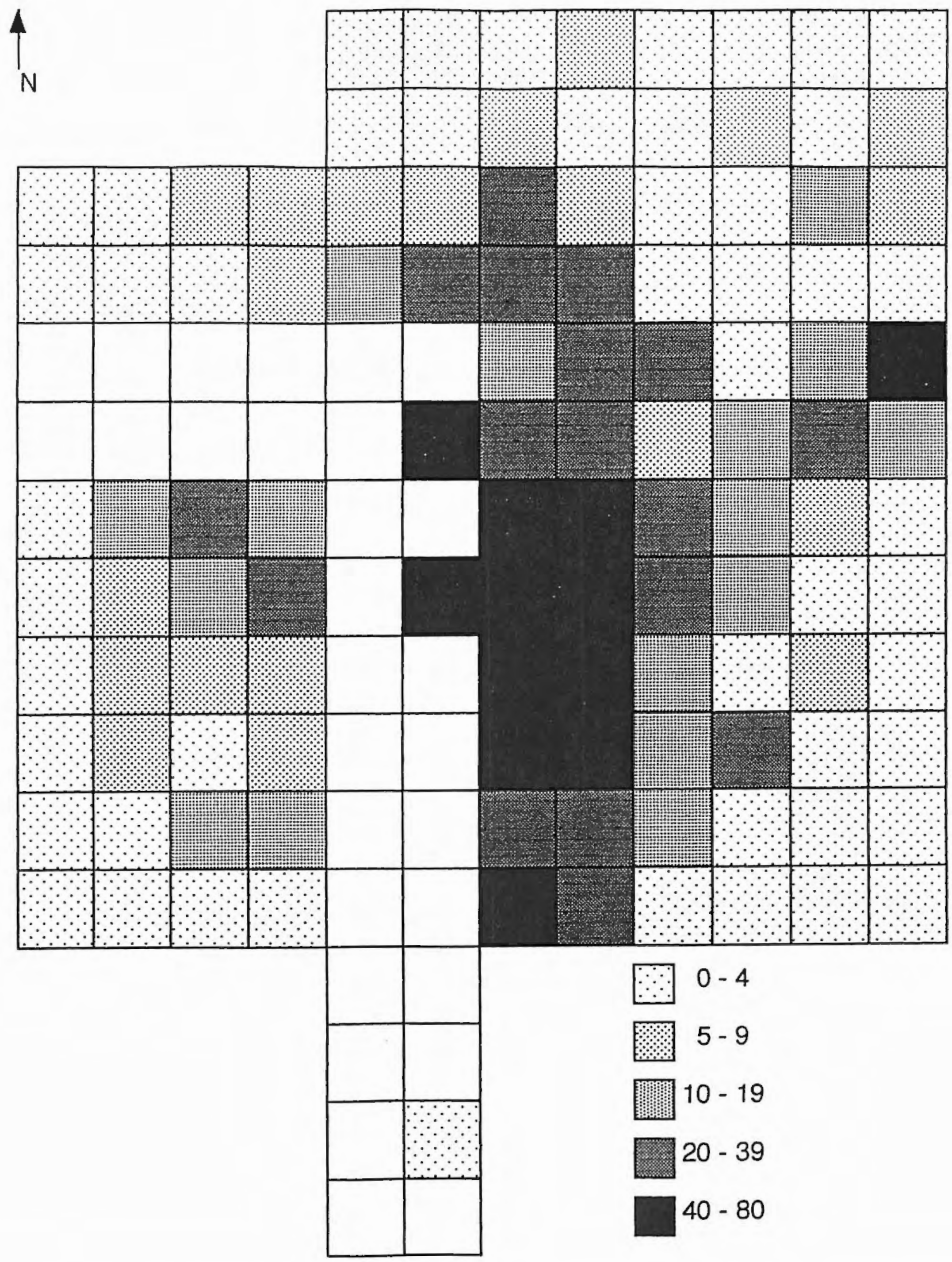


FIGURE 39. Number of Seeds Per One-Liter Soil Sample from the Main Block. Data from Appendix C.

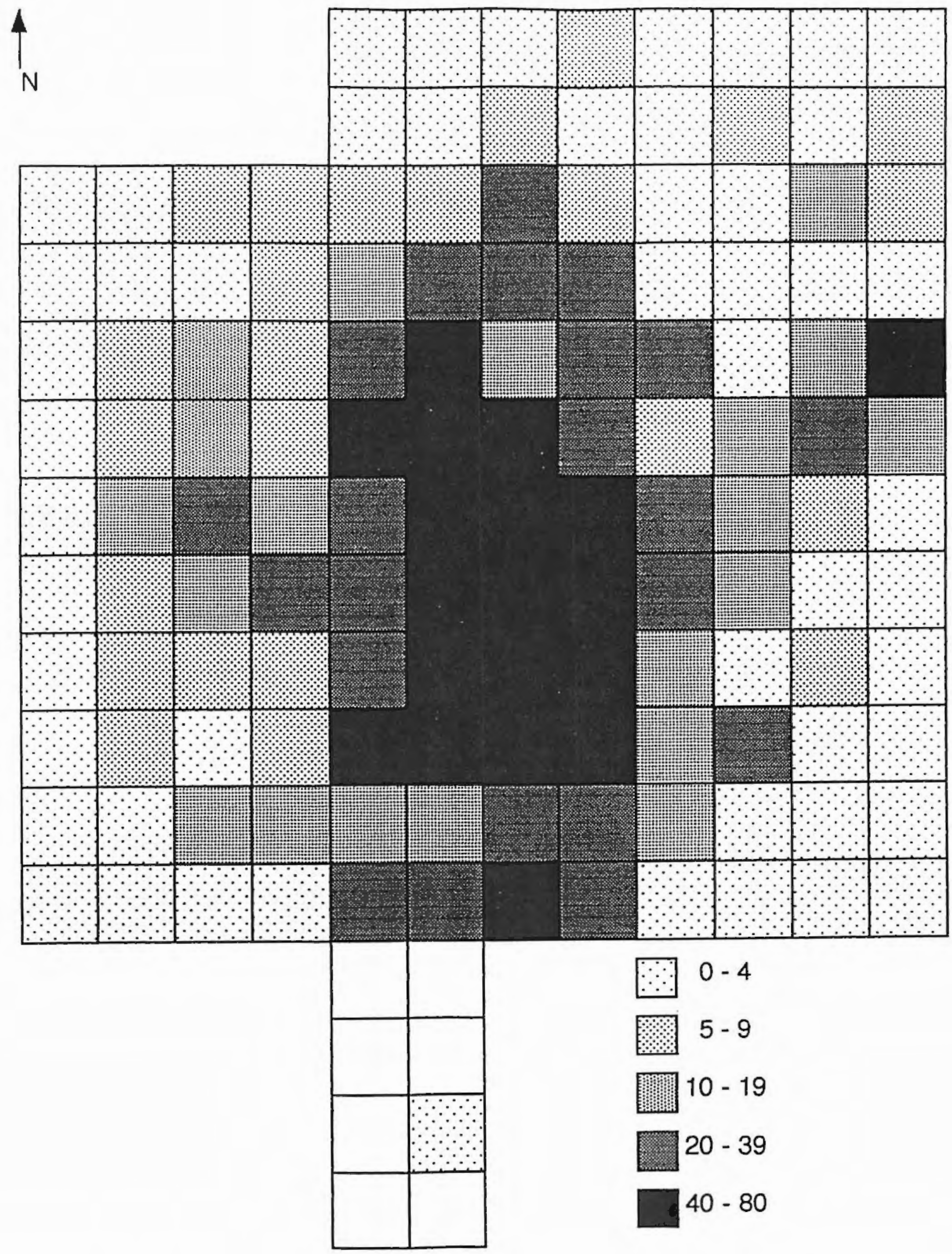


FIGURE 40. Number of Seeds Per One-Liter Soil Sample from the Main House Excavation - Includes Estimates in Un-Sampled Units.

densities across the floor of the main block excavation with estimates placed in the units where no soil was analyzed for macrobotanical remains. Estimates reflect an average of seed totals from the adjacent units. The purpose of filling ithe unsampled units with estimated returns is to conduct data smoothing so that anomalies are considered and general patterns emerge.

Data smoothing is a common technique employed by pollen analysts to "smooth" or "filter" stratigraphic data by using moving averages, or weighted figures (Birks and Gordon 1985). The techniques for smoothing data in paleoethnobotanical studies can vary, but the aim is the same: the removal of 'noise' from the data with minimal disturbance of the 'signal' (Birks and Gordon 1985:22).

For this project, data smoothing was accomplished by weighting the results in the 50 cm units. Each central unit was given a weight of 10. Adjacent units (those to the direct north, south, east, and west) were given a weight of 5. Finally, the four units located on a diagonal from the initial square were given a weight of 1. These quantities were added together and divided by the number of weighted units. The formula used in these calculations is as follows:

$$\frac{c*10 + 5(a1+a2+a3+a4) + 1(x1+x2+x3+x4)}{1(10) + 5(4) + 1(4)}$$ where:

c= the center unit a= the adjacent units x= the diagonal units

This formula was applied to all the units across the Main House floor.

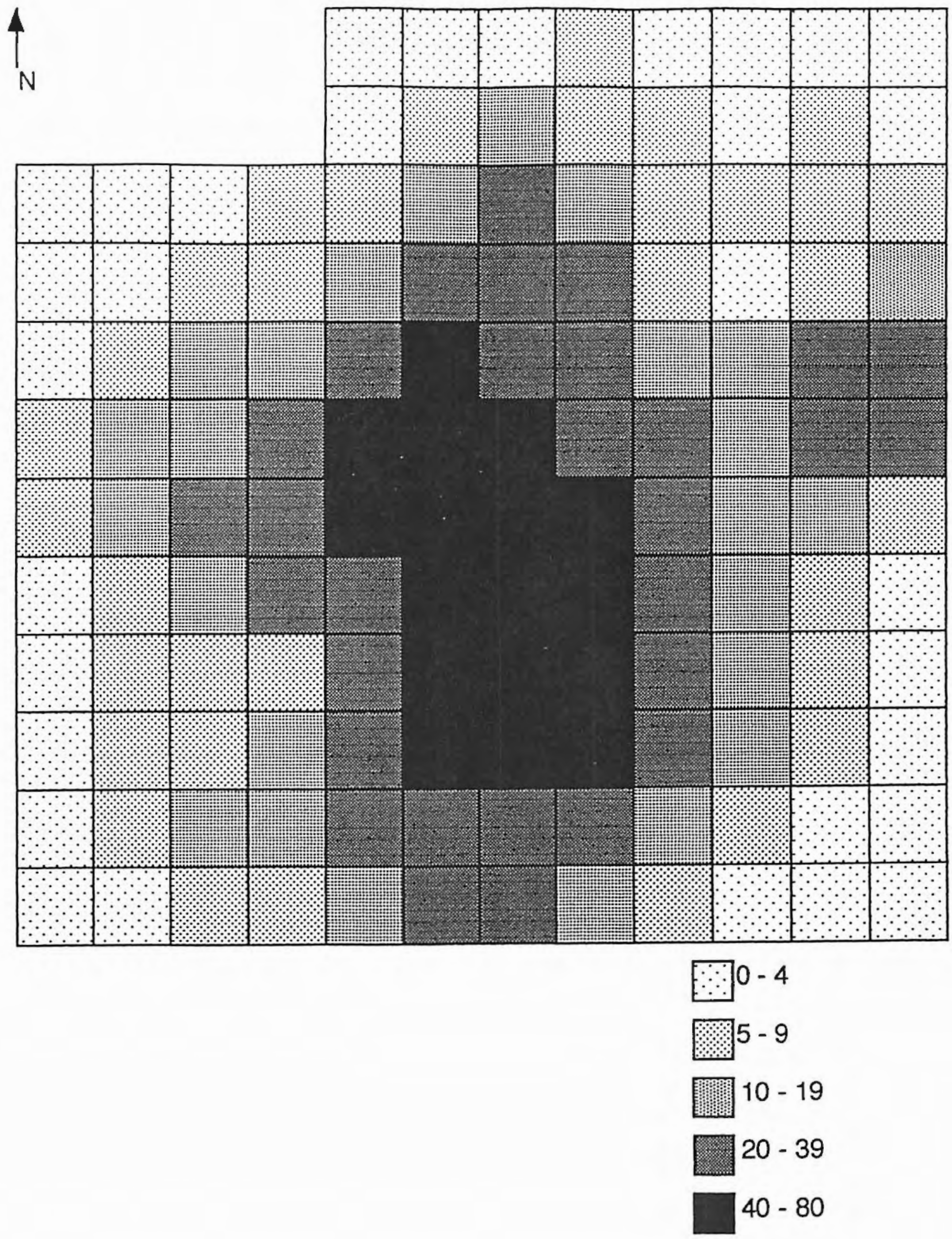


FIGURE 41. Distribution of Seeds on Main House Floor – Weighted for Data Smoothing. Data from Appendix C.

Figure 41 represents the weighted results of seed data from the main house floor. The distribution of seed densities across the block excavation in this figure depicts a clearer and more simplified pattern of the general trends. Similarly, the pattern represents high concentrations of seeds in and near the central hearth, while densities are reduced significantly in what has been designated as the area outside the house perimeter. The circular pattern that is represented in this distribution correlates with observations made in the field regarding the boundaries of the house structure. That is, evidence such as post holes and the shallow dish shaped contour of the floor suggested a circular structure. The distribution of seeds reflects this shape.

Another feature that consistently shows up in the seed distribution patterns of Figures 39, 40, and 41 is the high concentration of seeds on the east side of the block. If this area is located outside the house structure, one might have predicted a low percentage of botanical remains as is represented elsewhere in the block. However, spatial analysis of the data, both weighted and un-weighted, shows this concentration off to the east edge of the block. Since observations made during excavations indicate that the house structure was circular in shape, with a central hearth, it is inferred that this high density of botanical remains represents an east-facing doorway. Figures 40 and 41 also contain evidence of a pathway from the central portion of the house to the east-facing doorway. Accounts from both ethnographic and archaeological investigations in the region indicate that habitation structures often contained doorways facing east. For example, a shallow house depression with a ramp up toward an east-facing doorway was identified at the Big M site, another Middle Holocene occupation in the Fort Rock Basin (Jenkins 1994). A plausible explanation at the Bergen site is that the area just outside the door may have served as a human activity area where plant processing took place. The warmth and light of the morning sun would have made a processing area in this location particularly inviting during the cooler fall and winter months. Artifacts encountered in the surrounding units included an abundance of fire-cracked rock. In addition, excavators exposed the edge of what appeared to be a small pit-like feature on the extreme eastern edge of the block in this unit, suggesting the possibility of plant processing. While time limitations precluded further investigations in the field, the association of botanical remains with artifact distributions provides strong support for the "doorway" interpretation.

Another possible activity area on the eastern side of the house is suggested by artifacts from the southeast corner of the block, and lends credence to the idea of an east-facing doorway. In this area, very little botanical material was present, but extremely high numbers of obsidian flakes were collected in the field. It is likely that this area represents a lithic work station just south of the doorway.

Differential Seed Patterning on the Main House Floor

A comparison of different seed types represented in the house may also reflect different, perhaps specialized, activity areas. Figure 42 depicts the distribution pattern of Cheno-Ams (Chenopodiaceae/Amaranthus) across the house floor, while Figure 43 represents the distribution pattern of Scirpus, or bulrush. These seed types are the two most abundant plant categories preserved in the deposit. Cheno-Ams are more closely associated with the hearth region in the center of the house, while bulrush are distributed more broadly in the house. This may reflect a difference in plant usage. That is, while Cheno-ams are primarily utilized for food and fuel, bulrushes are exploited for food as well as for matting and shelter (Colville 1897; Fowler 1990b, 1989; Harrington 1967; Kelly 1964; Moerman 1998).

The higher concentration of bulrush seeds north of the central hearth in the house may reflect a sleeping area, where mats made from the wetland reeds would have been placed on the floor for protection and comfort. This interpretation was tested by investigating the presence of small, freshwater snail shell recovered from the fill associated with the contoured house floor. Freshwater snails live in wet, marshland settings where they attach themselves to reeds such as bulrush. When the plants are transported into the living area and woven into mats, the shells are deposited in the structure. It is reasonable to infer that if mats are concentrated in one area of a prehistoric house, a higher percentage of snail shells may be recovered from the same area. Snail shells recovered from the floor of the main house at the Bergen site were weighed and the results were mapped. Figure 44 indicates that snail shells were differentially distributed on the main house floor. The concentration of both shell and bulrush seeds in the northern portion of the block provides evidence for the presence of sleeping mats in this part of the house. This example underscores the value of paleobotany and micro-analyses as tools that can be used to probe particular questions about the past.

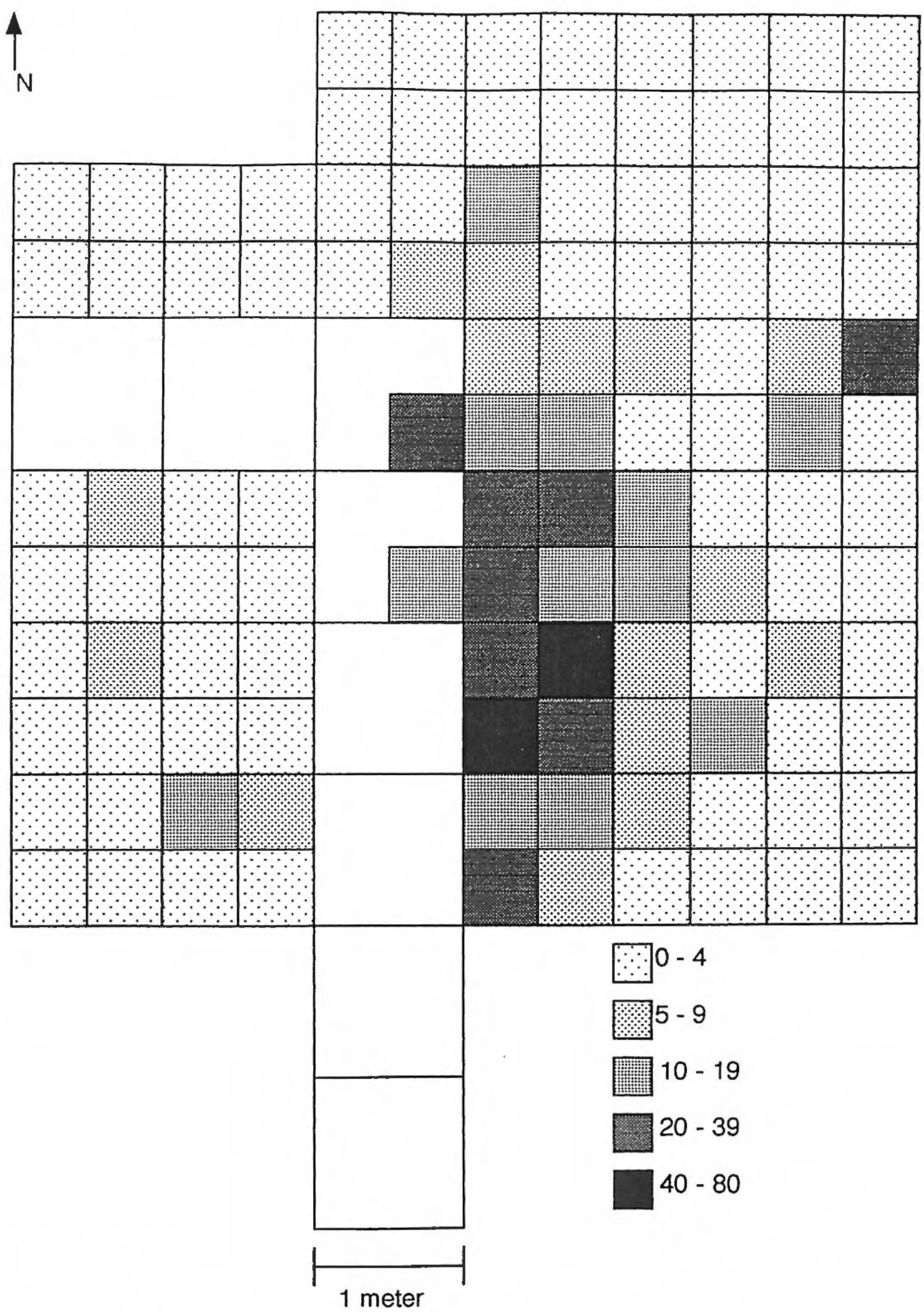


FIGURE 42. Distribution of Cheno-ams on the Main House Floor.

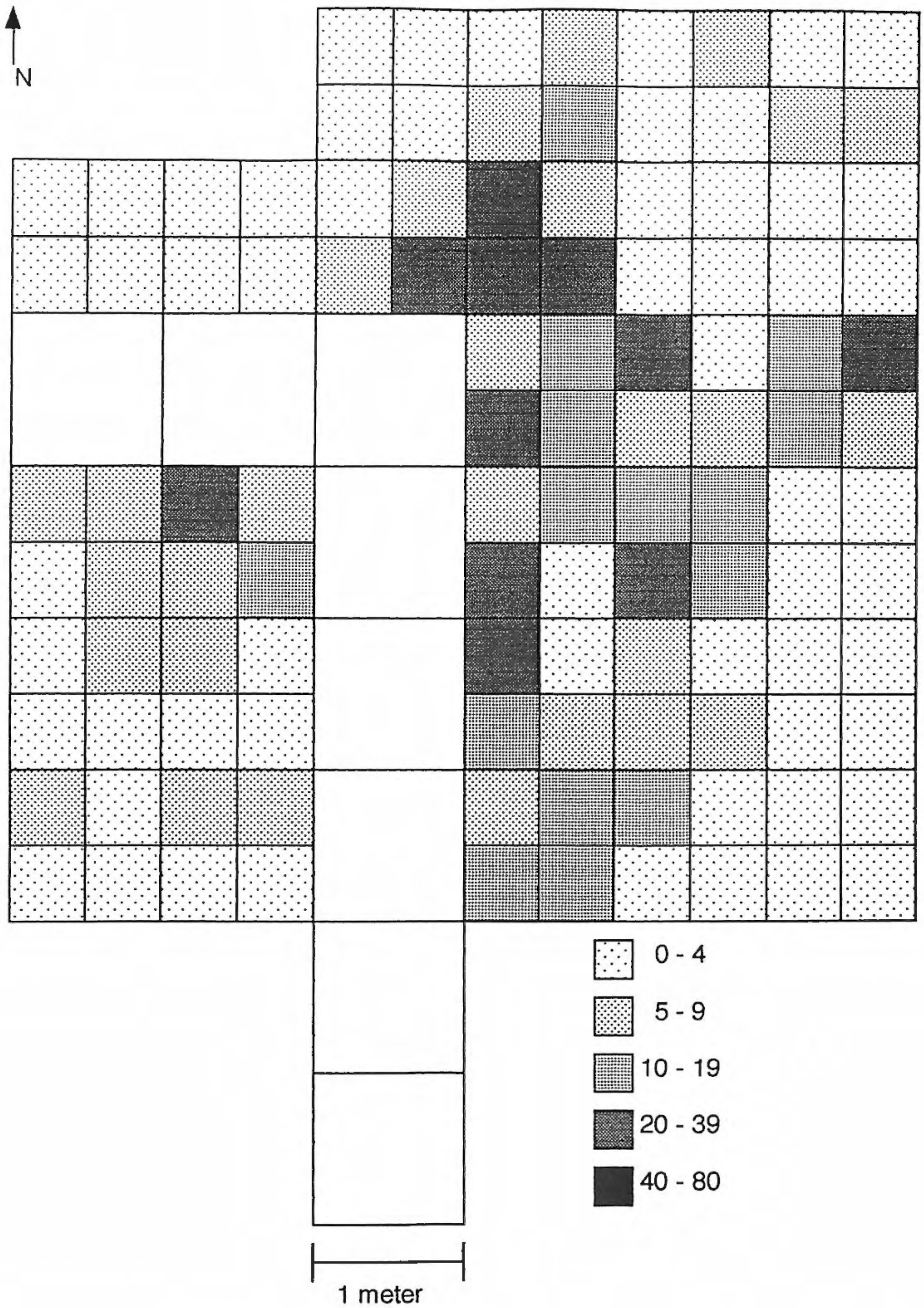


FIGURE 43. Distribution of Scirpus (Bulrush) on the Main House Floor.

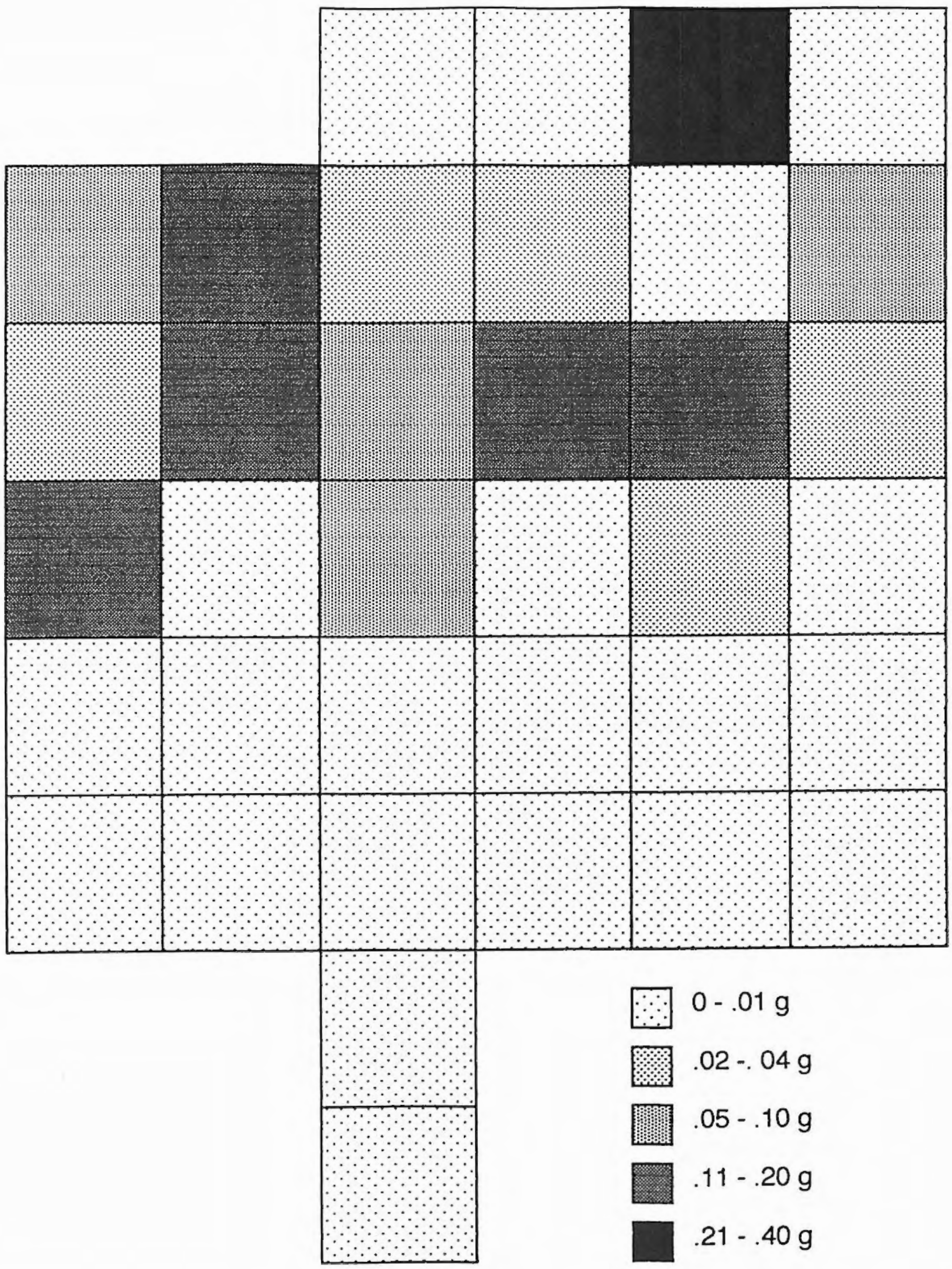


FIGURE 44. Distribution of Freshwater Snail Shell in the Main House at the Bergen Site.

Faunal Remains in Flotation Samples from the Main House Floor

Macrobotanical analyses that involve flotation techniques, such as those undertaken in this research, provide additional data recovered in the heavy fractions. While light fractions contain charred seeds, charcoal, and PET, heavy fractions contain items of greater density, such as bone and lithics. At the Bergen site, it was the presence of small fish bones in the flotation samples that proved significant.

Faunal remains collected in the field produced abundant evidence at the site for large mammal processing (O'Grady 2000). The flotation process, however, produced numerous small Tui chub (a small Great Basin minnow) fish bones, suggesting the importance of this dietary resource in addition to large mammals. Many of the fish vertebrae sections (Fig. 45), pharyngeals (teeth), and cranial bones (otoliths) that were recovered from the heavy fractions were no more than one millimeter in diameter. These fragments were passing through the 1/8th inch screen in the field and would not have been recovered if macrobotanical analyses had not been done at the site.

The distribution of fish bone collected from heavy fractions on the house floor is shown in Figure 46; the weighted data in Figure 47. The overall shape of the house is reflected more clearly in the analysis of fish bone as opposed to total bone recovered from the samples (represented in Figures 48 and 49).

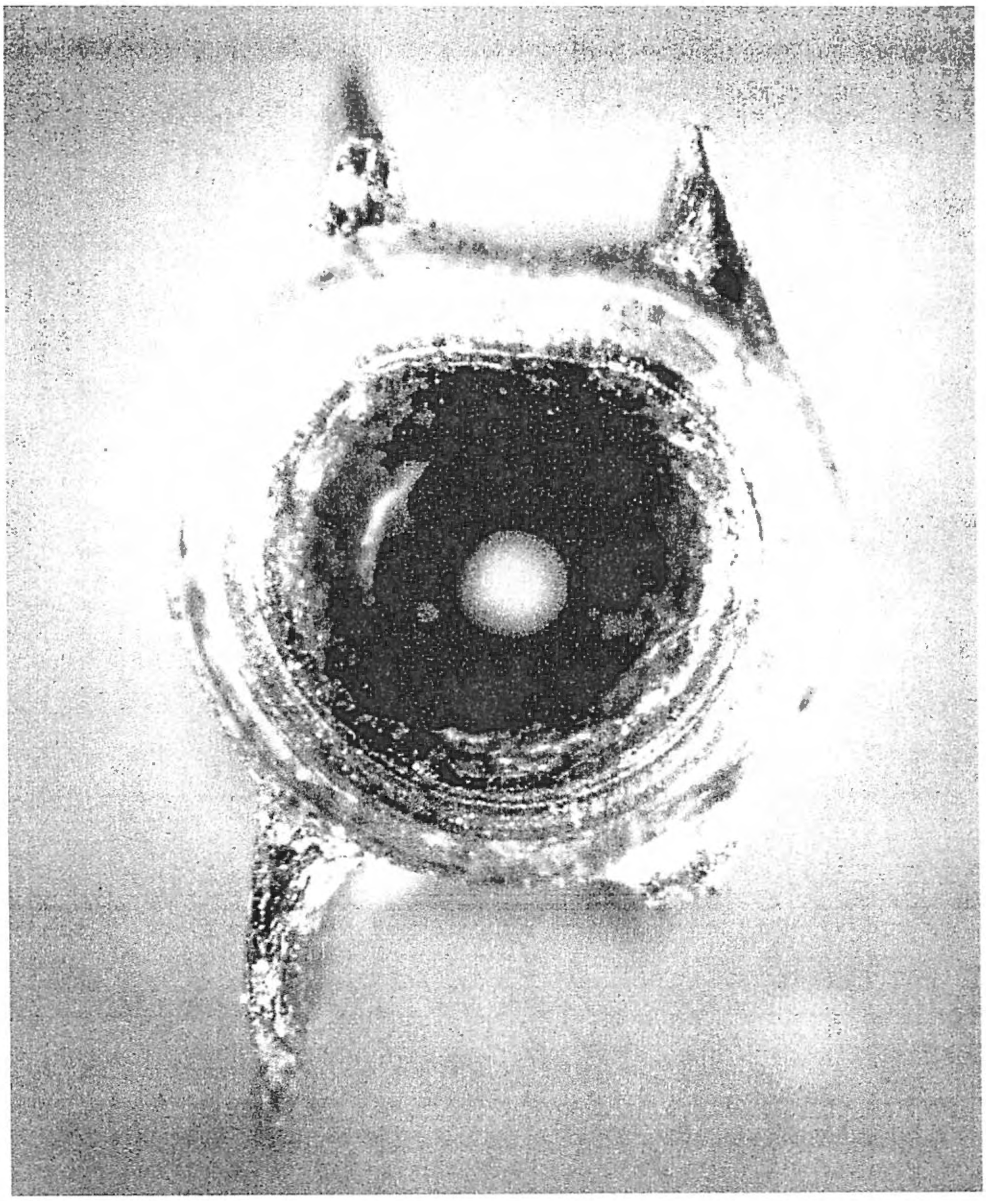


FIGURE 45. Photograph: Magnified Tui Chub Vertebrae.

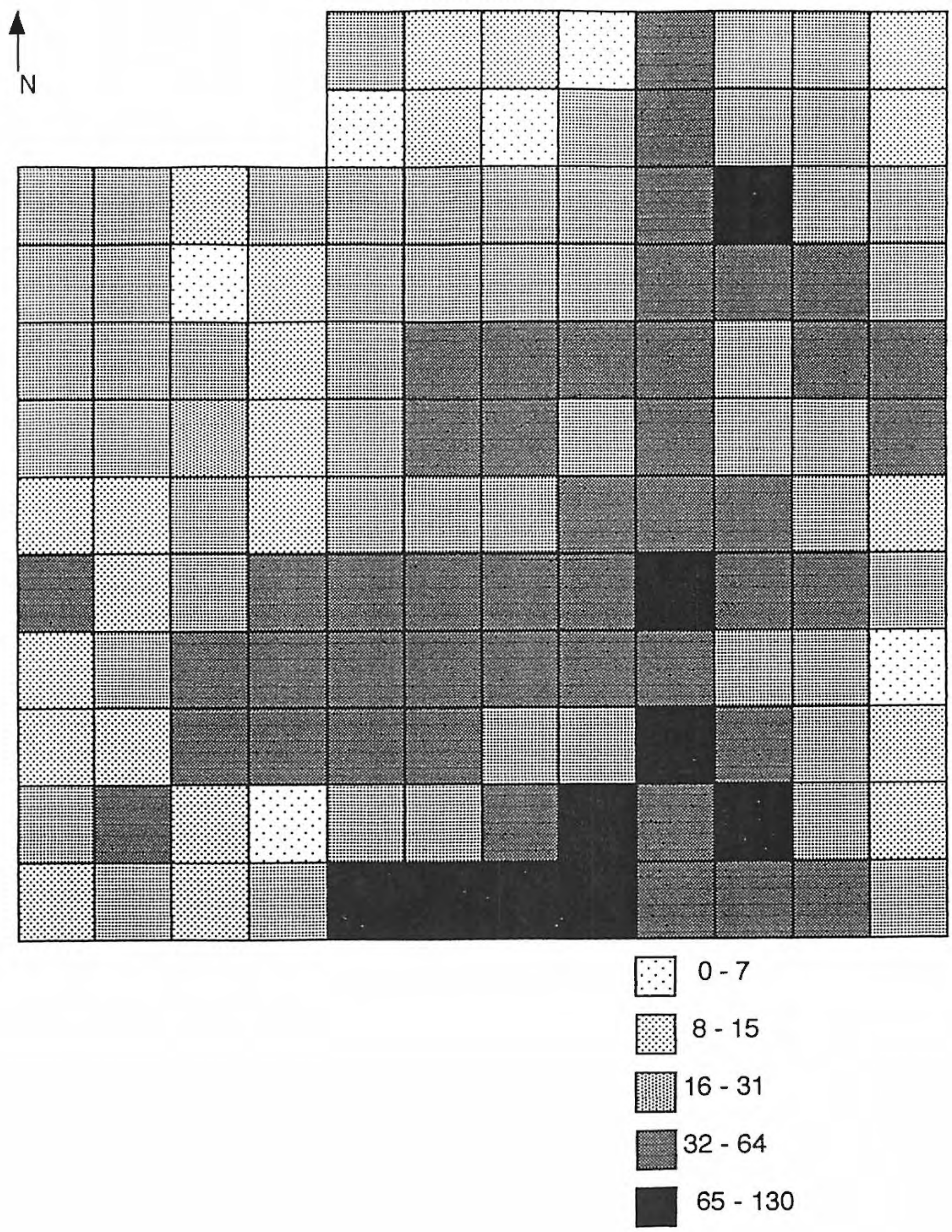


FIGURE 46. Distribution of Small Fish Bone on Main House Floor.

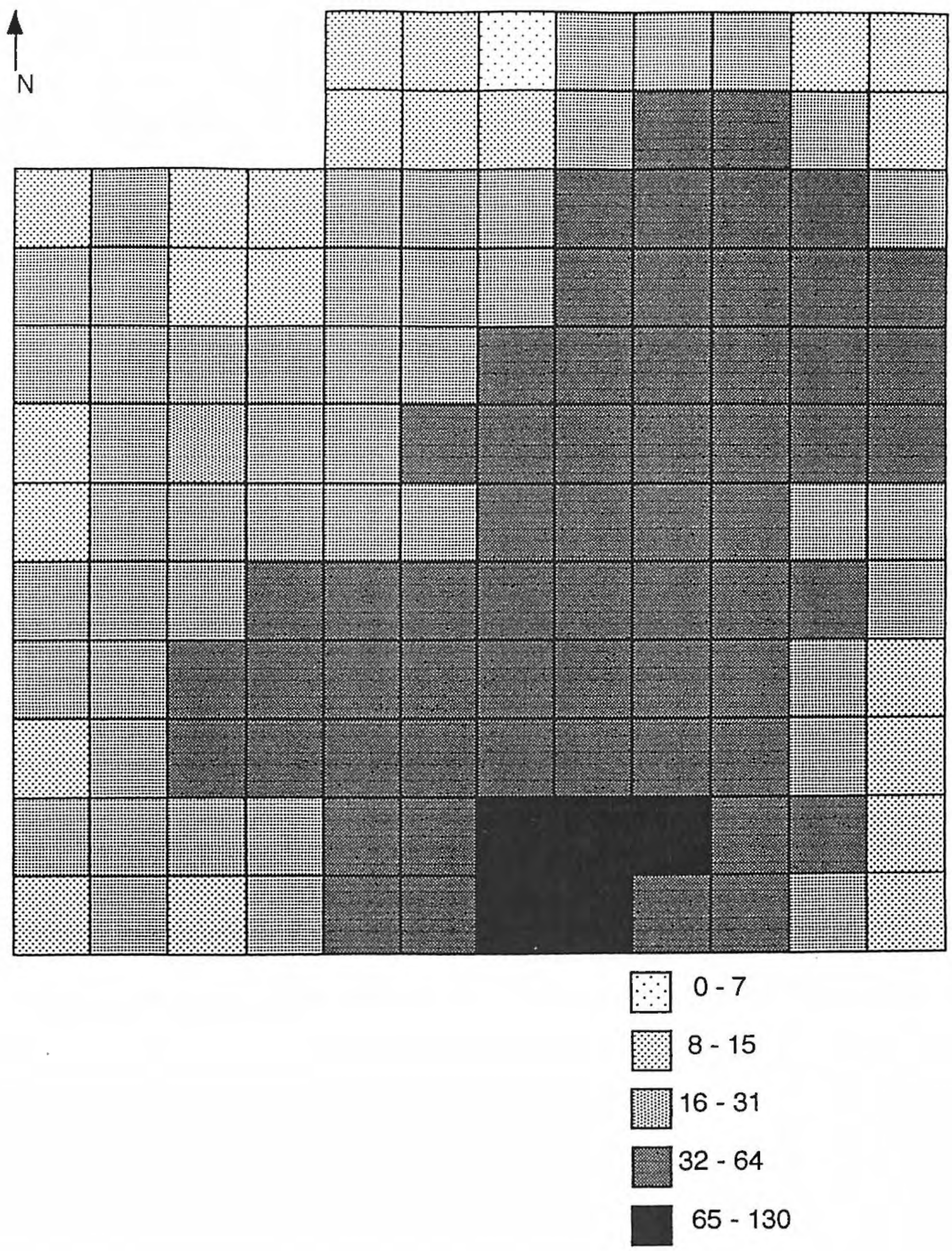


FIGURE 47. Distribution of Small Fish Bone on Main House Floor – Weighted for Data Smoothing.

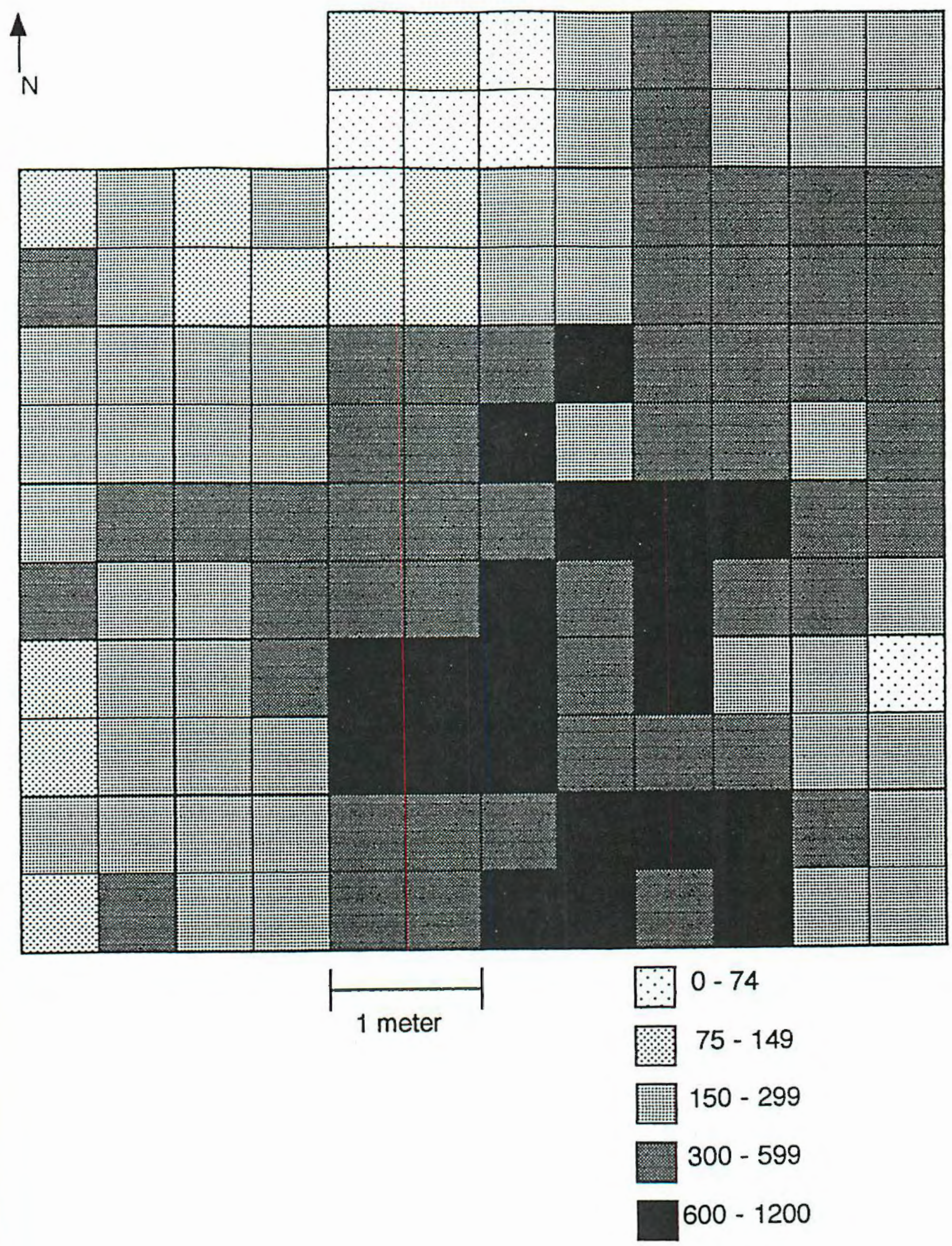


FIGURE 48. Distribution of Total Bone from Flotation Samples on Main House Floor.

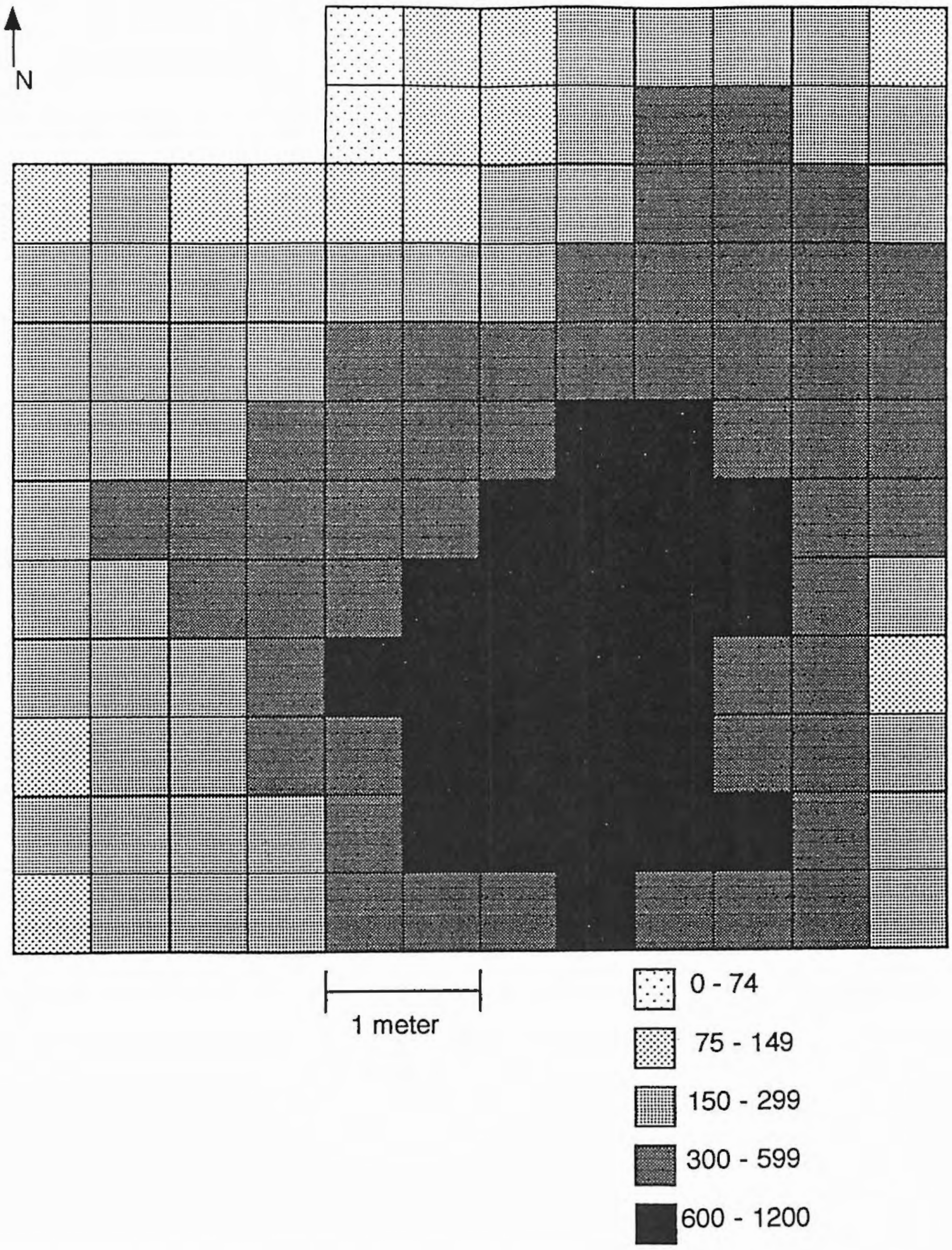


FIGURE 49. Distribution of Total Bone from Flotation Samples on Main House Floor, Weighted for Data Smoothing.

Distribution of Botanical Remains in the 2000 House at the Bergen Site

The human occupation represented in the "2000 House" is located 5 meters northeast of the main block excavation and was radiocarbon dated to 5090+/-100 BP. Sampling for macrobotanical remains in the 2000 house consisted of analyzing samples from a one meter wide swath on a north/south axis through the center of the house. A total of 20 samples were analyzed from seven one-meter square units. Cheno-ams and Scirpus represent the dominant seed types recovered from the flotation samples in this excavation (Fig. 50). A total of 466 seeds or seed fragments were recovered from the 2000 house floor. Of these seeds, 425, or 91%, were identified as Scirpus (bulrush). The remaining 9% were represented by Cheno-ams. Of the Cheno-Ams, 80% could not be further identified due to fragmentation or the presence of only the embryo. Fifteen percent of the Cheno-ams were identified as Suaeda (waada); and five percent were attributed to the genus Chenopodium (goosefoot).

The range of wood represented in the 2000 house is very similar to what was recovered in the main block excavation. While many pieces of charcoal were fragmented or vitrified to the degree that identification was made impossible, the larger pieces indicated the presence of Artemisia (sagebrush), Atriplex (saltbush), Cercocarpus (mountain mahogany), Chrysothamnus (rabbitbrush), Juniperus (juniper), Purshia (bitterbrush), and Sarcobatus (greasewood).

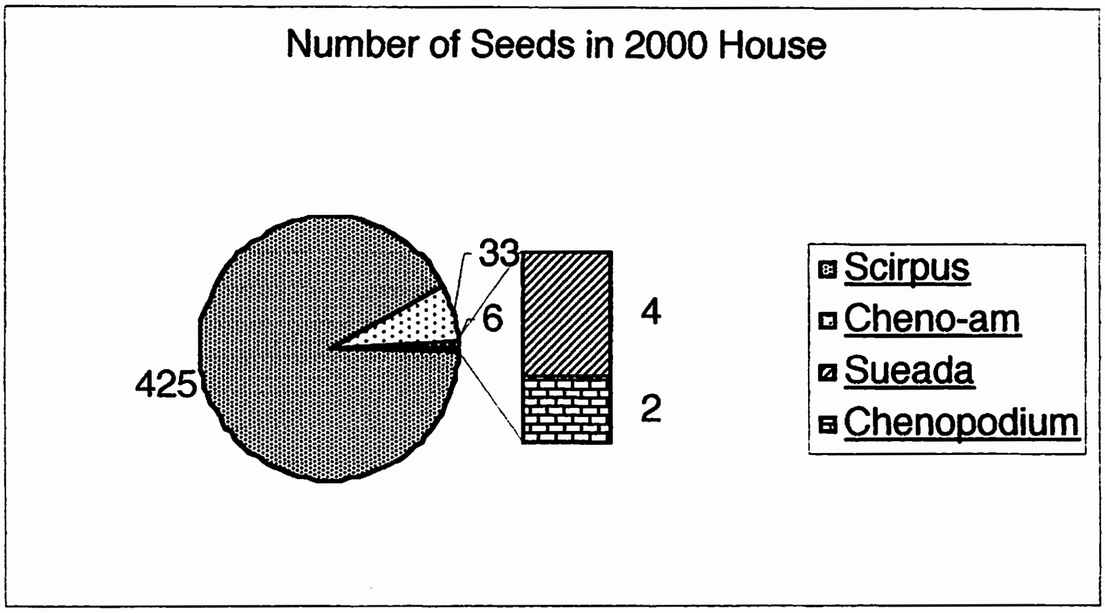


FIGURE 50. Number of seeds represented in 2000 House at the Bergen Site. Data from Appendix C.

The 2000 House posed some challenges to the excavators, due to previous looting by artifact collectors, on the eastern side of the block. Evidence for looting included the recovery of plastic cigarette butts 50 cm below the surface and soft, dark and light striated deposits of sediment indicative of mixing. These deposits also contained a much higher concentration of very fine rootlets. Rootlets are often observed in loose, aerated soils that provide a more conducive microhabitat for growth when compared to the compact sediments associated with undisturbed deposits. Fortunately, 11 one-meter units, on the western portion of the block, produced intact deposits. Cultural features encountered in these undisturbed units combined to provide convincing evidence of a house floor in that location.

Another problem associated with the macrobotanical sampling of the 2000 house involved excavator error. Eight soil samples were mislabeled on the collection bags and field notes were not detailed enough to correct the problem accurately. Therefore, samples within the one-meter units were averaged, rather than reported on a 50 cm grid. The distribution of seeds recovered from the one-meter wide trench through the 2000 house is represented in Figure 51. The lone 50 x 50 cm sample seen in this figure on the east side of the block was collected in a dark stain which was radiocarbon dated to 4780+/-90 BP. This portion of the house was excavated in 1999, and the dark stain was interpreted as the central hearth. Subsequent excavations that took place during the 2000 season exposed a rich, charcoal-laden sediment just two meters to the south in the same block excavation, which dated to 5090+/-100 BP. It is more likely that this southerly deposit represents the central hearth of the main occupation floor sampled for macrobotanical remains. The deposit which produced the earlier date could have been the result of some other process (i.e., mixing of sediment due to the close proximity of a looters pit, an overlying occupation, or a concentration of organic material from some other source).

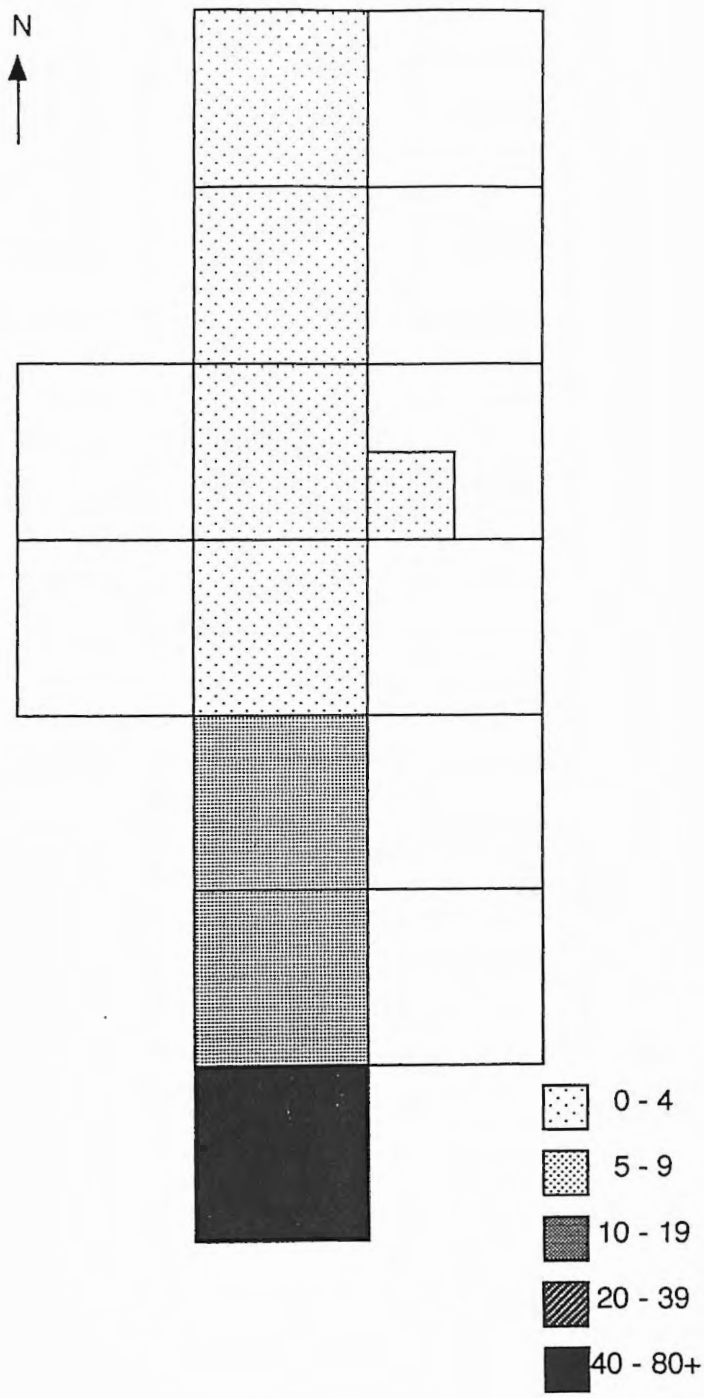


FIGURE 51. Distribution of Seeds in the 2000 House at the Bergen Site.

This interpretation is corroborated by analysis of macrobotanical remains in the block. Figure 51 indicates that the highest density of seeds and charcoal are found in the units to the south, where the central hearth was located. In contrast, only four Scirpus seed fragments were recovered from the 50 x 50cm sample in the dark stain of the eastern boundary of the excavation. Figure 51 also shows the relative scarcity of seeds and charcoal in the northern portion of the block. The northern most unit is where a grouping of lithic artifacts were recovered in close proximity with one another. As discussed in a previous chapter, the association of finely flaked blades, Northern Side-notched projectile points, and ground stone may represent a cache of tools just outside the perimeter of the house structure. In such a location, seeds and charcoal are not likely to be present, as is reflected in Figure 51.

Interpretations

Macrobotanical analyses at the Bergen site produced evidence of diet, environment, seasonality, and activity areas associated with the prehistoric human occupants in the lowlands of the Fort Rock Basin during the Late Middle Holocene. Soil samples from the main house floor at the Bergen site provide evidence of dietary resources that were important to the prehistoric occupants of the site. The data indicate that Cheno-ams such as Chenopodium (goosefoot), Suaeda (waada), and Atriplex (saltbush), were an important food resource. Scirpus (bulrush) was another primary food resource, but was also likely to have been used for other purposes such as shelter and matting. The primary types of wood utilized for fuel include Artemisia (sagebrush), Atriplex (saltbush), Cercocarpus (mountain mahogany), Chrysothamnus (rabbitbrush), Juniperus (juniper), Purshia (bitterbrush), Salix (Willow), and Sarcobatus (greasewood). In addition, the flotation samples produced abundant evidence for the importance of small Tui Chub fish at the site.

The high percentage of bulrush at the site supports the interpretation that, during the Middle Holocene, environmental conditions were different than they are today. Bulrush is a wetland reed that grows along the edges of lakes and marshlands (Hitchcock and Cronquist 1973; Kirk 1975; Peterson 1977), and none grows near the site today. Willow is another plant recovered at the Bergen site that is particularly adapted to wetland environments.

In addition to providing clues to the diet and environment associated with the prehistoric occupants of the Bergen site, results of flotation analyses were also helpful in defining which season or seasons the site was used by humans. The presence of small seeds, such as Chenopodiadeae (goosefoot family) and Cyperaceae (sedge family), lend support for a late summer/fall occupation. These types of small seeds typically ripen during the latter part of the summer, and have been known to ripen from fall, even into winter (Fowler 1982). This evidence, along with the conspicuous absence of summer ripening grasses or spring root crops provides overwhelming evidence for a fall/winter occupation.

Faunal data collected in the screens during excavation and recovered from the heavy fractions of the flotation samples corroborate this evidence. The high concentration of large mammal bone in the deposits suggest that ungulates such as deer and antelope were abundantly available in the region during the Middle Holocene. As previously mentioned, the Bergen site is located in close proximity to a current over-wintering location of large herd of mule deer and antelope (Jenkins et al. 2000b, O'Grady 2000). Biologists have indicated that these patterns of migration, which are shaped by persistent geographical circumstances, are likely to have occurred similarly in the past as they do today. Faunal remains of migratory waterfowl also support a fall occupation. Mature bones suggest that adult waterfowl were there, while eggshells and the bones of juveniles were rare, suggesting that occupation was more concentrated in the fall than in the spring hatching season.

From the flotation samples, a different kind of faunal evidence emerges. Extremely small vertebrae, pharyngeals (teeth), and cranial bones of minnows were identified by O'Grady as juvenile Tui Chubs. Analysis of Tui Chub behavioral patterns indicate that the juveniles remain in the shallows during the colder months of the year, while adults migrate into the deeper portions of the lakes. Thus, large quantities of juvenile fish would have been relatively easy to procure with nets, and a late fall occupation would explain the disproportionate representation of a juvenile fish population at the site.

Finally, the spatial patterning of botanical remains on the main house floor provides evidence of prehistoric human activity areas. With intensive sampling, drawing four samples from each 1-meter square and repeating this at 5cm depth intervals, a relatively detailed picture emerged. The highest concentrations of seeds were found in and around the central hearth feature. Seed frequencies dropped significantly outside the house structure. These results are extremely valuable in that they have the potential to guide future sampling for archaeobotanical sampling of hunter-gatherer sites. For instance, this study has shown that plant remains are more likely to be preserved within the confines of a house structure. Macrobotanical analyses, therefore, can be used to help identify prehistoric house floors.

The distribution of bone around the hearth and within the house is a somewhat less sensitive indicator than are seed and charcoal distributions, and therefore is not quite as reliable for reconstructing activity areas. More analyses of site formation processes and the subsequent disbursal of faunal remains in open dune sites are needed in order to obtain a fuller understanding of faunal distributions.

structure. Similar patterning, observed in a second house at the site encourages confidence in the results obtained. Second, identifications of floral taxa in the macrobotanical flotation samples from the site contribute substantial evidence of plant resources utilized by aboriginal peoples during the Middle Holocene in the Fort Rock Basin. This analysis thus demonstrates the value of archaeobotanical inquiries toward understanding human subsistence patterns among ancient hunters and gatherers worldwide. Third, the application of a household archaeology frame of reference combined with intensive paleoethnobotanical analyses in this study demonstrates the power of fine-grained analyses of hunter-gatherer societies, and leads to recommendations for future studies.

Spatial Analysis

Spatial analyses of cultural remains in and across archaeological sites grew in importance with the focus on Holocene settlement patterns in the 1950's and 1960's and the advent of processual archaeology (Schiffer 1983). Emphasis was placed on studying spatial variability in sites and assemblages to detect different aspects of cultural systems. Close attention was paid to settlement patterns, trade, and social organization, and the emergence of agriculture. Subsequently, studies in ethnoarchaeology, site formation processes, and experimental archaeology provided new insights into patterned human behavior in the archaeological record (Schiffer 1983, Kramer 1985, Binford 1962, 1964, Flenniken 1994).

The emphasis on spatial analyses that emerged with the advent of processual archaeology was applied to paleoethnobotanical investigations of archaeological sites associated with advanced horticultural or agricultural societies (Hill and Hevly 1968, Madsen and Lindsay 1977, Cully 1979, Cummings 1998). These studies (discussed previously) showed that differentially distributed plant remains within a site or a single occupation structure could indicate the location of human activity areas. This is important because these types of analyses provide substantial strength to interpretations of site function. Local and regional comparisons followed, strengthening our understanding of societal patterns associated with past human populations.

While intensive sampling for plant remains in sites associated with sedentary agricultural societies proved useful in spatial analyses, no such study had been undertaken for semi-sedentary hunter-gatherer societies. My research at the Bergen site was designed to do this, by exploring spatial patterns of plant remains in a hunter-gatherer site.

Sampling for macrobotanical remains at the Bergen site involved collecting soil samples on a 50-cm grid across the floor of one Middle Holocene house and similar analysis of another, less fully exposed house floor of comparable age. The patterning of macrobotanical remains in the Bergen site Main House included a concentration of seeds and charcoal in and around the central hearth, with decreasing densities away from the hearth and severe reductions outside the house structure. An area of increased plant concentration on the east side of the Main House floor was interpreted as a doorway. High densities of bulrush seeds and plant parts, along with shells of freshwater snails (which cling to bulrushes), in the northern portions of the Main House suggest the presence of reeds, possibly associated with sleeping mats. This pattern on the Main House floor was also evident in the undisturbed deposits of the 2000 house, located five meters to the north and dating to roughly the same time. Cultural material recovered from a large number of probes at the site suggest that more houses of similar size and antiquity exist there. The picture that emerges from intensive paleoethnobotanical studies at the Bergen site can thus be used to refine our current understandings of human settlement and mobility in the Fort Rock Basin.

Results from this research are significant for two main reasons. First, they provide an in-depth view into house structures occupied by people living about 6000 years ago. Patterns of behavior are evident from the distribution of plants in the excavation. This intra-site type of analysis contrasts and complements the emphasis of previous studies in the region, which centered on broader inter-site patterns of settlement and subsistence. Second, it provides the basis for evaluating macrobotanical studies previously done in the region, and leads to recommendations for improving sampling techniques in future studies.

Regional Archaeobotany

Archaeobotanical assemblages recovered from hearths, house floors, and cache pits associated with Middle Holocene occupations in the Fort Rock Basin indicate that the aboriginal diet was rich and diverse. Lowland sites occupied during the Early and Late Middle Holocene are associated with wetlands and/or wetlands-grasslands ecotonal settings. Houses and storage facilities appearing in the Late Middle Holocene suggest increased population densities and intensified harvest collecting of resources. The archaeobotanical remains from a number of these sites, however, are rather scanty due to poor preservation, bioturbation, or other problems. Although collectively the soil and charcoal samples dating to the Late Middle Holocene contain enough data to *support* general interpretations regarding diet and adaptations, more detailed information is needed to adequately specify and amplify the patterns adumbrated by previous research.

Plant material recovered from the extensive macrobotanical samples at the Bergen site strongly support previous indications that lowland resources were intensively exploited during the Late Middle Holocene. The results also suggest, however, that some previous archaeobotanical interpretations for Middle Holocene lowland occupations in the Fort Rock Basin are problematic. The DJ Ranch and Bowling Dune sites, located along the Silver Lake/Fort Rock channel system, represent habitations which would have existed in extremely rich wetlands/grasslands ecotone environments. Prouty (1995c) reported the presence of many bulrush seeds in flotation samples at DJ Ranch, but contrary to expectations, botanical remains at Bowling Dune were sparse. He suggested that this lack was perhaps because of deflation or bioturbation of the deposits (Prouty 1994b).

Bioturbation, mixing, and deflation have also been offered as explanations for the sparse remains in samples from the Sage, GP-2, and Big M sites (Prouty 1995b, Stenholm 1994). At the GP-2 site only a trace of sagebrush and one fragmented goosefoot (Chenopodium) seed were recovered in the six samples analyzed. Eight soil samples were tested for macrobotanical remains at the Big M site and produced only traces of juniper, sagebrush, conifer, and grass stem tissue in four samples (Stenholm 1994).

Results from the Bergen site indicate that other factors besides bioturbation and deflation influence macrobotanical results. Specifically, the variation in seed and charcoal densities represented in 135 samples taken from the Bergen site indicate that plant materials are not evenly dispersed within structures; therefore, sampling location is critical. Further, the number of samples analyzed is critical if accurate representation of preserved plant remains is to be obtained. In other words, macrobotanical results may be skewed by too few samples analyzed from a site or by samples accidentally taken in "unproductive" locations within the site. The few samples that Prouty (1994b,1995b) analyzed may simply have been too few, or wrongly placed, to give an adequate picture at the Bowling Dune, GP-2, Sage, and Locality III sites.

Recommendations for Archaeobotanical Investigations of Hunter-Gatherer Societies

Many archaeological investigations in the Great Basin have focused on ecological/behavioral models (Jenkins and Aikens 1994a, Fowler 1972, Madsen and O'Connell 1982, Thomas 1983). Such models are not only important to studies in the Great Basin, but to hunter-gatherer societies worldwide. While most ecologically focused research tends to deal with coarse-grained questions such as environmental change and population (Kelly 2000), my research at the Bergen site illuminates much finer-grained concerns.

The research I have undertaken at the Bergen site shows that fine-grained records are, indeed, preserved in archaeological sites by both ecological and artifactual evidence. Although I cannot discuss the thoughts, dreams, or spiritual reflections of the people who lived at the Bergen site 6000 years ago, I do have evidence of where they sat, slept, prepared food, and made tools. If such detailed evidence can be discerned from macrobotanical investigations in an open dune site in the Fort Rock Basin, similar studies should be possible in hunter-gatherer sites across the Great Basin and beyond. It is my opinion that our understandings of the lifeway associated with foraging populations of the past can be significantly enhanced by fine-grained household investigations such as the one discussed here.

Macrobotanical analysis of 235 soil samples from the two house floors at the Bergen site have provided a wealth of information about plant resources and human activity areas. Each one-liter soil sample collected and analyzed for macrobotanical contents produced both a heavy and a light fraction. Both fractions were scanned under 10-40x magnification and seeds, charcoal, processed edible tissue, bone, lithics, and shell were removed and identified. This type of analysis is time consuming and expensive, however, and few archaeology projects will include the time or budget to allow for investigations at a similar level of intensity. It was my intent from the outset of this project to conduct an in-depth analysis that would lead to better sampling techniques than those often employed at hunter-gatherer sites in the Great Basin, at a cost in sampling and analysis time much less than was expended on the Bergen site.

Appropriate Recovery Techniques

Before presenting specific recommendations for macrobotanical sampling based on the current study, taphonomic issues associated with the preservation of botanical remains in archaeological sites must be acknowledged. Many factors, both cultural and non-cultural, bias the botanical remains recovered in archaeological contexts (Pearsall 1989, Popper 1988). How a plant is used, what it is used for, how or if it is stored, and how it is deposited all affect preservation. Soil type, temperature, and moisture all determine the activity of micro-organisms that break down botanical material. In addition, the physical structure of some taxa favors their preservation over other taxa (Pearsall 1989, Popper 1988, Toll 1988, Gremillion 1997).

Other biases are reflected in the researcher's recovery techniques. Wagner (1988) argues that dry screening, water screening, and flotation techniques variously create biases not only for the recovery of particular specimens, but against others. Water screening using nested screens works well to recover lithics, non-fragile bone, and ceramics; however, shell and botanicals are often damaged or lost by the process. Flotation is the preferred technique for recovering macrobotanical remains from archaeological sites. Thoughtful analysis and care should be taken throughout the process to avoid loss or damage to plant materials (Wagner 1988).

Analysis of archaeological charcoal can provide evidence of wood selection or of ancient vegetation and environment. Factors that bias charcoal assemblages include cultural selection, burning and preservation of particular taxa, and regional plant diversity (Smart and Hoffman 1988). Although these are beyond their control, archaeologists must understand how they affect the assemblage. By controlling sampling and recovery techniques in the field and the lab, as well as drawing from an extensive comparative collection, further biases can be avoided.

Smart and Hoffman (1988) argue that a "synthetic" approach incorporating charcoal, other plant macrofosils, fauna, pollen, phytoliths, and sediment types should promote sound reconstruction of paleoenvironements. Wagner (1988) also advocates the use of two different techniques at a site to ensure the recovery of reliable data. Paleoethnobotanical investigations of Anasazi house pits excavated by the Delores Research Project demonstrate the value of combining pollen analysis with macrobotanical analysis (Cummings 1998).

How Many Samples to Take, and Where to Take Them?

The two primary decisions archaeologists have to make concerning macrobotanical analysis of a site are how many samples to take and where to take them. As researchers become aware of the patterning of preservation in archaeobotanical data, there is often a temptation to sample only the most productive areas such as hearths and trash middens. Toll (1988) warns that this approach may seriously skew the data. She advocates a two-phase process in which all flotation samples are first “scanned” in order to quickly assess the overall ethnobotanical productivity and preservation, and a smaller number are then studied in more detail. Toll (1988) employed scanning in the analysis of a large complex site in Chaco Canyon, New Mexico. At Pueblo Alto, scanning allowed the inclusion of floor samples of several rooms in the structure that would have otherwise been left out. The data from these low density areas led to a better understanding of the spatial distribution of food-processing activities within rooms and throughout the pueblo (Toll 1988).

Taking site formation processes, differential taxa preservation, sampling error and the limiting constraints of time and budget into consideration, alternative sampling strategies were explored in the Bergen site excavations. The first alternative tested was to ask whether fewer samples taken across the excavated block would produce similar distribution patterns to those achieved with many samples. The detailed analysis plotted the data on a quarter meter grid. For the test, a one meter grid was used. Data from the four quarters of each one-meter unit on the house floor were averaged to simulate results that would be obtained from a single large sample taken from the unit. Figure 52 depicts the density of seeds across the main block excavation in which

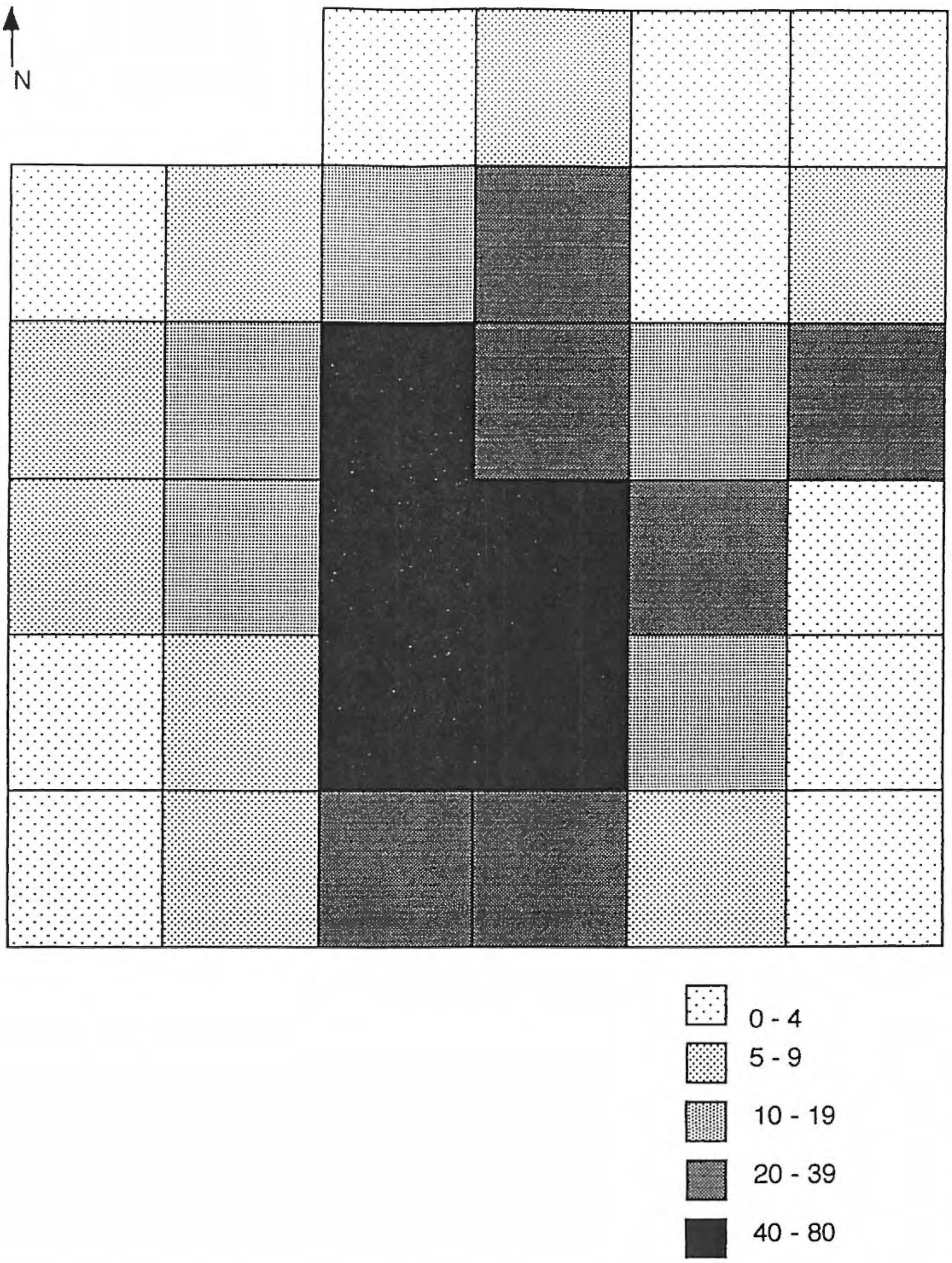


FIGURE 52. Distribution of Seeds in Main House Block, One-Meter Averages.

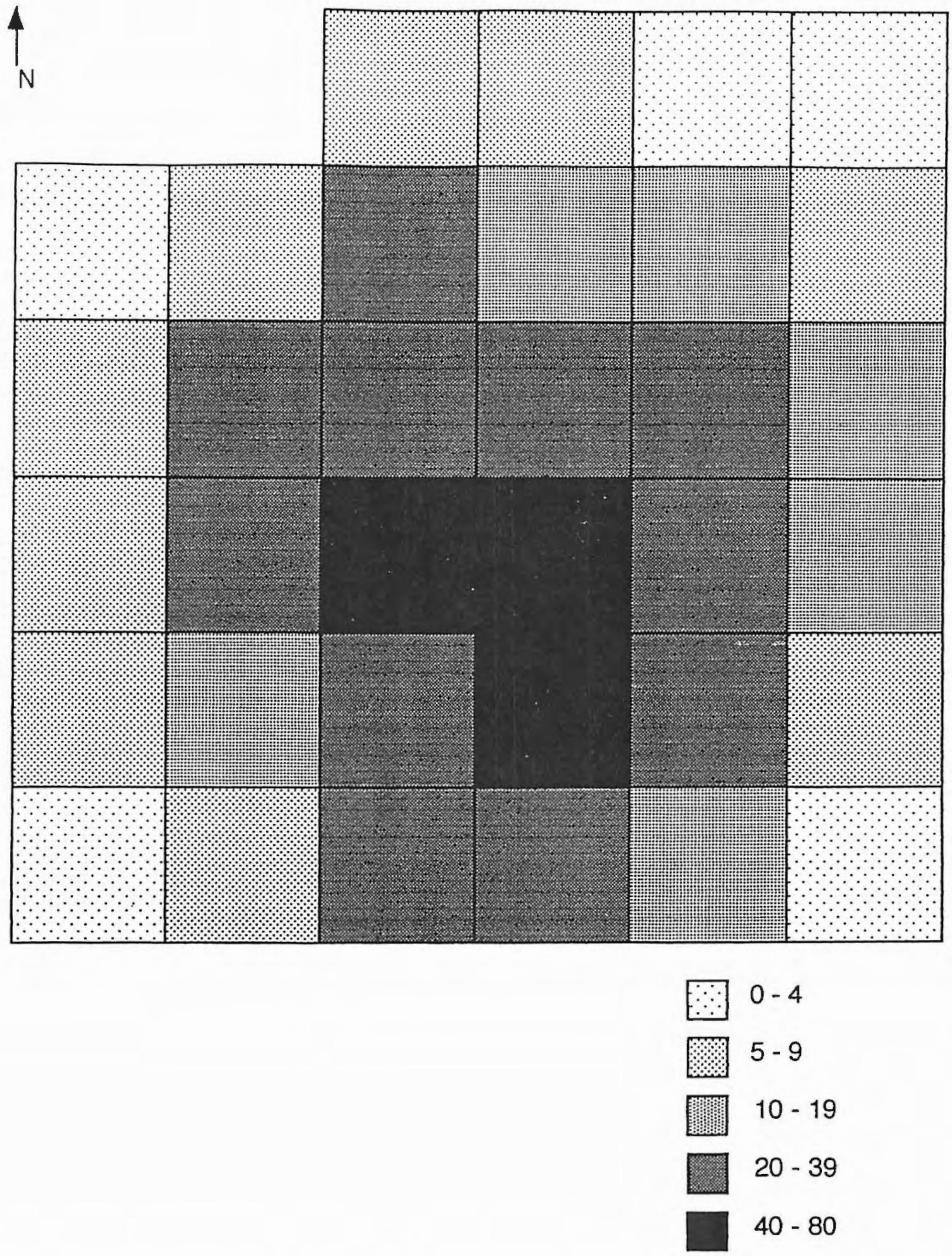


FIGURE 53. Distribution of Seeds in Main Block, One Meter Unit Averages. Weighted for Data Smoothing.

seeds per liter sample were averaged within each meter. Figure 53 depicts the same data after weighting, or data smoothing, was conducted (See formula in chapter III).

The concentration of seeds around the hearth and in the house is well represented in both Figures 52 and 53. In contrast to the quarter meter grid, of course, some detail is lost with this level of analysis. This is most obvious in Figure 53, where clear evidence of the doorway on the right side of the house floor is no longer apparent. Therefore, if the researcher is interested in identifying human activity areas in the site, taking one sample per meter square in the excavation would not yield sufficient data.

Alternatively, if the researcher was mainly interested in simply identifying the range of macrobotanical material in the site, then a different strategy could be employed. Obviously, fewer than 215 soil samples would be required in an excavation the size of the main block at the Bergen site if the goal was to obtain a list of plant foods preserved in an archaeological deposit. This study, in addition to others (Madsen and Lindsay 1977, Cummings 1998), indicates that central fire-hearths are excellent places to seek a sample of comprehensive botanical remains. With the possible exception of storage pits, middens, and vessels (not analyzed in this study), central hearths produce the greatest abundance and variety of plants remains preserved in an archaeological site.

Care must be taken, of course, to sample heavily in and around such a feature. Collecting and analyzing just one or two samples from a hearth would likely not represent the range of plant remains present in the feature. In addition, the condition of the remains must be considered. Samples recovered from deep at the base of a hearth may produce plant remains, but identification may be compromised due to fragmentation by intense heat. Therefore, archaeologists should collect and analyze soil samples from the full depth of the hearth as well as immediately around it.

It is my opinion that the best, and most cost-effective, approach to sampling a site similar to the main block excavation at the Bergen site would be to collect one sample per one-meter unit directly in the house fill above the underlying sterile floor. In addition, extra samples should be taken in features such as fireplaces and storage pits. For instance, on this latter point, the darker soil deposit encountered on the eastern side of the main block at the Bergen site was perplexing in the field. It was concentrated primarily in one unit and did not fit with our initial interpretation that this area was "outside" the house. It was not until the macrobotanical results were plotted on a map that the significance of this area was understood. The patterned distribution of seeds and charcoal across the living floor reflected the location of the central hearth with high densities of plant remains, while areas outside the structure were essentially devoid of botanicals. When considered in the context of this site and the archaeological and ethnographic histories of the region, it was concluded that the high concentrations of seeds and charcoal on the east side of the block were most probably associated with a doorway. Food refuse could have been tossed out the door or trampled and deposited by human movements within the site. In addition, this area may have served as an activity locale, where plant processing would have taken place in the warmth of the morning sun.

Summary of Recommendations

Based on archaeobotanical analysis of two Middle Holocene house structures at the Bergen site, the recommendations summarized in the following points are offered in an attempt to assist and improve upon sampling techniques employed in the archaeological investigations of comparable hunter-gatherer sites both within the Great Basin and outside of it.

1. Critical to the outcome of archaeological investigations of almost any project, research designs ought to include thorough consideration of all levels of analysis intended in the project. If researchers want to obtain clues to past diet, environment, shelter, tool manufacture, or medicine, then archaeobotanical investigations should be included as a priority in the research design.

2. Sampling strategies for pollens, phytoliths, and macrobotanical remains must be closely linked with the overall research questions associated with the project. If the archaeologist is interested mainly in obtaining information regarding past diet, samples should be collected in and around the potentially richest features, such as fire hearths and storage pits. It is important to include more than just one or two samples from these features to ensure that the range of plants preserved in the site will be represented in the collected data. In addition, it is critical to obtain samples from the area just outside a specified feature. While plant remains such as seeds and wood must be charred in order to be preserved in most archaeological contexts, the intense heat of a fire could destroy the identifiable features of macrofloral remains. Therefore, the area just outside a hearth may prove to be the most productive for positive identifications.

3. If the archaeologist wants to study human activity areas within an ancient occupation, samples should be taken systematically across the excavation block. In most cases, one sample collected in every one-meter square unit within the identified cultural deposit should suffice. Cultural features such as hearths, pits, or ovens should be sampled more intensively. I recommend sampling such features on a 50 cm grid. In addition, if there are any areas of doubt or concern in the field, these areas should also be sampled more intensively.

4. Macrobotanical samples should be analyzed in standardized one or two liter volumes. If the samples are kept at standardized volume sizes, patterns across space and through time will be more convincingly demonstrated in the archaeological record. This is especially important in long term research projects where inter and intra-site comparisons are common.

5. Procedures for separating macrobotanical remains from soil sediments in archaeological deposits should involve the soil flotation process, rather than water screening. The finest meshed sieves used in this process should be at least .25 mm in order to capture fragments of extremely small seeds.

6. Prior to flotation, a small amount of soil (1-2 cups) should be removed from the sample and set aside for storage. Pollen or phytolith analysis may not be included in the initial research design or budget, but may be possible or necessary in the future.

7. If the archaeologist takes the time to learn the relatively "low-tech" process of flotation, more soil samples can be collected in the field. Bulk samples can be problematic due to the limited space and weight requirements associated with collected artifacts. I contend, however, that even if the soil could not be

analyzed immediately, it could be *processed* by flotation. This would significantly reduce the bulk from a one or two liter volume sample to no more sediment than would fit into a sandwich-sized zip-lock baggie. Researchers must be cognizant of the museum curation issues surrounding the collection of soil in the field.

CHAPTER VI

SUMMARY AND CONCLUSIONS

The research presented in this dissertation combines paleoethnobotany with household archaeology in an investigation of a Middle Holocene site in the Fort Rock Basin. It represents the first study of its kind in the Great Basin, and serves to enhance and complement a decade of research in the Northern Great Basin. While previous studies in the region focused on broadly based settlement patterns, this study shifted the interpretive lens toward an in-depth analysis of a 6000 year-old, single family dwelling.

A total of 215 soil samples were collected from the floor of the Main House dwelling and analyzed for macrobotanical remains. An additional 20 samples were analyzed from a portion of the nearby 2000 House. The results were multi-dimensional in that they revealed information about diet, environment, and social behavior. The abundance of charred seeds and charcoal fragments recovered from the soil samples indicates that small seeds from wetland-adapted plants were an important dietary resource during the Middle Holocene.

The patterned distributions of this plant material across the main house floor also revealed human activity areas. The value of intensive soil sampling for paleoethnobotanical analysis is that the archaeological picture of hunter-gatherer societies achieves a comparatively finer-grained resolution. We begin to see how people used space for activities such as eating, sleeping, tool manufacture and food preparation. We also gain a sense of interior pathways and doorways. These results provide the basis for recommendations concerning future macrobotanical studies.

Archaeological investigations at the Bergen site reveal its unique character among other Middle Holocene sites in the Fort Rock Basin. It appears to be the largest and most intensively occupied Middle Holocene site thus far studied in the region. Over a mile in length, the Bergen dune likely supported scattered houses along the crest throughout much of the Middle Holocene. Beasley Lake, which at times of high water lapped up against the western edge of the dune, became the link to the many wetland food and non-food resources that are attested in the Bergen site deposits. Bulrush and willow grew along its banks, Tui chub flourished in its open waters, migratory waterfowl were seasonally abundant, and deer herds spent the winters nearby.

This picture comes into even clearer focus when we add the intensive analysis of one of the two houses that made up this village on the crest of the

Bergen Lunette dune. The contribution lies not only with increasing our understanding of settlement patterns in the Fort Rock Basin, but with enhancing our discussion of mobility and sedentism among hunter-gatherer societies in general.

Patterns of mobility and sedentism are central to discussions about hunter-gatherer societies. Archaeologists in the Great Basin have been particularly interested in analyzing the complex relationships associated with fluctuations in climate, the biotic environment and population densities – and how these variables might have influenced decisions people made about where and how to live. Initially, a concept of highly mobile hunters and gatherers who exploited sparse desert resources and were almost continuously on the move constituted the dominant view of the archaeology of the Great Basin. Although research also showed evidence of permanent or semi-permanent village settlements associated with wetland or lake-side settings, these settlements were thought to be the exception rather than the rule. Debate among archaeologists intensified as further investigations began to reveal a more complex and varied archaeological record. Contrasting views of Great Basin lifeways initially took on the tenor of an either/or debate. Today, however, researchers acknowledge that there is a continuum of mobile to sedentary lifeways, though many questions still remain unanswered. The Bergen site contributes to our progressively growing understanding of the people of the

Northern Great Basin, and hunter-gatherer societies in general, by providing an example of a semi-sedentary village settlement associated with a wetland environment at the relatively early date of about 6000 BP.

Four specific hypotheses were tested in this study:

1) Macrobotanical remains from the Middle Holocene Bergen site will provide evidence for the exploitation of wet lowland resources such as small seeds – in contrast to the upland resources which were more intensively exploited in the Late Holocene.

2) Macrobotanical analyses conducted on lowland sites over the preceding twelve years have been too small to adequately assess the plant resources utilized by the people who occupied those sites in ancient times.

3) Patterns associated with the spatial distributions of plant remains across the floor of a hunter-gatherer living structure will reflect human activity areas.

4) The in-depth analyses of botanical remains at the Bergen site will enhance our understanding of the early history of the Fort Rock Basin.

Analysis of total of 235 soil samples collected from two house structures at the Bergen site indicates that small seeds from wetland plants were an important resource utilized by the occupants of the site. Bulrush (Scirpus) and cheno-ams were most abundantly represented in the samples. Very little processed edible tissue, associated with charred root crops from the uplands, was recovered in the samples. In addition, many small fish bones of Tui chub were represented in the heavy fraction portion of the samples. Combined, these data strongly support the hypothesis that wet lowlands were intensively exploited during the Middle Holocene in the Fort Rock Basin.

Many archaeobotanical samples of lowland sites in the Fort Rock Basin over the past 10 years have produced little or no plant remains. Suggested explanations for this paucity of data focused on bioturbation and deflation of deposits. While the present results from the Bergen site corroborate previous studies concerning the range of plants in use by early Fort Rock Basin people, they also indicate that bioturbation and deflation are not the only factors that influence archaeological results. Plant remains are not evenly distributed through archaeological deposits, and care must therefore be taken when sampling for macrobotanical remains.

The patterned distribution of plant remains from 215 soil samples collected on a 50 cm grid across the Main House floor at the Bergen site strongly suggests areas of human activity. The highest concentration of seeds and charcoal was located in and around the central fire hearth, where seeds were cooked and dropped onto the floor. Seed densities decreased with distance from the hearth and significantly dropped off outside the structure. The east-facing doorway of the house also produced a high density of seeds and charcoal, suggesting a work station just outside the house – or a place where refuse was tossed. The differential distribution of bulrush to cheno-am seeds on the house floor may reflect differences in plant uses. Higher concentrations of bulrush in the northern area of the living floor, away from the hearth suggest the presence of sleeping mats.

These results significantly enhance our understanding of Fort Rock Basin early history in several ways. First, the sheer number of soil samples analyzed at the Bergen site more than triples the size of our archaeobotanical database on lowland sites in the region. We can now discuss with more confidence the utilization of wetland plant resources during the Middle Holocene. Second, the in-depth analysis of a single house shifts the scale of our archaeological focus. Previous studies have focused on regional patterns of settlement and subsistence in the Fort Rock Basin. Macrobotanical studies at the Bergen site focus on more localized patterns within single structures. The likelihood that such patterns exist at other sites in the Northern Great Basin is high. Continued research, with a similar focus on paleoethnobotany, is needed to further test this hypothesis.

Recommendations are offered as guidelines for improving collection and sampling strategies for future archaeological studies. Archaeobotanical investigations should be incorporated in research designs from the outset, and sampling strategies should be linked with the overall research questions. If the research is focused mainly on dietary plants, sampling for macrobotanical remains in hearths and storage pits will suffice. If the researcher seeks to identify human activity areas within a structure, systematic sampling on at least a one-meter grid across the structure is necessary. Sample sizes may be standardized so that comparisons could be more easily made between and within sites. Soil flotation is the desired technique for extracting seeds and charcoal, but small soil samples should be reserved for the possibility of subsequent pollen studies. Lastly, researchers should be aware of the policies associated with museum curation of soil they have removed from the site.

These recommendations are based on the results of soil flotation and analysis of 235 samples from the Bergen site. While this study underscores the potential of paleoethnobotanical investigations in archaeological contexts, more research needs to be done. Further studies in Holocene hunter-gatherer sites should be conducted with these recommendations in mind.

In a larger context, this research may serve as a model for emerging trends in archaeological interpretation. Anthropology can be thought of as a multi-dimensional study of humanity. Its subject is the manifold nature of culture through time and across geographical space. As the concern of archaeology is primarily the interpretation of culture along the vertical dimension of time, it hopes to contribute to our understanding of Homo sapiens by sketching in the first pages of what Clifford Geertz (1983) referred to as a "consultable record."

My research draws on paleoethnobotany and household archaeology to contribute to this record in a very specific way. It provides a glimpse into the lives of a people who constructed their winter homes on a dune, near a lake, in what is now south-central Oregon. They left part of that story sprinkled around the borders of a fire hearth, a story which I – through the lens of a microscope - have had the privilege to read, some six thousand years after they walked the face of this earth.

APPENDIX A

STRATIGRAPHIC POLLEN ANALYSIS OF SEDIMENTS FROM SILVER LAKE, FORT ROCK BASIN, OREGON

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INTRODUCTION

Fourteen stratigraphic samples were examined from Silver Lake in the Fort Rock Basin of Oregon to provide a pollen record that would inform about the paleoenvironment. Specifically, the pollen record was expected to provide information concerning vegetation growing around Silver Lake that human occupants of the Fort Rock Basin might have used as part of their subsistence base.

Methods

A chemical extraction technique based on flotation is the standard preparation technique used in this laboratory for the removal of the pollen from the large volume of sand, silt, and clay with which they are mixed. This particular process was developed for extraction of pollen from soils where preservation has been less than ideal and pollen density is low.

Hydrochloric acid (10%) was used to remove calcium carbonates present in the soil, after which the samples were screened through 150 micron mesh. The samples were rinsed until neutral by adding water, letting the samples stand for 2 hours, then pouring off the supernatant. A small quantity of sodium hexametaphosphate was added to each sample once it reached neutrality, then the beaker was again filled with water and allowed to stand for 2 hours. The samples were again rinsed until neutral, filling the beakers only with water. This step was added to remove clay prior to heavy liquid separation. At this time the samples are dried then pulverized. Sodium polytungstate (density 2.1) was used for the flotation process. The samples were mixed with sodium polytungstate and centrifuged at 2000 rpm for 5 minutes to separate organic from inorganic remains. The supernatant containing pollen and organic remains is decanted. Sodium polytungstate is again added to the inorganic fraction to repeat the separation process. The supernatant is decanted into the same tube as the supernatant from the first separation. This supernatant is then centrifuged at 2000 rpm for 5 minutes to allow any silica remaining to be separated from the organics. Following this, the supernatant is decanted into a 50 ml conical tube and diluted with distilled water. These samples are centrifuged at 3000 rpm to concentrate the organic fraction in the bottom of the tube. After rinsing the pollen-rich organic fraction obtained by this separation, all samples received a short (10-15 minute) treatment in hot hydrofluoric acid to remove any remaining inorganic particles. The samples were then acetolated for 3 minutes to remove any extraneous organic matter.

A light microscope was used to count the pollen to a total of approximately 100 to 200 pollen grains at a magnification of 600x. Pollen preservation in these samples varied from good to poor. Many of the samples contained fragmentary pollen and algal bodies. Comparative reference material collected at the Intermountain Herbarium at Utah State University and the University of Colorado Herbarium was used to identify the pollen to the family, genus, and species level, where possible. In addition to pollen, fern spores and algal bodies were tabulated and counted outside the pollen total.

Pollen aggregates were recorded during identification of the pollen. Aggregates are clumps of a single type of pollen, and may be interpreted to represent pollen dispersal over short distances, or the introduction of portions of the plant represented into an archaeological setting. Aggregates were included in the pollen counts as single grains, as is customary. The presence of aggregates is noted by an "A" next to the pollen frequency on the pollen diagram. Pollen diagrams are produced using Tilia, which was developed by Dr. Eric Grimm of the Illinois State Museum. Pollen concentrations are calculated in Tilia using the quantity of sample processed, the quantity of exotics (spores) added to the sample, the quantity of exotics counted, and the total pollen counted.

Indeterminate pollen includes pollen grains that are folded, mutilated, and otherwise distorted beyond recognition. These grains are included in the total pollen count, as they are part of the pollen record.

Discussion

Silver Lake is located in the southern portion of the Fort Rock Basin at the northwestern edge of the Great Basin. Carlon Village, which was occupied intermittently between approximately 5,000 and 200 years ago, is situated on the southeastern short of modern Silver Lake (Droz n.d.), possibly to exploit resources available at Silver Lake. Pollen analysis of stratigraphic samples from Silver Lake should inform concerning local vegetation available to the occupants of Carlon Village and possibly other archaeological sites. Archaeological investigation at Carlon Village reveals a diverse subsistence system that included "fish, sagebrush, ponderosa pine, mountain mahogany and numerous native food plants (seeds, roots and bulbs)" (Droz n.d.). A conceptual model of seasonal mobility with more permanent winter houses, characteristic of the Klamath, is being investigated for Carlon Village. Both the modern Klamath and Northern Paiute peoples have lived within systems of "seasonal foraging and settlement based on resource availability" (Droz n.d.). For this reason, pollen analysis of stratigraphic sediments from Silver Lake should provide excellent data concerning available resources through time.

Previous geoarchaeological research in the vicinity of Carlon village and Silver Lake examined paleoenvironmental data using trenching, auguring, and topographic mapping of the lake shoreline, which revealed evidence of "successive lacustrine, marsh, beach and dune sedimentary environments" (Droz n.d.). Paulina Marsh is the only body of water fed by a perennial stream in the basin. Overflow from this marsh drains into Silver Lake. When the lake reached capacity it would, in turn, overflow into channels and basins.

Stratigraphic samples from Silver Lake were collected from a trench and represent three major strata: 1) a loose, sandy soil, 2) a dark, organic lens, and 3) at the base, a diatomite. Local vegetation within Fort Rock Basin is typical for a high sagebrush desert. A trench was dug away from the shoreline of the modern lake by perhaps 100 meters, but within an area that would have been inundated by Silver Lake during wet years.

The diatomite/tephra layer at the base of the deposits examined for pollen is composed primarily of biogenic silica (diatomite) (90-95%) and approximately 5-10% volcanic glass. The volcanic glass appears to "be a mixture of Mount Mazama eruptions including Red Cloud (23,200 BP) and Llao rock (7015 BP)" (Droz n.d.), suggesting an age of approximately 7015 BP, since the older ash could have been redeposited. The overlying marsh soil, a dark clay loam, yielded a bulk date of 6470 $\pm$ 70 RCYBP and appears to represent a buried soil. This date anchors the pollen record. Droz (n.d.) Reviews the environmental reconstruction summary for Carlon Village, which indicates marsh development during the Early Archaic between 7,600 and 5,600 BP. The beginning of this interval is suggested as cool and moist, changing to a brief late period of warm, dry conditions (Droz n.d.). The Middle to Late Holocene (5,600 to 3,000 BP), which has exhibited fluctuating cool, moist and warm, dry conditions, is interpreted to have supported a Neopluvial Lake. During the Late Holocene (3,000 to 2,000 BP), Late Archaic people probably experienced warm, dry conditions interspersed with periodic wet periods, which resulted in a high energy beach approximately 2,800 BP at the lake. Active aeolian dune formation and warm, dry conditions are posited for the past 2,000 years (Late Holocene to Present) when Late Archaic to Historic peoples lived in the area.

The pollen record from Silver Lake exhibits four distinct intervals. First, the diatomite/tephra level at the base, represented by samples 1 and 2, exhibits moderately large quantities of *Pinus* pollen, accompanied by slightly elevated *Artemisia* and Liguliflorae pollen. Poaceae and Cyperaceae pollen frequencies are very low. *Typha* pollen is present in moderately large quantities compared with other portions of the Silver Lake pollen record. In addition, the lowest sample contains a very large quantity of *Botryococcus* fragments. Both samples from the diatomite layer contain significant quantities of *Pediastrum* remains. *Pediastrum* is tolerant of chemical changes in water and can live in oligotrophic to mesotrophic and even eutrophic lakes (Whiteside 1965:144), meaning conditions of depleted to moderate to abundant quantities of nutrients within the waters of the lakes. *Botryococcus* tends to be more abundant in saline than freshwater lakes (Davis *et al.* 1977:26). Recovery of large quantities of *Botryococcus* algal spores in the lowest sample suggests saline conditions, which become less saline by sample 2. This change in water salinity might reflect a rise in lake level, which would dilute the minerals.

The dark, organic lens, represented by samples 3 through 10, exhibits three distinct pollen signatures. Samples 3 through 6 probably represent the period of marsh development during the Early Archaic. The radiocarbon age of 6470 ± 70 BP was obtained near the base of this segment. The pollen record, which reflects local vegetation including Liguliflorae-type members of the aster family, Cyperaceae, Poaceae, *Artemisia*, and a variety of other plants, is accompanied by an abundance of *Pediastrum* and similar small quantities of *Botryococcus* algal bodies to that observed in sample 2. This continuation of algal bodies suggests continued water chemistry to that represented in sample 2, and perhaps a similar lake depth. Recovery of small quantities of *Polygonum amphibium*-type pollen in samples 4, 5, 7, and 8 represents the presence of water smartweed or water ladysthumb, an aquatic or semi-aquatic plant described as cosmopolitan or very common (Hitchcock and Cronquist 1981:90). Recovery of large quantities of Poaceae and moderate quantities of Cyperaceae and *Typha* pollen is consistent with marsh development, since marshes should support grasses, sedges, and cattails. *Sarcobatus* continues as part of the pollen record, reflecting moist, saline sediments. *Pinus* pollen frequencies are moderate, suggesting either that pines were farther removed from Silver Lake than at other times or that local vegetation was denser, producing larger quantities of pollen.

Pollen samples 7 and 8 exhibit larger quantities of *Pinus* pollen and reduced quantities of *Artemisia*, Liguliflorae, and Poaceae pollen. *Typha* pollen continues in quantities similar to those observed in samples 3 through 6, while Cyperaceae pollen peaks in sample 7 after a slight rise in sample 6. Quantities of *Pediastrum* algal bodies decline sharply, while *Botryococcus* algal bodies are only slightly less abundant. This pattern suggests an expansion of lake shore due to declining lake depth. It is interesting that Silver Lake does not appear to have become particularly saline during this process, as the *Botryococcus* frequencies do not increase. This pollen record is consistent with the presence of a Neopluvial Lake and probably accompanying marsh along the lake shores. The increase in *Pinus* pollen suggests the presence of more pines closer to the lake.

Samples 9 and 10 are more similar in content to samples 3 through 6 in that *Pinus* pollen declines again and Poaceae pollen increases. Cyperaceae frequencies also are similar to those noted in samples 3 and 4. The biggest exception to this observation is the continued small quantity of Liguliflorae pollen in these samples and the small quantities of *Pediastrum* algal bodies. The pollen record is consistent with a warmer, drier interval during the accumulation of these sediments and resulting reduction in lake size and increase in vegetation surrounding the lake, probably facilitating a transition from marshy to drier, grassier areas surrounding the lake. This trend shows the beginning of a reversal in sample 10, which contains larger quantities of *Pediastrum* algal bodies and a smaller pollen concentration. Recovery of *Myriophyllum* pollen in sample 10 indicates growth of water-milfoil, an aquatic plant.

Pollen samples 11 through 14, representing loose, sandy soil, exhibit some similarities to the samples from the upper portion of the dark, organic lens, again with a few differences apparent. While the *Pinus* pollen frequencies are similar, *Artemisia* and Liguliflorae pollen frequencies increase at least slightly. Poaceae declines, continuing a trend begun in sample 9. *Typha* pollen continues to be present, although there is a change either in species or in sediment movement that tends to break apart the tetrads of pollen characteristic of *Typha latifolia*-type pollen. Given the loose, sandy soil of this layer, the latter is most probable. Presence of *Myriophyllum* supports an interpretation of open water, since these are aquatic plants. *Botryococcus* algal bodies continue to be present in small quantities, although there is a slight increase in sample 11, suggesting slightly more saline water for a limited period of time. *Pediastrum* algal bodies increase, peak in sample 12, then decline, suggesting the possibility of deeper water than previously when marshy conditions appear to have prevailed. Samples 13 and 14 deviate from the rest of the record through an increase in Cheno-am pollen. The large quantity of Cheno-am pollen observed in sample 14 likely represents full transition to a vegetation community expected for active aeolian dunes postulated for this layer. Indeed, the pollen record reflects definite drying in the upper two samples examined.

Summary and Conclusions

This record reflects relatively saline conditions in the lower portion of the diatomite layer sampled, then probably a rise in lake level resulting in decreased salinity. Marshes appear to have lined the lake throughout this record, as identified through the recovery of Cyperaceae and *Typha* pollen. The presence of *Myriophyllum* pollen in samples 10-12 indicates open water, as water-milfoil are aquatic plants. Other indicators of open water include recovery of *Pediastrum* algal spores throughout most of the samples. Samples 7-9 contained the smallest quantities of *Pediastrum*, suggesting that Silver Lake was shrinking and might have left only a marsh in this area. The upper four samples represent loose, sandy soil. Recovery of an abundance of *Pediastrum* algal bodies in these samples might represent secondary deposition of these bodies through high energy wave action.

Typha pollen is present in all samples, indicating a continuing population of cattails living around the margins of Silver Lake. These resources would have been available for humans and animals living in this area. Three pollen zones are noted within the dark organic lens, which have previously been interpreted as representing marsh deposits (Droz n.d.). The lower portion of this dark, organic lens appears to represent open water through the recovery of large quantities of *Pediastrum*. During this interval sample 5 exhibits a slight increase in *Botryococcus* algal bodies, suggesting a slight increase in salinity. Samples 7 and 8 probably represent a significantly drier interval, with sample 6 representing a transition. Samples 9 and 10 represent another transition to more open water conditions, which are documented by recovery of *Myriophyllum* pollen in samples 10-12, as well as increasing quantities of *Pediastrum* algal bodies in samples 10-12. After this time the quantities of *Pediastrum* decline, suggesting further drying.

TABLE A-1
PROVENIENCE DATA FOR SAMPLES FROM SILVER LAKE, FORT ROCK BASIN, OREGON

Sampl e No.	Depth (cmbs)	Provenience/ Description
14	15	Stratigraphic pollen column; large sandy granules; soft, loose sandy soil
13	20	Stratigraphic pollen column; large sandy granules; soft, loose sandy soil; rodent activity present
12	25	Stratigraphic pollen column; large sandy granules; soft, loose sandy soil
11	30	Stratigraphic pollen column; large sandy granules; soft, loose sandy soil
10	35	Stratigraphic pollen column; dark organic lens
9	40	Stratigraphic pollen column; dark organic lens
8	45	Stratigraphic pollen column; dark organic lens
7	50	Stratigraphic pollen column; dark organic lens
6	55	Stratigraphic pollen column; dark organic lens
5	60	Stratigraphic pollen column; dark organic lens
4	65	Stratigraphic pollen column; dark organic lens
3	70	Stratigraphic pollen column; dark organic lens
2	75	Stratigraphic pollen column; diatomite
1	80	Stratigraphic pollen column; diatomite

TABLE A- 2
POLLEN TYPES OBSERVED IN SAMPLES FROM SILVER LAKE, FORT ROCK BASIN, OREGON

Scientific Name	Common Name
ARBOREAL POLLEN:	
Alnus	Alder
Cupressaceae	Cypress family
Pinaceae:	Pine family
Abies	Fir
Picea	Spruce
Pinus	Pine
Pseudotsuga	Douglas fir
Salix	Willow
Tsuga canadensis	Eastern hemlock, Canadian hemlock
Tsuga heterophylla	Western hemlock
NON-ARBOREAL POLLEN:	
Apiaceae	Parsley/carrot family
Asteraceae:	Sunflower family
Artemisia	Sagebrush
Low-spine	Includes ragweed, cocklebur, etc.
High-spine	Includes aster, rabbitbrush, snakeweed, sunflower, etc.
Liguliflorae	Includes dandelion and chicory
Brassicaceae	Mustard family
Cheno-am	Includes amaranth and pigweed family
Sarcobatus	Greasewood
Corylaceae	Hazel family
Cyperaceae	Sedge family

Table A-2 (Continued)

Scientific Name	Common Name
Ephedra nevadensis-type	Mormon tea
Eriogonum	Wild buckwheat
Myriophyllum	Water-milfoil
Petalostemum	Prairie clover
Phlox	Phlox
Poaceae	Grass family
Polygonum amphibium	Water smartweed, weedy ladysthumb
Rhamnaceae	Buckthorn family
Rosaceae	Rose family
Typha angustifolia	Cattail
Typha latifolia	Cattail
Indeterminate	Too badly deteriorated to identify
SPORES:	
Lycopodium	Clubmoss
Monolete	Fern
Trilete	Fern
ALGAE:	
Botrycoccus	
Pediastrum	

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APPENDIX B

X-RAY FLUORESCENCE AND OBSIDIAN HYDRATION STUDIES OF THE BERGEN SITE, FORT ROCK BASIN, OREGON

by

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TABLE B-1 Results of XRF Studies: Bergen Site (35-LK-3175), Fort Rock Basin, Oregon

Site	Specimen No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Fe:Ti	Artifact Source
			Trace Element Concentrations											Ratios		
35-LK-3175	1	21	53	23	149	69	44	297	20	1083	263	889	1.36	54.7	40.9	Newberry Volcano
			± 7	3	3	7	3	7	2	96	47	13	0.11			
35-LK-3175	2	25	95	29	130	6	53	353	19	755	504	825	1.56	29.7	66.1	Silver Lake/Sycan Marsh
			± 7	3	3	7	3	7	2	96	48	13	0.11			
35-LK-3175	3	27	47	15	106	47	24	122	16	621	644	825	0.89	13.5	47.5	Spodue Mountain
			± 6	3	3	7	3	7	1	96	48	13	0.11			
35-LK-3175	4	28	73	23	118	10	53	345	16	884	475	805	1.58	31.9	57.1	Silver Lake/Sycan Marsh
			± 7	3	3	7	3	7	2	96	48	13	0.11			
35-LK-3175	5	29	64	'17	93	40	55	134	11	446	296	1193	1.10	38.8	78.8	Cougar Mountain
			± 6	2	3	7	3	7	2	96	47	13	0.11			
35-LK-3175	6	30	37	28	98	73	25	67	12	443	468	319	0.52	11.9	40.7	McComb Butte
			± 6	2	3	7	3	7	1	95	47	13	0.11			
35-LK-3175	7	31	54	18	112	48	23	124	17	737	515	887	0.73	14.5	33.7	Spodue Mountain
			± 6	3	3	7	3	7	2	96	47	14	0.11			
35-LK-3175	8	32	31	27	95	74	21	71	13	361	430	361	0.49	12.5	47.6	McComb Butte
			± 6	2	3	7	3	7	1	95	47	13	0.11			
35-LK-3175	9	33	76	26	123	8	56	341	21	1023	566	822	1.96	32.5	61.0	Silver Lake/Sycan Marsh
			± 7	2	3	7	3	7	1	97	48	13	0.11			
35-LK-3175	10	34	73	21	99	41	57	135	11	256	250	1313	0.82	36.4	102.2	Cougar Mountain
			± 7	3	3	7	3	7	2	96	47	14	0.11			
35-LK-3175	11	40	46	16	76	187	20	191	12	1382	315	902	1.64	52.7	38.3	Carver Flow
			± 7	3	3	7	3	7	2	97	47	13	0.11			
35-LK-3175	12	41	78	22	98	36	53	137	15	310	268	1281	1.02	40.9	104.0	Cougar Mountain
			± 7	2	3	7	3	7	2	96	47	14	0.11			
35-LK-3175	13	43	50	18	104	167	27	101	12	835	563	986	1.25	21.4	48.7	Unknown Rhyolite
			± 6	3	3	7	3	7	2	96	48	13	0.11			
35-LK-3175	14	45	48	19	113	49	24	127	16	469	500	857	0.66	13.6	47.7	Spodue Mountain
			± 6	3	3	7	3	7	2	96	47	13	0.11			
35-LK-3175	15	46	68	21	96	40	55	134	15	348	314	1286	1.10	36.5	100.3	Cougar Mountain
			± 6	2	3	7	3	7	1	96	47	14	0.11			

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

TABLE B-1 Results of XRF Studies: Bergen Site (35-LK-3175), Fort Rock Basin, Oregon

Site	Specimen No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Fe:Ti	Artifact Source
			Trace Element Concentrations											Ratios		
35-LK-3175	16	47	89	22	108	43	60	142	11	229	240	1340	0.84	39.1	115.6	Cougar Mountain
			± 7	3	3	7	3	7	2	96	47	15	0.11			
35-LK-3175	17	48	83	27	105	39	58	141	10	246	247	1328	0.89	39.8	114.3	Cougar Mountain
			± 7	3	3	7	3	7	2	96	47	14	0.11			
35-LK-3175	18	49	94	26	129	11	52	349	18	779	521	847	1.64	29.9	67.1	Silver Lake/Sycan Marsh
			± 7	3	3	7	3	7	2	96	48	13	0.11			
35-LK-3175	19	50	89	18	98	40	58	135	9	274	298	1282	1.09	38.5	124.7	Cougar Mountain
			± 7	3	3	7	3	7	2	96	47	14	0.11			
35-LK-3175	20	51	72	17	100	39	57	135	16	278	288	1228	1.02	37.5	115.3	Cougar Mountain
			± 7	3	3	7	3	7	2	96	47	14	0.11			
35-LK-3175	21	52	75	23	101	40	56	140	10	275	257	1324	0.93	39.5	107.0	Cougar Mountain
			± 7	2	3	7	3	7	2	96	47	14	0.11			
35-LK-3175	22	53	33	26	131	23	23	92	11	412	405	79	0.54	14.5	45.4	Drews Creek/Butcher Flat
			± 7	2	3	7	3	7	2	95	47	12	0.11			
35-LK-3175	23	54	88	24	125	8	52	342	18	859	545	795	1.78	30.8	66.0	Silver Lake/Sycan Marsh
			± 7	3	3	7	3	7	2	96	48	13	0.11			
35-LK-3175	24	55	61	25	136	65	44	183	10	531	284	911	1.49	54.4	89.2	Quartz Mountain
			± 6	2	3	7	3	7	2	96	47	13	0.11			
35-LK-3175	25	56	77	19	100	39	56	139	11	290	306	1251	1.10	37.6	119.1	Cougar Mountain
			± 6	2	3	7	3	7	2	96	47	14	0.11			
35-LK-3175	26	58	70	19	147	70	44	294	16	1208	309	887	1.68	55.0	44.6	Newberry Volcano
			± 7	3	3	7	3	7	2	97	47	13	0.11			
35-LK-3175	27	62	38	27	99	75	26	69	8	261	447	326	0.49	12.0	64.4	McComb Butte
			± 6	2	3	7	3	7	2	95	47	13	0.11			
35-LK-3175	28	63	95	26	134	4	99	170	39	690	570	30	0.77	13.5	37.5	Buck Spring
			± 7	2	3	8	3	7	2	95	48	13	0.11			
35-LK-3175	29	65	68	18	98	41	55	138	14	260	274	1320	0.97	38.1	117.5	Cougar Mountain
			± 7	3	3	7	3	7	2	96	47	14	0.11			
35-LK-3175	30	67	34	21	137	183	11	164	9	900	353	1036	1.09	31.6	39.9	Beatys Butte
			± 7	3	3	7	3	7	2	97	47	13	0.11			

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

TABLE B-1 Results of XRF Studies: Bergen Site (35-LK-3175), Fort Rock Basin, Oregon

Site	Specimen No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe2O3^T$	Fe:Mn	Fe:Ti	Artifact Source
			Trace Element Concentrations											Ratios		
35-LK-3175	31	68	31	33	159	80	29	218	11	1271	231	779	1.26	59.7	32.5	East Medicine Lake
			± 7	2	3	7	3	7	2	97	47	13	0.11			
35-LK-3175	32	69	88	16	98	36	60	135	11	329	286	1262	1.06	39.3	102.3	Cougar Mountain
			± 6	3	3	7	3	7	2	96	47	14	0.11			
35-LK-3175	33	71	59	20	109	48	24	124	13	530	564	880	0.74	13.1	46.6	Spodue Mountain
			± 6	2	3	7	3	7	2	96	48	14	0.11			
35-LK-3175	34	72	73	18	104	40	58	136	11	295	279	1315	1.01	38.7	108.4	Cougar Mountain
			± 7	3	3	7	3	7	2	96	47	14	0.11			
35-LK-3175	35	75	76	21	107	43	59	138	10	198	205	1284	0.71	41.2	114.3	Cougar Mountain
			± 7	3	3	7	3	7	2	95	47	16	0.11			
35-LK-3175	36	76	61	23	93	38	52	130	12	272	281	1278	0.98	37.1	113.5	Cougar Mountain
			± 7	2	3	7	3	7	2	96	47	14	0.11			
35-LK-3175	37	79	62	21	97	41	57	133	10	294	299	1289	1.10	38.4	117.0	Cougar Mountain
			± 6	2	3	7	3	7	2	96	47	14	0.11			
35-LK-3175	38	80	148	36	223	ND	94	583	28	1429	773	11	1.94	23.0	43.4	Massacre Lake/Guano Valley
			± 7	3	4	ND	3	7	2	96	48	16	0.11			
35-LK-3175	39	81	80	28	127	13	54	350	19	903	557	842	1.80	30.5	63.6	Silver Lake/Sycan Marsh
			± 7	2	3	7	3	7	2	96	48	13	0.11			
35-LK-3175	40	88	52	18	88	28	53	94	13	315	258	1286	0.59	26.1	62.7	Glass Buttes 1
			± 6	2	3	7	3	7	2	96	47	14	0.11			
35-LK-3175	41	92	53	19	106	48	22	125	17	589	578	854	0.77	13.3	43.8	Spodue Mountain
			± 6	2	3	7	3	7	1	96	48	13	0.11			
35-LK-3175	42	97	75	18	97	40	58	136	11	323	272	1320	0.93	36.9	92.2	Cougar Mountain
			± 7	2	3	7	3	7	2	96	47	14	0.11			
35-LK-3175	43	98	75	22	102	43	54	134	17	328	274	1364	0.83	32.9	82.0	Cougar Mountain
			± 7	2	3	7	3	7	2	96	47	16	0.11			
35-LK-3175	44	99	43	19	116	54	23	126	16	810	435	895	0.73	17.4	30.8	Spodue Mountain
			± 7	3	3	7	3	7	2	96	47	15	0.11			
35-LK-3175	45	100	66	22	103	41	57	134	14	301	285	1246	1.11	41.1	115.6	Cougar Mountain
			± 7	2	3	7	3	7	2	96	47	14	0.11			

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

TABLE B-1 Results of XRF Studies: Bergen Site (35-LK-3175), Fort Rock Basin, Oregon

Site	Specimen No.	Catalog No.	Trace Element Concentrations											Ratios		Artifact Source
			Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe2O3^T$	Fe:Mn	Fe:Ti	
35-LK-3175	46	103	39	18	134	176	14	164	8	847	355	1016	1.02	29.5	39.7	Beatys Butte
			± 7	3	3	7	3	7	2	96	47	14	0.11			
35-LK-3175	47	111	74	18	101	41	54	139	14	276	316	1288	1.10	36.0	124.1	Cougar Mountain
			± 7	2	3	7	3	7	2	96	47	14	0.11			
35-LK-3175	48	115	40	27	155	77	31	188	11	1101	244	807	1.17	51.9	34.7	GF/LIW/RS
			± 6	2	3	7	3	7	2	97	47	13	0.11			
35-LK-3175	49	116	58	27	110	56	30	136	10	284	530	874	1.07	19.8	118.5	Hager Mountain
			± 7	2	3	7	3	7	2	95	48	14	0.11			
35-LK-3175	50	118	50	18	110	49	24	126	16	472	525	924	0.67	13.0	47.8	Spodue Mountain
			± 6	3	3	7	3	7	2	96	47	14	0.11			
35-LK-3175	51	119	74	18	101	39	54	135	15	352	272	1360	0.96	38.1	87.8	Cougar Mountain
			± 7	3	3	7	3	7	2	96	47	15	0.11			
35-LK-3175	52	125	74	15	102	43	59	137	10	492	282	1308	1.02	38.6	67.5	Cougar Mountain
			± 7	3	3	7	3	7	2	96	47	14	0.11			
35-LK-3175	53	126	82	14	99	39	54	136	9	232	200	1333	0.68	41.1	95.2	Cougar Mountain
			± 7	3	3	7	3	7	2	95	47	15	0.11			
35-LK-3175	54	128	50	24	110	64	25	125	16	441	424	868	0.54	13.8	42.7	Spodue Mountain
			± 7	3	3	7	3	7	2	96	47	14	0.11			
35-LK-3175	55	130	34	19	103	46	24	124	18	489	464	875	0.62	14.0	43.4	Spodue Mountain
			± 7	3	3	7	3	7	2	96	47	15	0.11			
35-LK-3175	56	133	72	19	95	35	55	132	12	312	288	1194	1.06	39.0	107.4	Cougar Mountain
			± 7	3	3	7	3	7	2	96	47	13	0.11			
35-LK-3175	57	149	36	15	73	58	47	127	16	521	299	1309	0.84	30.2	53.5	Glass Buttes 2
			± 6	2	3	7	3	7	1	96	47	14	0.11			
35-LK-3175	58	157	81	16	98	38	56	135	9	414	301	1230	1.13	39.2	87.0	Cougar Mountain
			± 6	3	3	7	3	7	2	96	47	13	0.11			
35-LK-3175	59	172	57	17	96	43	52	133	13	442	277	1324	0.89	34.8	65.8	Cougar Mountain
			± 7	2	3	7	3	7	2	96	47	14	0.11			
35-LK-3175	60	177	69	18	102	41	58	135	13	292	244	1297	0.83	38.1	91.7	Cougar Mountain
			± 7	3	3	7	3	7	2	96	47	15	0.11			

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

TABLE B-1 Results of XRF Studies: Bergen Site (35-LK-3175), Fort Rock Basin, Oregon

Site	Specimen No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Fe:Ti	Artifact Source
			Trace Element Concentrations											Ratios		
35-LK-3175	8	1136-BE-3C-3-1	77	26	130	13	53	354	15	960	570	883	1.84	30.4	61.2	Silver Lake/Sycan Marsh
			± 7	2	3	7	3	7	2	97	48	13	0.11			
35-LK-3175	9	1136-BE-3A-4-1	59	17	112	53	24	126	19	545	478	869	0.62	13.5	39.1	Spodue Mountain
			± 7	3	3	7	3	7	2	96	47	15	0.11			
35-LK-3175	10	1136-BE-3A-5-1	84	20	102	39	56	135	15	265	290	1332	0.95	35.0	113.3	Cougar Mountain
			± 7	2	3	7	3	7	2	96	47	14	0.11			
35-LK-3175	11	1136-BE-3A-6-2	37	19	102	69	27	98	10	189	338	811	0.45	15.1	79.8	Coglan Buttes
			± 7	3	3	7	3	7	2	95	47	14	0.11			
35-LK-3175	12	1136-BE-3A-7-1	26	19	85	27	55	98	11	289	303	1199	0.68	24.6	77.3	Glass Buttes 1
			± 7	2	3	7	3	7	2	96	47	14	0.11			
35-LK-3175	13	1136-BE-3A-9-1	80	24	122	14	53	342	16	899	595	870	1.93	30.2	68.1	Silver Lake/Sycan Marsh
			± 6	2	3	7	3	7	2	97	48	13	0.11			
35-LK-3175	14	1136-BE-3A-12-1	42	20	132	169	14	166	12	819	360	985	1.02	29.1	41.1	Beatys Butte
			± 6	3	3	7	3	7	2	96	47	13	0.11			
35-LK-3175	15	1136-BE-3A-12-2	75	26	124	7	56	346	19	737	551	811	1.70	29.2	73.2	Silver Lake/Sycan Marsh
			± 7	2	3	7	3	7	2	96	48	13	0.11			
35-LK-3175	16	1136-BE-3A-12-3	44	23	111	46	25	126	15	483	535	895	0.67	12.8	47.0	Spodue Mountain
			± 7	3	3	7	3	7	2	96	47	13	0.11			
35-LK-3175	17	1136-BE-3A-12-4	69	21	117	13	32	89	18	147	572	79	0.50	9.3	109.7	Cowhead Lake
			± 7	3	3	7	3	7	2	95	47	13	0.11			
35-LK-3175	18	1136-BE-3A-14-1	80	21	123	13	54	349	19	794	552	889	1.71	29.3	68.7	Silver Lake/Sycan Marsh
			± 7	3	3	7	3	7	2	96	48	14	0.11			
35-LK-3175	19	1136-BE-4C-5-1	76	19	104	43	58	136	10	231	240	1345	0.81	37.8	110.9	Cougar Mountain
			± 7	3	3	7	3	7	2	96	47	14	0.11			
35-LK-3175	20	1136-BE-4A-6-1	50	19	107	50	22	122	14	618	482	882	0.64	13.8	35.6	Spodue Mountain
			± 6	3	3	7	3	7	2	96	47	14	0.11			
35-LK-3175	21	1136-BE-4C-6-1	59	25	109	55	33	144	8	378	372	888	0.81	22.7	70.3	Hager Mountain
			± 7	3	3	7	3	7	2	95	47	14	0.11			
35-LK-3175	22	1136-BE-4A-7-1	42	24	132	14	29	89	11	232	382	34	0.46	13.5	68.1	Drews Creek/Butcher Flat
			± 7	3	3	7	3	7	2	95	47	13	0.11			

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

TABLE B-1 Results of XRF Studies: Bergen Site (35-LK-3175), Fort Rock Basin, Oregon

Site	Specimen No.	Catalog No.	Trace Element Concentrations											Ratios		Artifact Source
			Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Fe:Ti	
35-LK-3175	23	1136-BE-4A-10-1	84	18	101	40	54	136	16	222	292	1315	1.02	36.9	141.9	Cougar Mountain
			± 6	2	3	7	3	7	2	96	47	14	0.11			
35-LK-3175	24	1136-BE-4A-14-1	64	17	94	37	52	132	12	292	325	1282	1.17	37.0	125.0	Cougar Mountain
			± 6	2	3	7	3	7	1	96	47	13	0.11			
35-LK-3175	25	1136-BE-5A-4-1	26	31	96	74	23	75	15	154	279	332	0.26	12.5	63.2	McComb Butte
			± 7	3	3	7	3	7	2	95	47	13	0.11			
35-LK-3175	26	1136-BE-5C-7-1	68	19	97	40	56	137	15	383	314	1296	1.23	40.3	101.5	Cougar Mountain
			± 6	2	3	7	3	7	1	96	47	14	0.11			
35-LK-3175	27	1136-BE-5A-11-1	82	22	104	43	60	143	9	186	196	1370	0.63	38.8	108.0	Cougar Mountain
			± 7	3	3	7	3	7	2	95	47	16	0.11			
35-LK-3175	28	1136-BE-5C-11-1	36	16	73	58	49	124	10	532	280	1338	0.81	31.3	50.4	Glass Buttes 2
			± 6	2	3	7	3	7	2	96	47	14	0.11			
35-LK-3175	29	1136-BE-6C-1-1	90	27	97	82	73	405	19	1134	450	1314	1.88	40.1	52.9	Yreka Butte
			± 7	2	3	7	3	7	2	97	48	15	0.11			
35-LK-3175	30	1136-BE-6C-9-1	14	17	ND	17	10	17	3	NM	NM	NM	NM	NM	NM	Not Obsidian
			± 8	2	ND	7	3	17	2	95	49	NM	0.11			
35-LK-3175	31	1136-BE-7C-7-1	88	24	132	15	53	355	17	785	536	864	1.65	29.2	67.0	Silver Lake/Sycan Marsh
			± 7	3	3	7	3	7	2	96	48	13	0.11			
35-LK-3175	32	1136-BE-9B-1-1	88	23	105	50	60	134	13	360	167	1458	0.50	39.7	48.4	Cougar Mountain?
			± 8	3	4	7	3	7	2	95	47	17	0.11			
35-LK-3175	33	1136-BE-9A-2-1	100	26	117	12	51	347	17	540	348	916	0.98	29.2	59.5	Silver Lake/Sycan Marsh
			± 7	3	3	7	3	7	2	96	47	14	0.11			
35-LK-3175	34	1136-BE-9A-7-1	85	22	106	43	55	143	13	282	277	1274	1.04	40.1	115.9	Cougar Mountain
			± 7	3	3	7	3	7	2	96	47	14	0.11			
35-LK-3175	35	1136-BE-9B-10-1	101	29	87	80	74	400	21	1373	545	1249	2.32	39.8	53.7	Yreka Butte
			± 7	2	3	7	3	7	2	98	48	14	0.11			
35-LK-3175	36	1136-BE-9B-10-2	69	17	96	40	53	134	10	315	308	1259	1.16	39.2	116.0	Cougar Mountain
			± 6	2	3	7	3	7	1	96	47	13	0.11			
35-LK-3175	37	1136-BE-9B-12-2	66	14	91	37	53	132	15	275	183	1342	0.61	41.4	73.4	Cougar Mountain
			± 7	3	3	7	3	7	2	95	47	15	0.11			

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

TABLE B-1 Results of XRF Studies: Bergen Site (35-LK-3175), Fort Rock Basin, Oregon

Site	Specimen No.	Catalog No.		Trace Element Concentrations											Ratios		Artifact Source
				Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe2O3^T$	Fe:Mn	Fe:Ti	
35-LK-3175	38	1136-BE-9B-14-1		77	15	94	38	55	136	12	328	333	1211	1.25	38.4	119.4	Cougar Mountain
			±	6	2	3	7	3	7	1	96	47	13	0.11			
35-LK-3175	39	1136-BE-10C-2-1		75	13	93	39	56	135	14	157	190	1323	0.59	38.6	119.6	Cougar Mountain
			±	7	3	3	7	3	7	2	95	47	16	0.11			
35-LK-3175	40	1136-BE-P28-5-2		98	27	125	15	53	350	20	793	528	875	1.69	30.4	67.8	Silver Lake/Sycan Marsh
			±	7	3	3	7	3	7	2	96	48	14	0.11			

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

TABLE B-2 Obsidian Hydration Results and Sample Provenience: Bergen Site (35-LK-3175), Fort Rock Basin, Oregon

Site	Specimen No.	Catalog No.	Unit	Depth (cm)	Artifact Type[A]	Artifact Source	Hydration Rims: Rim 1	Hydration Rims: Rim 2	Comments[B]
35-LK-3175	8	1136-BE-3C-3-1	3C	3	PPT	Silver Lake/Sycan Marsh	5.0 ± 0.1	NM ± NM	--
35-LK-3175	9	1136-BE-3A-4-1	3A	4	PPT	Spodue Mountain	4.4 ± 0.1	NM ± NM	--
35-LK-3175	10	1136-BE-3A-5-1	3A	5	PPT	Cougar Mountain	4.2 ± 0.1	NM ± NM	--
35-LK-3175	13	1136-BE-3A-9-1	3A	9	PPT	Silver Lake/Sycan Marsh	4.4 ± 0.1	NM ± NM	--
35-LK-3175	15	1136-BE-3A-12-2	3A	12	PPT	Silver Lake/Sycan Marsh	4.9 ± 0.1	NM ± NM	Same measurement on BRE
35-LK-3175	16	1136-BE-3A-12-3	3A	12	PPT	Spodue Mountain	4.4 ± 0.1	NM ± NM	--
35-LK-3175	18	1136-BE-3A-14-1	3A	14	PPT	Silver Lake/Sycan Marsh	3.5 ± 0.1	NM ± NM	--
35-LK-3175	19	1136-BE-4C-5-1	4C	5	PPT	Cougar Mountain	3.7 ± 0.1	NM ± NM	--
35-LK-3175	20	1136-BE-4A-6-1	4A	6	PPT	Spodue Mountain	5.0 ± 0.1	NM ± NM	--
35-LK-3175	23	1136-BE-4A-10-1	4A	10	PPT	Cougar Mountain	4.2 ± 0.1	NM ± NM	--
35-LK-3175	24	1136-BE-4A-14-1	4A	14	PPT	Cougar Mountain	4.2 ± 0.1	NM ± NM	--
35-LK-3175	26	1136-BE-5C-7-1	5C	7	PPT	Cougar Mountain	6.6 ± 0.1	NM ± NM	--
35-LK-3175	27	1136-BE-5A-11-1	5A	11	PPT	Cougar Mountain	NA ± NA	NM ± NM	REC; UNR; PAT
35-LK-3175	28	1136-BE-5C-11-1	5C	11	PPT	Glass Buttes 2	4.1 ± 0.1	NM ± NM	Same measurement on BRE
35-LK-3175	31	1136-BE-7C-7-1	7C	7	PPT	Silver Lake/Sycan Marsh	4.5 ± 0.1	NM ± NM	--
35-LK-3175	32	1136-BE-9B-1-1	9B	1	PPT	Cougar Mountain?	3.0 ± 0.1	NM ± NM	Same measurement on BRE
35-LK-3175	33	1136-BE-9A-2-1	9A	2	PPT	Silver Lake/Sycan Marsh	5.9 ± 0.1	NM ± NM	--
35-LK-3175	34	1136-BE-9A-7-1	9A	7	PPT	Cougar Mountain	4.6 ± 0.1	NM ± NM	--
35-LK-3175	36	1136-BE-9B-10-2	9B	10	PPT	Cougar Mountain	2.8 ± 0.1	NM ± NM	--
35-LK-3175	37	1136-BE-9B-12-2	9B	12	PPT	Cougar Mountain	4.2 ± 0.1	NM ± NM	Same measurement on BRE
35-LK-3175	38	1136-BE-9B-14-1	9B	14	PPT	Cougar Mountain	4.2 ± 0.1	NM ± NM	--
35-LK-3175	39	1136-BE-10C-2-1	10C	2	PPT	Cougar Mountain	2.4 ± 0.1	NM ± NM	REC
35-LK-3175	40	1136-BE-P28-5-2	P28	5	PPT	Silver Lake/Sycan Marsh	4.6 ± 0.1	NM ± NM	--

[A] PPT = Projectile Point
[B] See text for explanation of comment abbreviations
NA = Not Available; NM = Not Measured; * = Small sample

APPENDIX C

MACROBOTANICAL DATA FROM THE BERGEN SITE, FORT ROCK BASIN, OREGON

by

Margaret M. Helzer

Research at the Bergen site was conducted by the University of Oregon Archaeological Field School from 1998 to 2000. The site dates to the Middle Holocene and represents late fall occupations in the lowlands of the Fort Rock Basin, where indigenous hunters and gatherers relied on wetland resources some 6000 years ago. Intensive sampling and analysis for macrobotanical remains were conducted at the site. This appendix contains the data from 235 soil samples collected from the floors of two house structures at the Bergen site.

FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
1	430N 502E	Cheno-Am	embryo	1			<0.01 g
	QA L15	Cheno-Am	seed		5		<0.01 g
	Unit 11	Scirpus	seed		2		<0.01 g
		PET	tissue		1		<0.01 g
		Chrysothamnus	charcoal		1		<0.01 g
		Unidentifiable	charcoal		2		<0.01 g
		Bone	fragment			415	total
		Bone	fish			29	
		Lithic	flake			75	obsidian
2	430N 502E	Cheno-Am	embryo	5			<0.01 g
	QC L15	Suaeda	seed	8	2		<0.01 g
	Unit 11	Scirpus	seed		6		<0.01 g
		Bone	fragment			666	total
		Bone	fish			54	
		Lithic	flake			43	obsidian
3	430N 502E	Cheno-Am	seed		5	1	<0.01 g
	QA L16	Scirpus	seed		19		<0.01 g
	Unit 11	Asteraceae	charcoal		1		<0.01 g
		Bone	fragment			525	total
		Bone	fish			47	
		Lithic	flake			82	obsidian
4	430N 502E	Cheno-Am	seed		2		<0.01 g
	QA L16	Scirpus	seed		1		<0.01 g
	Unit 11	Unidentifiable	charcoal		x		<0.01 g
		Bone	fragment			425	total
		Bone	fish			32	
		Lithic	flake			65	obsidian

PET=Processed Edible Tissue
FL=Flotation WH=Whole, Charred
FR=Frag, Charred UNC=Uncharred

FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
5	430N 502E	Scirpus	seed		11		<0.01 g
	QA L16	Bone	fragment			586	total
	Unit 11	Bone	fish			43	
		Lithic	flake			86	obsidian
		Shell	fragment			2	<0.01 g
		Ochre	fragment			2	<0.01 g
6	430N 502E	Cheno-Am	embryo	1			<0.01 g
	QA L16	Cheno-Am	seed	2			<0.01 g
	Unit 11	Scirpus	seed		12		<0.01 g
		Conifer	charcoal		1		<0.01 g
		Rosaceae	charcoal		1		<0.01 g
		Unidentifiable	charcoal		3		<0.01 g
		Bone	fragment			538	total
		Bone	fish			21	
		Lithic	flake			108	obsidian
7	430N 502E	Cheno-Am	embryo	4			<0.01 g
	QA L16	Suaeda	seed	1			<0.01 g
	Unit 11	Chenodopiaceae	charcoal		3		<0.01 g
		Sarcobatus	charcoal		3		<0.01 g
		Rosaceae	charcoal		1		<0.01 g
		Unidentifiable	charcoal		4		<0.01 g
		Scirpus	seed		25		<0.01 g
		Bone	fragment			661	total
		Bone	fish			52	
		Lithic	flake			103	obsidian
8	430N 502E	Cheno-Am	embryo	3			<0.01 g
	QC L19	Cheno-Am	seed		13		<0.01 g
	Unit 11	Suaeda	seed	9	5		<0.01 g
		Chenopodiaceae	charcoal		5		<0.01 g
		Bone	fragment			545	total
		Bone	fish			39	
		Lithic	flake			58	obsidian

PET=Processed Edible Tissue
FL=Flotation WH=Whole, Charred
FR=Frag, Charred UNC=Uncharred

FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
9	430N 502E	Cheno-Am	embryo	1			<0.01 g
	QC L18	Cheno-Am	seed	1	3		<0.01 g
	Unit 11	Suaeda	seed	1			<0.01 g
		Scirpus	seed		7		<0.01 g
		PET	tissue		1		<0.01 g
		Artemisia	charcoal		1		0.01 g
		Chrysothamnus	charcoal		3		0.02 g
		Salicaceae	charcoal		9		0.03 g
		Unidentifiable	charcoal		7		<0.01 g
		Bone	fragment			929	total
		Bone	fish			41	
		Lithic	flake			72	obsidian
10	430N 502E	Cheno-Am	embryo	4			<0.01 g
	QC L18	Cheno-Am	seed		3		<0.01 g
	Unit 11	Suaeda	seed		3		<0.01 g
		Scirpus	seed		5		<0.01 g
		Chrysothamnus	charcoal		11		0.02 g
		Rosaceae	charcoal		1		<0.01 g
		Sarcobatus	charcoal		5		0.04 g
		Unidentifiable	charcoal		3		<0.01 g
		Bone	fragment			975	total
		Bone	fish			51	
		Lithic	fragment			118	obsidian
11	430N 502E	Cheno-Am	embryo		2		<0.01 g
	QB L15	Chenopodium	seed		1		<0.01 g
	Unit 11	Scirpus	seed		5		<0.01 g
		Bone	fragment			263	total
		Bone	fish			14	
		Lithic	flake			56	obsidian

PET=Processed Edible Tissue
FL=Flotation WH=Whole, Charred
FR=Frag, Charred UNC=Uncharred

FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
12	430N 502E	Cheno-Am	seed		4		<0.01 g
	QB L15	Scirpus	seed		2		<0.01 g
	Unit 11	Unidentifiable	charcoal		2		<0.01 g
		Bone	fragment			135	total
		Bone	fish			5	
		Lithic	flake			22	obsidian
13	430N 502E	Cheno-Am	embryo	3			<0.01 g
	QB L15	Cheno-Am	seed		24		<0.01 g
	Unit 11	Chenopodium	seed		4		<0.01 g
		Atriplex	seed		2		<0.01 g
		Scirpus	seed	1	35		<0.01 g
		Unidentifiable	charcoal		3		<0.01 g
		Bone	fragment			573	total
		Bone	fish			55	
		Lithic	flake			75	obsidian
		Ochre	fragment			1	
14	430N 502E	Cheno-Am	embryo	1			<0.01 g
	QB L15	Chenopodium	seed		3		<0.01 g
	Unit 11	Scirpus	seed		7		<0.01 g
		Bone	fragment			403	total
		Bone	fish			33	
		Lithic	flake			68	obsidian

PET=Processed Edible Tissue
FL=Flotation WH=Whole, Charred
FR=Frag, Charred UNC=Uncharred

FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
15	430N 502E	Cheno-Am	embryo	1			<0.01 g
	QB L16	Cheno-Am	seed		6		<0.01 g
	Unit 11	Suaeda	seed		2		<0.01 g
		Scirpus	seed		16		<0.01 g
		Chrysothamnus	charcoal		1		<0.01 g
		Rosaceae	charcoal		3		<0.01 g
		Sarcobatus	charcoal		1		<0.01 g
		Unidentifiable	charcoal		5		<0.01 g
		Bone	fragment			352	total
		Bone	fish			41	
		Lithic	flake			65	obsidian
16	430N 502E	Cheno-Am	embryo	2			<0.01 g
	QB L16	Cheno-Am	seed		6		<0.01 g
	Unit 11	Scirpus	seed		19		<0.01 g
		Chenopodiaceae	charcoal		2		<0.01 g
		Unidentifiable	charcoal		1		<0.01 g
		Bone	fragment			257	total
		Bone	fish			30	
		Lithic	flake			59	obsidian
		Ochre	fragment			1	
17	430N 502E	Cheno-Am	embryo	1			<0.01 g
	QB L17	Cheno-Am	seed		24		<0.01 g
	Unit 11	Suaeda	seed	4	1		<0.01 g
		Scirpus	seed		27		<0.01 g
		Rosaceae	charcoal		1		<0.01 g
		Unidentified-vitrifie	charcoal		1		<0.01 g
		Unidentified-small	charcoal		11		<0.01 g
			charcoal				
		Bone	fragment			408	total
		Bone	fish			36	
		Lithic	flake			79	obsidian

PET=Processed Edible Tissue
FL=Flotation WH=Whole, Charred
FR=Frag, Charred UNC=Uncharred

FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
18	430N 500E	Cheno-Am	embryo	2			<0.01 g
	QD L18	Cheno-Am	seed		19		<0.01 g
	Unit 3	Suaeda	embryo	3			<0.01 g
		Suaeda	seed	5	12		<0.01 g
		Unidentified	seed	1			<0.01 g
		Chenopodiaceae	charcoal		27		0.22 g
		Sarcobatus	charcoal		3		0.03 g
		Bone	fragment			309	total
		Bone	fish			28	
		Lithic	flake			21	obsidian
19	430N 500E	Cheno-Am	embryo	1			<0.01 g
	QD L18	Cheno-Am	seed		12		<0.01 g
	Unit 3	Suaeda	embryo	1			<0.01 g
		Suaeda	seed	14	8		<0.01 g
		Scirpus	seed		8		<0.01 g
		Unidentified	seed		2		<0.01 g
		Sarcobatus	charcoal		5		0.01 g
		Unidentifiable-vit.	charcoal		10		0.01 g
		Bone	fragment			919	total
		Bone	fish			30	
		Lithic	flake			65	obsidian
20	430N 500E	Cheno-Am	embryo	5			<0.01 g
	QD L18	Cheno-Am	seed		28		<0.01 g
	Unit 3	Suaeda	seed	10	11		<0.01 g
		Scirpus	seed	1	35		<0.01 g
		Bone	fragment			756	total
		Bone	fish			21	
		Lithic	flake			47	obsidian

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FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
21	430N 500E	Cheno-Am	embryo	4	1		<0.01 g
	QD L18	Cheno-Am	seed		11		<0.01 g
	Unit 3	Suaeda	embryo	2	1		<0.01 g
		Scirpus	seed	2			<0.01 g
		Chenopodiaceae	charcoal		20		0.06 g
		Bone	fragment			306	total
		Bone	fish			24	
		Lithic	flake			23	obsidian
22	430N 500E	Cheno-Am	embryo		3		<0.01 g
	QD L17	Cheno-Am	seed		3		<0.01 g
	Unit 3	Suaeda	seed	5	5		<0.01 g
		Scirpus	seed		14		<0.01 g
		Unidentified	seed	1	2		<0.01 g
		PET	tissue		2		starchy
		Artemisia	charcoal		3		<0.01 g
		Chenopodiaceae	charcoal		3		<0.01 g
		Sarcobatus	charcoal		1		<0.01 g
		Chrysothamnus	charcoal		2		<0.01 g
		Unidentifiable	charcoal		7		<0.01 g
		Bone	fragment			485	total
		Bone	fish			15	
		Lithic	flake			49	obsidian
		Shell	whole			1	snail
23	430N 500E	Cheno-Am	embryo	3			<0.01 g
	QD L17	Cheno-Am	seed		22		<0.01 g
	Unit 3	Suaeda	seed	4	4		<0.01 g
		Scirpus	seed		27		<0.01 g
		Chenopodiaceae	charcoal		6		<0.01 g
		Sarcobatus	charcoal		1		<0.01g
		Bone	fragment			792	total
		Bone	fish			45	
		Lithic	flake			72	obsidian

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FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
24	430N 500E	Cheno-Am	embryo	5			<0.01 g
	QD L17	Cheno-Am	seed		30		<0.01 g
	Unit 3	Suaeda	seed	4			<0.01 g
		Atriplex	seed	1			<0.01 g
		Chrysothamnus	seed	1			<0.01 g
		Scirpus	seed		62		<0.01 g
		Rosaceae	charcoal		1		<0.01 g
		Unidentifiable	charcoal		10		0.01 g
		Bone	fragment			755	total
		Bone	fish			29	
		Lithic	flake			107	obsidian
25	430N 500E	Cheno-Am	embryo		1		<0.01 g
	QD L17	Cheno-Am	seed		5		<0.01 g
	Unit 3	Atriplex	seed		1		<0.01 g
		Suaeda	seed		1		<0.01 g
		Scirpus	seed		4		<0.01 g
		Unidentified	seed		4		<0.01 g
		Artemisia	charcoal		2		<0.01 g
		Chenopodiaceae	charcoal		5		0.01 g
		Salicacea	charcoal		3		<0.01 g
		Bone	fragment			766	total
		Bone	fish			90	
		Lithic	flake			209	obsidian
		Ochre	fragment			8	
		Shell	fragment			1	snail
26	430N 500E	Cheno-Am	seed	1	4		<0.01 g
	QD L19	Suaeda	seed	2	1		<0.01 g
	Unit 3	Scirpus	seed		1		<0.01 g
		Chenopodiaceae	charcoal		7		<0.01 g
		Unidentifiable	charcoal		6		<0.01 g
		Bone	fragment			1198	total
		Bone	fish			36	
		Lithic	flake			110	obsidian

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FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
27	430N 500E	Cheno-Am	embryo	2			<0.01 g
	QD L19	Suaeda	seed	2			<0.01 g
	Unit 3	Scirpus	seed		4		<0.01 g
		Chenopodiaceae	charcoal		19		0.07 g
		Sarcobatus	charcoal		1		0.05 g
		Bone	fragment			675	total
		Bone	fish			61	
		Lithic	flake			46	obsidian
		Ochre	fragment			3	
28	430N 500E	Cheno-Am	seed		1		<0.01 g
	QB L15	Scirpus	seed		3		<0.01 g
	Unit 3	Chrysothamnus	charcoal		2		0.01 g
		Rosaceae	charcoal		1		<0.01 g
		Unidentifiable	charcoal		7		<0.01 g
		Bone	fragment			424	total
		Bone	fish			29	
		Lithic	flake			55	obsidian
29	430N 500E	Cheno-Am	seed		6		<0.01 g
	QB L15	Scirpus	seed		19		<0.01 g
	Unit 3	Chrysothamnus	charcoal		1		<0.01 g
		Sarcobatus	charcoal		3		<0.01 g
		Unidentifiable- vit	charcoal		10		0.01 g
		Bone	fragment			809	total
		Bone	fish			44	
		Lithic	flake			79	obsidian
		Ochre	fragment			2	<0.01 g

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FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
30	430N 500E	Cheno-Am	seed		5		<0.01 g
	QB L15	Scirpus	seed		19		<0.01 g
	Unit 3	Artemisia	charcoal		5		0.01 g
		Rosaceae	charcoal		5		0.01 g
		Unidentifiable-vit	charcoal		5		0.01 g
		Bone	fragment			968	total
		Bone	fish			179	
		Lithic	flake			145	obsidian
		Ochre	fragment			1	
		Shell	fragment			1	snail
31	430N 500E	Cheno-Am	embryo	1			<0.01 g
	QB L15	Suaeda	seed	1			<0.01 g
	Unit 3	Unidientifiable	charcoal		2		<0.01 g
		Bone	fragment			290	total
		Bone	fish			16	
		Lithic	flake			30	obsidian
32	430N 500E	Cheno-Am	embryo	1			<0.01 g
	QB L16	Suaeda	seed	1			<0.01 g
	Unit 3	Scirpus	seed		1		<0.01 g
		Chrysothamnus	charcoal		1		<0.01 g
		Salicacea			3		<0.01 g
		Unidentifiable			x		<0.01 g
		Bone	fragment			726	total
		Bone	fish			56	
		Lithic	flake			73	obsidian
		Shell	fragment			1	snail
33	430N 500E	Cheno-Am	seed		4		<0.01 g
	QB L16	Scirpus	seed		15		<0.01 g
	Unit 3	Bone	fragment			745	total
		Bone	fish			67	
		Lithic	flake			84	obsidian
		Ochre	fragment			6	

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FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
34	430N 500E	Cheno-Am	embryo	3			<0.01 g
	QB L16	Cheno-Am	seed		7		<0.01 g
	Unit 3	Suaeda	seed	2			<0.01 g
		Scirpus	seed		27		<0.01 g
		Artemisia	charcoal		4		<0.01 g
		Chenopodiaceae-\	charcoal		6		0.01 g
		Sarcobatus	charcoal		1		<0.01 g
		Bone	fragment			449	total
		Bone	fish			36	
		Lithic	flake			56	obsidian
35	430N 500E	Cheno-Am	embryo	4			<0.01 g
	QB L16	Cheno-Am	seed		1		<0.01 g
	Unit 3	Scirpus	seed		17		<0.01 g
		Asteraceae-vitrifie(	charcoal		2		<0.01 g
		Chrysothamnus	charcoal		1		<0.01 g
		Chenopodiaceae	charcoal		1		<0.01 g
		Unidentifiable-vitri	charcoal		6		<0.01 g
		Bone	fragment			252	total
		Bone	fish			22	
		Lithic	flake			53	obsidian
36	430N 500E	Cheno-Am	embryo		1		<0.01 g
	QB L17	Cheno-Am	seed		12		<0.01 g
	Unit 3	Suaeda	embryo		1		<0.01 g
		Suaeda	seed	4	5		<0.01 g
		Scirpus	seed		21		<0.01 g
		PET	tissue		1		starchy
		Artemisia	charcoal		2		0.01 g
		Chenopodiaceae	charcoal		13		0.04 g
		Bone	fragment			214	total
		Bone	fish			17	
		Lithic	flake			23	obsidian

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FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
37	430N 500E	Cheno-Am	embryo	1			<0.01 g
	QB L17	Cheno-Am	seed		5		<0.01 g
	Unit 3	Atriplex	seed	1			<0.01 g
		Suaeda	embryo	1			<0.01 g
		Suaeda	seed	3	1		<0.01 g
		Scirpus	embryo	1			<0.01 g
		Scirpus	seed		12		<0.01 g
		Sarcobatus	charcoal		3		<0.01 g
		Rosaceae	charcoal		2		<0.01 g
		Unidentifiable-vit	charcoal		5		<0.01 g
		Bone	fragment			555	total
		Bone	fish			32	
		Lithic	flake			89	obsidian
38	428N 500E	Cheno-Am	seed		28		<0.01 g
	QB L16	Scirpus	seed		51		<0.01 g
	Unit 4	Bone	fragment			584	total
		Bone	fish			33	
		Lithic	flake			91	obsidian
39	428N 500E	Cheno-Am	embryo	2			<0.01 g
	QB L16	Cheno-Am	seed		87		<0.01 g
	Unit 4	Atriplex	seed	1	1		<0.01 g
		Chenopodium	seed	1	1		<0.01 g
		Suaeda	seed	7	15		<0.01 g
		Scirpus	seed		6		<0.01 g
		Asteraceae	charcoal		3		0.04 g
		Chrysothamnus	charcoal		3		0.03 g
		Rosaceae	charcoal		1		0.02 g
		Sarcobatus	charcoal		7		0.06 g
		Unidentifiable-vit	charcoal		11		0.11 g
		Bone	fragment			748	total
		Bone	fish			66	
		Lithic	flake			87	obsidian

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FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
40	428N 500E	Cheno-Am	embryo	7			<0.01 g
	QB L16	Cheno-Am	seed		114		<0.01 g
	Unit 4	Atriplex	seed		1		<0.01 g
		Suaeda	seed	5	1		<0.01 g
		Scirpus	seed		19		<0.01 g
		cf. Asteraceae	charcoal		30		0.13 g
		Bone	fragment			1162	total
		Bone	fish			38	
		Lithic	flake			99	obsidian
		Ochre	fragment			7	<0.01 g
41	428N 500E	Cheno-Am	embryo	4			<0.01 g
	QB L16	Cheno-Am	seed		35		<0.01 g
	Unit 4	Atriplex	seed	2			<0.01 g
		Suaeda	embryo		1		<0.01 g
		Suaeda	seed	4	2		<0.01 g
		Scirpus	seed		10		<0.01 g
		PET	tissue		2		starchy
		Artemisia	charcoal		3		0.01 g
		Chenopodiaceae	charcoal		8		0.01 g
		Chrysothamnus	charcoal		2		<0.01 g
		Salicacea	charcoal		1		<0.01 g
		Bone	fragment			447	total
		Bone	fish			19	
		Lithic	flake			41	obsidian

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FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
42	428N 500E	Cheno-Am	embryo		2		<0.01 g
	QB L17	Chenopodium	seed	3	10		<0.01 g
	Unit 4	Scirpus	seed		6		<0.01 g
		PET	tissue		8		starchy
		Artemisia	charcoal		1		0.01 g
		Atriplex	charcoal		29		0.23 g
		Unidentifiable	charcoal		x		0.11 g
		Bone	fragment			854	total
		Bone	fish			42	
		Lithic	flake			56	obsidian
43	428N 500E	Cheno-Am	embryo	2			<0.01 g
	QB L17	Cheno-Am	seed		4		<0.01 g
	Unit 4	Cyperaceae	seed	1			<0.01 g
		Cyperus	seed		1		<0.01 g
		Scirpus	seed		1		<0.01 g
		Chenopodiaceae	charcoal		27		0.24 g
		Sarcobatus	charcoal		3		0.02 g
		Bone	fragment			379	total
		Bone	fish			31	
		Lithic	flake			34	obsidian
		Shell	whole			2	snail
44	428N 500E	Cheno-Am	embryo	1			<0.01 g
	QB L17	Sarcobatus	embryo		1		<0.01 g
	Unit 4	Unidentifiable	seed		2		<0.01 g
		PET	tissue		9		starchy
		Chenopodiaceae	charcoal		30		0.05 g
		Unidentifiable	charcoal		x		0.10 g
		Bone	fragment			450	total
		Bone	fish			25	
		Lithic	flake			32	obsidian

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FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
45	428N 500E	Cheno-Am	embryo	3			<0.01 g
	QB L17	Cheno-Am	seed		21		<0.01 g
	Unit 4	Suaeda	seed	8	2		<0.01 g
		Scirpus	seed		29		<0.01 g
		Unidentified	seed		4		<0.01 g
		Chrysothamnus	charcoal		1		<0.01 g
		Sarcobatus	charcoal		3		0.01 g
		Unidentifiable-vit	charcoal		11		0.01 g
		Bone	fragment			1259	total
		Bone	fish			40	
		Lithic	flake			53	obsidian
46	428N 500E	Cheno-Am	embryo	3	1		<0.01 g
	QB L18	Cheno-Am	seed		18		<0.01 g
	Unit 4	Suaeda	embryo	2			<0.01 g
		Suaeda	seed	1	5		<0.01 g
		Scirpus	seed		2		<0.01 g
		Chenopodiaceae	charcoal		23		0.11 g
		Sarcobatus	charcoal		2		0.01 g
		Bone	fragment			988	total
		Bone	fish			45	
		Lithic	flake			65	obsidian
		Shell	fragment		1		snail
47	428N 500E	Cheno-Am	embryo	2			<0.01 g
	QB L18	Cheno-Am	seed		20		<0.01 g
	Unit 4	Suaeda	seed	3	2		<0.01 g
		Scirpus	seed		10		<0.01 g
		Chenopodiaceae	charcoal		19		0.13 g
		Sarcobatus	charcoal		1		0.02 g
		Bone	fragment			143	total
		Bone	fish			15	
		Lithic	flake			10	obsidian
		Shell	whole			1	snail

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FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
48	428N 500E	Cheno-Am	embryo	1			<0.01 g
	QD L13	Cheno-Am	seed		16		<0.01 g
	Unit 4	Chenopodium	seed	1	1		<0.01 g
		Scirpus	seed		10		<0.01 g
		Asteraceae	charcoal		3		<0.01 g
		Unidentifiable-vit	charcoal		12		0.01 g
		Bone	fragment			590	total
		Bone	fish			71	
		Lithic	flake			65	obsidian
49	428N 500E		charcoal				
	QD L13	Bone	fragment			685	total
	Unit 4	Bone	fish			156	
		Lithic	flake			130	obsidian
50	428N 500E	Cheno-Am	embryo	1			<0.01 g
	QD L13	Cheno-Am	seed		20		<0.01 g
	Unit 4	Suaeda	seed	2	1		<0.01 g
		Chrysothamnus	seed	1			<0.01 g
		Scirpus	seed		16		<0.01 g
		Bone	fragment			787	total
		Bone	fish			111	
		Lithic	flake			113	obsidian

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FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
51	428N 500E	Cheno-Am	seed		8		<0.01 g
	QD L13	Scirpus	seed		13		<0.01 g
	Unit 4	Asteraceae-vitrified	charcoal		1		<0.01 g
		Chrysothamnus	charcoal		1		<0.01 g
		Sarcobatus	charcoal		1		<0.01 g
		Unidentifiable-vit	charcoal		10		<0.01 g
		Bone	fragment			760	total
		Bone	fish			87	
		Lithic	flake			106	obsidian
		Ochre	fragment			2	
52	428N 500E	Cheno-Am	seed		11		<0.01 g
	QD L14	Chenopodium	seed	2			<0.01 g
	Unit 4	Scirpus	seed		10		<0.01 g
		Chrysothamnus	charcoal		2		<0.01 g
		Rosaceae	charcoal		1		<0.01 g
		Unidentifiable-vit	charcoal		15		0.02 g
		Bone	fragment			252	total
		Bone	fish			36	
		Lithic	flake			76	obsidian
53	428N 500E	Cheno-Am	embryo	1			<0.01 g
	QD L14	Cheno-Am	seed	1	5		<0.01 g
	Unit 4	Scirpus	seed		22		<0.01 g
		Unidentified	seed		1		<0.01 g
		Chenopodiaceae	charcoal		9		0.02 g
		Salicacea	charcoal		1		<0.01 g
		Bone	fragment			989	total
		Bone	fish			102	
		Lithic	flake			55	obsidian

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FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
54	428N 500E	Cheno-Am	seed		12		<0.01 g
	QD L15	Atriplex	seed	1			<0.01 g
	Unit 4	Scirpus	seed		1		<0.01 g
		Unidentified	tissue		9		<0.01 g
		Chenopodiaceae	charcoal		1		<0.01 g
		Salicacea	charcoal		1		0.02 g
		Bone	fragment			659	total
		Bone	fish			38	
		Lithic	flake			81	obsidian
		Shell	whole			1	snail
55	428N 502E	Chenopodium	seed			2	modern
	QA L16	Unidentifiable	charcoal		1		<0.01 g
	Unit 12	Bone	fragment			418	total
		Bone	fish			33	
		Lithic	flake			73	obsidian
		Ochre	fragment			1	
56	428N 502E	Cheno-Am	seed			1	modern
	QA L16	Scirpus	seed		1		<0.01 g
	Unit 12	Bone	fragment			184	total
		Bone	fish			28	
		Lithic	flake			43	obsidian
57	428N 502E	Cheno-Am	embryo	1			<0.01 g
	QA L16	Scirpus	seed		6		<0.01 g
	Unit 12	PET	tissue		1		starchy
		Chrysothamnus	charcoal		7		0.10 g
		Rosaceae	charcoal		3		0.01 g
		Bone	fragment			742	total
		Bone	fish			121	
		Lithic	flake			134	obsidian
		Ochre	fragment			3	

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FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
58	428N 502E	Cheno-Am	seed		3		<0.01 g
	QA L16	Chenopodium	seed	1			<0.01 g
	Unit 12	Scirpus	seed		1		<0.01 g
		Unidentifiable - vit	charcoal		5		<0.01 g
		Bone	fragment			315	total
		Bone	fish			24	
		Lithic	flake			85	obsidian
59	428N 502E	Cheno-Am	seed		13		<0.01 g
	QA L17	Suaeda	seed	1	2		<0.01 g
	Unit 12	Scirpus	seed		17		<0.01 g
		Rosaceae	charcoal		2		<0.01 g
		Unidentifiable	charcoal		8		0.01 g
		Bone	fragment			898	total
		Bone	fish			64	
		Lithic	flake			129	obsidian
60	428N 502E	Cheno-Am	embryo	1			<0.01 g
	QA L17	Cheno-Am	seed		1		<0.01 g
	Unit 12	Bone	fragment			310	total
		Bone	fish			28	
		Lithic	flake			70	obsidian
61	428N 502E	Cheno-Am	embryo	1			<0.01 g
	QA L17	Cheno-Am	seed		6		<0.01 g
	Unit 12	Scirpus	seed		9		<0.01 g
		Unidentifiable - vit	charcoal		5		0.004 g
		Bone	fragment			250	total
		Bone	fish			22	
		Lithic	flake			70	obsidian
		Ochre	fragment			1	

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FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
62	428N 502E	Cheno-Am	embryo	8	1		<0.01 g
	QA L17	Cheno-Am	seed		10		<0.01 g
	Unit 12	Suaeda	seed	4	1		<0.01 g
		Scirpus	seed		16		<0.01 g
		Chenopodiaceae	charcoal		15		0.02 g
		Rosaceae	charcoal		5		<0.01 g
		Bone	fragment			631	total
		Bone	fish			69	
		Lithic	flake			45	obsidian
63	428N 502E	Scirpus	seed		1		<0.01 g
	QB L13	Chenopodiaceae	charcoal		2		<0.01 g
	Unit 12	Bone	fragment			342	total
		Bone	fish			40	
		Lithic	flake			41	obsidian
64	428N 502E	Cheno-Am	embryo	1			<0.01 g
	QB L14	Cheno-Am	seed		6		<0.01 g
	Unit 12	Suaeda	seed	2			<0.01 g
		Scirpus	seed		1		<0.01 g
		cf. Asteraceae	charcoal		1		<0.01 g
		Unidentifiable-vit	charcoal		5		<0.01 g
		Bone	fragment			179	total
		Bone	fish			12	
		Lithic	flake			30	obsidian

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FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
65	428N 502E	Cheno-Am	seed	1	3		<0.01 g
	QB L14	<u>Scirpus</u>	seed		4		<0.01 g
	Unit 12	Unidentifiable - vit	charcoal		2		<0.01 g
		Bone	fragment			57	total
		Bone	fish			3	
		Lithic	flake			49	obsidian
66	428N 502E	Unidentifiable	charcoal		4		<0.01 g
	QB L14	Bone	fragment			487	total
	Unit 12	Bone	fish			18	
		Lithic	flake			99	obsidian
67	428N 502E	Unidentified	seed		1		<0.01 g
	QB L14	Bone	fragment			178	total
	Unit 12	Bone	fish			8	
		Lithic	flake			94	obsidian
68	428N 502E	Cheno-Am	seed		3		<0.01 g
	QC L13	Rosaceae	charcoal		1		<0.01 g
	Unit 12	Bone	fragment			741	total
		Bone	fish			95	
		Lithic	flake			164	obsidian
		Ochre	fragment			1	
69	428N 502E	Cheno-Am	seed		2		<0.01 g
	QC L13	<u>Scirpus</u>	seed		1		<0.01 g
	Unit 12	Bone	fragment			992	total
		Bone	fish			60	
		Lithic	flake			372	obsidian

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FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
70	428N 502E	Cheno-Am	embryo	2			<0.01 g
	QC L14	Cheno-Am	seed		3		<0.01 g
	Unit 12	Chenopodiaceae	charcoal		5		<0.01 g
		Sarcobatus	charcoal		1		<0.01 g
		Unidentifiable	charcoal		8		<0.01 g
		Bone	fragment			1002	total
		Bone	fish			46	
		Lithic	flake			301	obsidian
71	428N 502E	Bone	fragment			397	total
	QC L14	Bone	fish			47	
	Unit 12	Lithic	fragment			133	obsidian
		Shell	whole			1	snail
72	428N 502E	Unidentified	seed		1		<0.01 g
	QC L14	Chrysothamnus	charcoal		1		0.01 g
	Unit 12	Bone	fragment			336	total
		Bone	fish			35	
		Lithic	flake			128	obsidian
73	428N 502E	Chenopodiaceae	charcoal		3		<0.01 g
	QC L14	Bone	fragment			359	total
	Unit 12	Bone	fish			54	
		Lithic	flake			147	obsidian

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FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
74	428N 502E	Cheno-Am	embryo	1	11		<0.01 g
	QC L15	Chenopodium	seed		1		<0.01 g
	Unit 12	Suaeda	seed	1			<0.01 g
		Scirpus	seed		23		<0.01 g
		Chenopodiaceae	charcoal		16		0.05 g
		Sarcobatus	charcoal		4		0.03 g
		Bone	fragment			1329	total
		Bone	fish			39	
		Lithic	flake			502	obsidian
75	428N 502E	Bone	fragment			225	total
	QD L12	Bone	fish			21	
	Unit 12	Lithic	flake			200	obsidian
76	428N 502E	Scirpus	seed		2		<0.01 g
	QD L13	Bone	fragment			600	total
	Unit 12	Bone	fish			11	
		Lithic	flake			229	obsidian
77	430N 499E	Cheno-Am	seed		2		<0.01 g
	QD L13	Scirpus	seed		2		<0.01 g
	Unit 9DD	Artemisia	charcoal		1		<0.01 g
		Chrysothamnus	charcoal		1		<0.01 g
		Bone	fragment			192	total
		Bone	fish			22	
		Lithic	flake			25	obsidian
78	430N 499E	Scirpus	seed		3		<0.01 g
	QD L13	Chrysothamnus	charcoal		1		<0.01 g
	Unit 9DD	Unidentifiable	charcoal		3		<0.01 g
		Bone	fragment			405	total
		Bone	fish			20	
		Lithic	flake			36	obsidian

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FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
79	430N 499E	Bone	fragment			205	total
	QD L13	Bone	fish			18	
	Unit 9DD	Lithic	flake			37	obsidian
80	430N 499E	Scirpus	seed		12		<0.01 g
	QD L13	Chenopodiaceae	charcoal		6		0.01 g
	Unit 9DD	Unidentifiable	charcoal		1		0.01 g
		Bone	fragment			448	total
		Bone	fish			19	
		Lithic	flake			50	obsidian
81	430N 499E	Bone	fragment			647	total
	QD L14	Bone	fish			82	
	Unit 9DD	Lithic	flake			63	obsidian
82	430N 499E	Suaeda	seed	1			<0.01 g
	QD L14	Scirpus	seed		2		<0.01 g
	Unit 9DD	Unidentified	seed		1		<0.01 g
		Chenopodiaceae	charcoal		3		<0.01 g
		Bone	fragment			232	total
		Bone	fish			21	
		Lithic	flake			21	obsidian
		Shell	whole			1	snail
83	430N 499E	Unidentified	seed	1			<0.01 g
	QD L15	Bone	fragment			79	total
	Unit 9DD	Bone	fish			11	
		Lithic	flake			14	obsidian

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FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
84	430N 499E	Chenopodium	seed	1	1		<0.01 g
	QD L16	Unidentifiable	charcoal		2		0.01 g
	Unit 9DD	Bone	fragment			137	total
		Bone	fish			10	
		Lithic	flake			16	obsidian
85	432N 500E	Cheno-Am	embryo	1			<0.01 g
	QD L14	Cheno-Am	seed		1		<0.01 g
	Unit 9	Suaeda	seed	1			<0.01 g
		Scirpus	seed		10		<0.01 g
		Unidentifiable-vit	charcoal		2		<0.01 g
		Unidentifiable-sma	charcoal		1		<0.01 g
		Bone	fragment			146	total
		Bone	fish			8	
		Lithic	flake			24	obsidian
86	432N 500E	Cheno-Am	seed		1		<0.01 g
	QD L14	Scirpus	seed		2		<0.01 g
	Unit 9	Bone	fragment			327	total
		Bone	fish			34	
		Lithic	flake			50	obsidian
87	432N 500E	Cheno-Am	seed		6		<0.01 g
	QD L14	Scirpus	seed		17		<0.01 g
	Unit 9	Unidentifiable-sma	charcoal		1		<0.01 g
		Bone	fragment			245	total
		Bone	fish			45	
		Lithic	flake			72	obsidian

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FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
88	432N 500E	Cheno-Am	seed		1		<0.01 g
	QD L14	Scirpus	seed		34		<0.01 g
	Unit 9	Sarcobatus	charcoal		1		<0.01 g
		Bone	fragment			222	total
		Bone	fish			14	
		Lithic	flake			40	obsidian
89	432N 500E	Cheno-Am	seed		15		<0.01 g
	QD L15	Atriplex	seed	1			<0.01 g
	Unit 9	Suaeda	seed	1			<0.01 g
		Scirpus	seed	1	37		<0.01 g
		Artemisia	charcoal		1		<0.001 g
		Rosaceae	charcoal		1		<0.001 g
		Unid hardwood	charcoal		1		<0.001 g
		Unidentifiable-vit	charcoal		6		0.003 g
		Unidentified-small	charcoal		x		0.003 g
		Bone	fragment			293	total
		Bone	fish			38	
		Lithic	flake			31	obsidian
90	432N 500E	Cheno-Am	seed		3		<0.01 g
	QD L15	Scirpus	seed		10		<0.01 g
	Unit 9	Asteraceae	charcoal		3		<0.01 g
		Chrysothamnus	charcoal		2		<0.01 g
		Unidentifiable-vit	charcoal		2		<0.01 g
		Unidentifiable-sma	charcoal		3		<0.01 g
		Bone	fragment			275	total
		Bone	fish			21	
		Lithic	flake			34	obsidian

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FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
91	432N 500E	Cheno-Am	seed		3		<0.01 g
	QD L15	Scirpus	seed		22		<0.01 g
	Unit 9	Juncus type	seed	1			<0.01 g
		Bone	fragment			131	total
		Bone	fish			15	
		Lithic	flake			27	obsidian
92	432N 500E	Cheno-Am	seed		10		<0.01 g
	QD L15	Scirpus	seed		42		<0.01 g
	Unit 9	Asteraceae	charcoal		2		<0.01 g
		Chrysothamnus	charcoal		1		<0.01 g
		Unidentifiable-sma	charcoal		x		<0.01 g
		Bone	fragment			243	total
		Bone	fish			15	
		Lithic	flake			46	obsidian
93	432N 500E	Cheno-Am	seed		3		<0.01 g
	QD L16	Suaeda	seed	1	1		<0.01 g
	Unit 9	Scirpus	seed		21		<0.01 g
		Artemisia	charcoal		7		0.001 g
		Unidentifiable-vit	charcoal		1		<0.001 g
		Bone	fragment			244	total
		Bone	fish			10	
		Lithic	flake			71	obsidian
94	432N 500E	Cheno-Am	seed		1		<0.01 g
	QD POST	Scirpus	seed		5		<0.01 g
	Unit 9	Unidentifable	charcoal		4		<0.01 g
		Bone	fragment			174	total
		Bone	fish			20	
		Lithic	flake			43	obsidian

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FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
95	432N 500E	Cheno-Am	seed		3		<0.01 g
	QC L14	Scirpus	seed		8		<0.01 g
	Unit 9	Unidentifiable	charcoal		4		<0.01 g
		Bone	fragment			130	total
		Bone	fish			17	
		Lithic	flake			27	obsidian
96	432N 500E	Cheno-Am	seed		7		<0.01 g
	QC L14	Suaeda	seed	1			<0.01 g
	Unit 9	Scirpus	seed		9		<0.01 g
		cf. Asteraceae	charcoal		2		<0.01 g
		Bone	fragment			95	total
		Bone	fish			9	
		Lithic	flake			11	obsidian
97	432N 500E	Cheno-Am	seed		4		<0.01 g
	QC L14	Scirpus	seed		14		<0.01 g
	Unit 9	Unidentifiable	charcoal		x		
		Bone	fragment			58	obsidian
		Bone	fish			9	
		Lithic	flake			48	obsidian
98	432N 500E	Scirpus	seed		6		<0.01 g
	QC L14	Unidentifiable	charcoal		1		<0.01 g
	Unit 9	Bone	fragment			122	total
		Bone	fish			12	
		Lithic	flake			24	obsidian

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FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
99	432N 500E	Cheno-Am	seed		9		<0.01 g
	QC L14	Scirpus	seed		30		<0.01 g
	Unit 9	Sarcobatus	charcoal		2		<0.01 g
		Unidentifiable	charcoal		1		<0.01 g
		Bone	fragment			125	total
		Bone	fish			18	
		Lithic	flake			18	obsidian
100	432N 500E	Cheno-Am	seed		5		<0.01 g
	QC L15	Suaeda	seed	1			<0.01 g
	Unit 9	Scirpus	seed		21		<0.01 g
		Artemisia	charcoal		3		<0.01 g
		Unidentifiable	charcoal		13		<0.01 g
		Bone	fragment			180	total
		Bone	fish			18	<0.01 g
		Lithic	flake			38	obsidian
101	432N 500E	Cheno-Am	seed		4		<0.01 g
	QB L13	Scirpus	seed		1		<0.01 g
	Unit 9	PET	tissue		1		starchy
		Unidentifiable	charcoal		1		<0.01 g
		Bone	fragment			73	total
		Bone	fish			14	
		Lithic	flake			10	obsidian
102	432N 500E	Scirpus	seed		4		<0.01 g
	QB L13	Unidentifiable	charcoal		1		<0.01 g
	Unit 9	Bone	fragment			123	total
		Bone	fish			5	
		Lithic	flake			62	obsidian

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FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
103	432N 500E	Scirpus	seed		15		<0.01 g
	Unit 9	Unidentifiable	charcoal		1		<0.01 g
	QB L13	Asteraceae	charcoal		1		<0.01 g
		Bone	fragment			65	total
		Bone	fish			3	
		Lithic	flake			9	obsidian
104	432N 500E	Cheno-Am	seed		24		<0.01 g
	QB L13	Scirpus	seed	1	99		<0.01 g
	Unit 9	Unidentifiable-vit	charcoal		7		<0.01 g
		Bone	fragment			174	total
		Bone	fish			5	
		Lithic	flake			54	obsidian
105	432N 500E	Scirpus	seed		1		
	QB L12	Bone	fragment			72	total
	Unit 9	Bone	fish			5	
		Lithic	flake			20	obsidian
106	432N 500E	Cheno-Am	seed		1		<0.01 g
	QB L12	Scirpus	seed		11		<0.01 g
	Unit 9	Bone	fragment			207	total
		Bone	fish			8	
		Lithic	flake			67	obsidian
107	432N 500E	Cheno-Am	embryo		1		<0.01 g
	QB L12	Atriplex	seed	2			<0.01 g
	Unir 9	Scirpus	seed		16		<0.01 g
		Unidentifiable	charcoal		2		<0.01 g
		Bone	fragment			55	total
		Bone	fish			4	
		Lithic	flake			20	obsidian

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FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
108	432N 500E	Cheno-Am	seed		2		<0.01 g
	QB L12	Scirpus	seed		22		<0.01 g
	Unit 9	Bone	fragment			297	total
		Bone	fish			39	
		Lithic	flake			43	obsidian
109	432N 500E	Scirpus	seed		1		<0.01 g
	QA L11	Bone	fragment			140	total
	Unit 9	Bone	fish			16	
		Lithic	flake			21	obsidian
110	432N 500E	Bone	fragment			89	total
	QA L11	Bone	fish			10	<0.01 g
	Unit 9	Lithic	flake			20	obsidian
111	432N 500E	Scirpus	seed		3		<0.01 g
	QA L11	Bone	fragment			51	total
	Unit 9	Bone	fish			3	
		Lithic	flake			26	obsidian
112	432N 500E	Cheno-Am	seed		1		<0.01 g
	QA L11	Scirpus	seed		2		<0.01 g
	Unit 9	Bone	fragment			54	total
		Bone	fish			2	
		Lithic	flake			17	obsidian
113	432N 500E	Bone	fragment			37	total
	QA L12	Bone	fish			5	
	Unit 9	Lithic	flake			6	obsidian
114	432N 500E	Scirpus	seed		3		<0.01 g
	QA L12	Bone	fragment			90	total
	Unit 9	Bone	fish			15	
		Lithic	flake			17	obsidian

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FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
115	428N 498E	Cheno-Am	embryo	1			<0.01 g
	QD L10	Cheno-Am	seed		2		<0.01 g
	Unit 9CC	Scirpus	seed		3		<0.01 g
		Bone	fragment			167	total
		Bone	fish			13	
		Lithic	flake			51	obsidian
116	428N 498E	Cheno-Am	seed		1		<0.01 g
	QD L10	Scirpus	seed		2		<0.01 g
	Unit 22	Bone	fragment			178	total
		Bone	fish			10	
		Lithic	flake			56	obsidian
117	Unit 22						
118	428N 498E	Cheno-Am	seed		25		<0.01 g
	QD L11	Scirpus	seed		6		<0.01 g
	Unit 22	Bone	fragment			142	total
		Bone	fish			12	
		Lithic	flake			27	obsidian
119	428N 498E	Cheno-Am	embryo	1	1		<0.01 g
	QD L11	Cheno-Am	seed		6		<0.01 g
	Unit 22	Suaeda	seed	1			<0.01 g
		Scirpus	seed		3		<0.01 g
		Bone	fragment			150	total
		Bone	fish			9	
		Lithic	flake			21	obsidian
120	428N 498E	Bone	fragment			194	total
	QD L11	Bone	fish			6	<0.01 g
	Unit 22	Lithic	flake			113	obsidian

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FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
121	428N 498E	Scirpus	seed		2		<0.01 g
	QD L11	Bone	fragment			245	total
	Unit 22	Bone	fish			22	
		Lithic	flake			58	obsidian
122	428N 498E	Cheno-Am	seed		8		<0.01 g
	QD L12	Chrysothamnus	seed		1		<0.01 g
	Unit 22	Scirpus	seed		6		<0.01 g
		Bone	fragment			172	total
		Bone	fish			4	
		Lithic	flake			41	obsidian
123	428N 500E	Cheno-Am	seed		21		<0.01 g
	QB L15	Scirpus	seed		3		<0.01 g
	Unit 4	Chrysothamnus	charcoal		2		<0.01 g
		Rosaceae	charcoal		1		<0.01 g
		Unidentified A	charcoal		1		<0.01 g
		Unidentifiable - vit	charcoal		11		<0.01 g
		Bone	fragment			586	total
		Bone	fish			32	
		Lithic	flake			100	obsidian
124	428N 500E	Cheno-Am	embryo	2			<0.01 g
	QB L15	Cheno-Am	seed		54		<0.01 g
	Unit 4	Suaeda	seed	3			<0.01 g
		Scirpus	seed		72		<0.01 g
		Asteraceae	charcoal		1		<0.01 g
		Chrysothamnus	charcoal		2		<0.01 g
		Rosaceae, cf cowa	charcoal		6		0.02 g
		Sarcobatus	charcoal		6		0.01 g
		Unidentifiable-vit	charcoal		15		0.03 g
		Bone	fragment			960	total
		Bone	fish			32	
		Lithic	flake			68	obsidian

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FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
125	428N 498E	Bone	fragment			259	total
	QB L10	Bone	fish			30	
	Unit 22	Lithic	flake			35	obsidian
126	428N 498E	Scirpus	seed		4		<0.01 g
	QB L10	Bone	fragment			482	total
	Unit 22	Bone	fish			40	
		Lithic	flake			26	obsidian
127	428N 498E	Bone	fragment			269	total
	QB L10	Bone	fish			37	
	Unit 22	Lithic	flake			42	obsidian
128	428N 498E	Cheno-Am	seed		11		<0.01 g
	QB L11	Scirpus	seed		8		<0.01 g
	Unit 22	Artemisia	charcoal		1		<0.01 g
		Chrysothamnus	charcoal		1		<0.01 g
		Unidentifiable	charcoal		x		<0.01 g
		Bone	fragment			251	total
		Bone	fish			34	
		Lithic	flake			49	obsidian
129	428N 498E	Cheno-Am	embryo	1			<0.01 g
	QB L11	Cheno-Am	seed		3		<0.01 g
	Unit 22	Scirpus	seed		3		<0.01 g
		Asteraceae	charcoal		3		<0.01 g
		Sarcobatus	charcoal		2		<0.01 g
		Bone	fragment			227	total
		Bone	fish			30	
		Lithic	flake			49	obsidian

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FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
130	428N 498E	Bone	fragment			223	total
	QB L11	Bone	fish			41	
	Unit 22	Lithic	flake			41	obsidian
131	428N 498E	Cheno-Am	seed		2		<0.01 g
	QB L12	Scirpus	seed		5		<0.01 g
	Unit 22	Asteraceae	charcoal		1		<0.01 g
		Chrysothamnus	charcoal		1		<0.01 g
		Rosaceae	charcoal		1		<0.01 g
		Unidentifiable-vit	charcoal		7		<0.01 g
		Bone	fragment			514	total
		Bone	fish			80	
		Lithic	flake			84	obsidian
132	428N 498E	Cheno-Am	embryo	1			<0.01 g
	QB L12	Cheno-Am	seed		2		<0.01 g
	Unit 22	Scirpus	seed		7		<0.01 g
		Rosaceae	charcoal		1		<0.01 g
		Unidentifiable-vit	charcoal		9		0.01 g
		Bone	fragment			242	total
		Bone	fish			31	
		Lithic	flake			23	obsidian
133	428N 498E	Bone	fragment			129	total
	QA L10	Bone	fish			14	
	Unit 22	Lithic	flake			33	obsidian

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FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
134	428N 498E	Bone	fragment			138	total
	QA L10	Bone	fish			12	obsidian
		Lithic	flake			22	obsidian
135	428N 498E	Cheno-Am	seed		1		<0.01 g
	QA L10	*Scirpus*	seed		2		<0.01 g
	Unit 22	Unidentifiable-vit	charcoal		1		<0.01 g
		Bone	fragment			299	total
		Bone	fish			24	
		Lithic	flake			47	obsidian
136	428N 498E	Bone	fragment			213	total
	QA L10	Bone	fish			30	
	Unit 22	Lithic	flake			23	obsidian
137	428N 498E	Cheno-Am	embryo	1			<0.01 g
	QA L11	Cheno-Am	seed		4		<0.01 g
	Unit 22	*Scirpus*	seed		1		<0.01 g
		Bone	fragment			90	total
		Bone	fish			4	
		Lithic	flake			14	obsidian
138	428N 498E	Cheno-Am	seed		2		<0.01 g
	QA L11	*Chenopodium*	seed	1			<0.01 g
	Unit 22	*Scirpus*	seed		5		<0.01 g
		Bone	fragment			141	total
		Bone	fish			8	
		Lithic	flake			24	obsidian

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FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
139	428N 498E	Cheno-Am	embryo	1			<0.01 g
	QA L11	Cheno-Am	seed		1		<0.01 g
	Unit 22	Scirpus	seed		5		<0.01 g
		Asteraceae	charcoal		1		<0.01 g
		Unidentifiable	charcoal		6		<0.01 g
		Bone	fragment			131	total
		Bone	fish			6	
		Lithic	flake			33	obsidian
140	428N 498E	Cheno-Am	embryo	3			<0.01 g
	QA L11	Cheno-Am	seed		3		<0.01 g
	Unit 22	Chenopodium	seed	1			<0.01 g
		Scirpus	seed		7		<0.01 g
		Bone	fragment			184	total
		Bone	fish			28	
		Lithic	flake			43	obsidian
141	432N 502E	Bone	fragment			535	total
	QA L12	Bone	fish			42	
	Unit 10	Lithic	flake			45	obsidian
142	432N 502E	Scirpus	seed		2		<0.01 g
	QA L12	Bone	fragment			199	total
	Unit 10	Bone	fish			18	
		Lithic	flake			69	obsidian

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FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
143	432N 502E	Scirpus	seed		3		<0.01 g
	QA L12	Bone	fragment			361	total
	Unit 10	Bone	fish			70	
		Lithic	flake			36	obsidian
144	432N 502E	Cheno-Am	seed		4		<0.01 g
	QA L12	Scirpus	seed		4		<0.01 g
	Unit 10	Bone	fragment			235	total
		Bone	fish			20	
		Lithic	flake			47	obsidian
145	432N 502E	Bone	fragment			269	total
	QA L13	Bone	fish			40	
	Unit 10	Lithic	flake			32	obsidian
146	432N 502E	Cheno-Am	seed		1		
	QB L13	Scirpus	seed		1		<0.01 g
	Unit 10	Bone	fragment			271	total
		Bone	fish			26	
		Lithic	flake			58	obsidian
147	432N 502E	Scirpus	seed		1		<0.01 g
	QA L13	Bone	fragment			208	total
	Unit 10	Bone	fish			16	
		Lithic	flake			65	obsidian
148	432N 502E	Scirpus	seed		2		<0.01 g
	QB L13	Bone	fragment			157	total
	Unit 10	Bone	fish			20	
		Lithic	flake			28	obsidian

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FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
149	432N 502E	Cheno-Am	embryo	2			<0.01 g
	QB L13	Scirpus	seed		1		<0.01 g
	Unit 10	Bone	fragment			172	total
		Bone	fish			12	
		Lithic	flake			36	obsidian
150	432N 502E	Bone	fragment			178	total
	QB L13	Bone	fish			24	
	Unit 10	Lithic	flake			54	obsidian
151	432N 502E	Bone	fragment			192	total
	QB L14	Bone	fish			18	
	Unit 10	Lithic	flake			34	obsidian
152	432N 502E	Cheno-Am	seed		2		<0.01 g
	QB L14	Scirpus	seed		2		<0.01 g
	Unit 10	Bone	fragment			213	total
		Bone	fish			12	
		Lithic	flake			18	obsidian
153	432N 502E	Cheno-Am	embryo	2	1		<0.01 g
	QB L14	Scirpus	seed		6		<0.01 g
	Unit 10	Bone	fragment			140	obsidian
		Bone	fish			6	
		Lithic	flake			43	obsidian
154	432N 502E	Cheno-Am	seed		2		<0.01 g
	QB L14	Scirpus	seed		6		<0.01 g
	Unit 10	Bone	fragment			159	obsidian
		Bone	fish			4	
		Lithic	flake			34	obsidian

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FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
155	432N 502E	Cheno-Am	seed		2		<0.01 g
	QD L11	Scirpus	seed	1	3		<0.01 g
	Unit 10	Bone	fragment			134	obsidian
		Bone	fish			12	
		Lithic	flake			18	obsidian
156	432N 502E	Cheno-Am	seed		1		<0.01 g
	QD L11	Scirpus	seed		8		<0.01 g
	Unit 10	Bone	fragment			119	total
		Bone	fish			6	
		Lithic	flake			12	obsidian
157	432N 502E	Scirpus	seed		4		<0.01 g
	QD L11	Bone	fragment			143	total
	Unit 10	Bone	fish			4	
		Lithic	flake			16	obsidian
158	432N 502E	Scirpus	seed		9		<0.01 g
	QD L11	Bone	fragment			126	total
	Unit 10	Bone	fish			4	
		Lithic	flake			12	obsidian
159	432N 502E	Cheno-Am	seed		1		<0.01 g
	QC L13	Bone	fragment			360	total
	Unit 10	Bone	fish			54	
		Lithic	flake			64	obsidian
160	432N 502E	Scirpus	seed		1		<0.01 g
	QC L13	Bone	fragment			612	total
	Unit 10	Bone	fish			102	
		Lithic	flake			30	obsidian

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FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
161	432N 502E	Bone	fragment			505	total
	QC L13	Bone	fish			32	
	Unit 10	Lithic	flake			61	obsidian
162	432N 502E	Bone	fragment			583	total
	QC L13	Bone	fish			100	
	Unit 10	Lithic	flake			77	obsidian
163	432N 502E	<u>Scirpus</u>	seed		5		<0.01 g
	QC L14	Bone	fragment			300	total
	Unit 10	Bone	fish			52	
		Lithic	flake			58	obsidian
164	432N 502E	<u>Scirpus</u>	seed		3		<0.01 g
	QC L14	Bone	fragment			323	total
	Unit 10	Bone	fish			56	
		Lithic	flake			49	obsidian
165	432N 502E	<u>Scirpus</u>	seed		1		<0.01 g
	QC L14	Bone	fragment			429	total
	Unit 10	Bone	fish			48	
		Lithic	flake			79	obsidian
166	432N 502E	Cheno-Am	seed		1		<0.01 g
	QC L14	<u>Scirpus</u>	seed		6		<0.01 g
	Unit 10	Bone	fragment			507	total
		Bone	fish			24	
		Lithic	flake			112	obsidian

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FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
167	432N 502E	Scirpus	seed		1		<0.01 g
	QD L13	Bone	fragment			539	total
	Unit 10	Bone	fish			18	
		Lithic	flake			140	obsidian
168	432 N 502 E	Cheno-Am	seed		2		<0.01 g
	QD L13	Scirpus	seed		1		<0.01 g
	Unit 10	Bone	fragment			356	total
		Bone	fish			28	
		Lithic	flake			41	obsidian
169	432N 502E	Bone	fragment			435	total
	QD L13	Bone	fish			62	
	Unit 10	Lithic	flake			65	obsidian
170	432N 502E	Cheno-Am	embryo	1			<0.01 g
	QD L13	Cheno-Am	seed		1		<0.01 g
	Unit 10	Bone	fragment			336	total
		Bone	fish			14	
		Lithic	flake			70	obsidian
171	432N 502E	Cheno-Am	seed		5		<0.01 g
	QD L14	Scirpus	seed		14		<0.01 g
	Unit 10	Bone	fragment			276	total
		Bone	fish			18	
		Lithic	flake			70	obsidian
172	432N 502E	Cheno-Am	seed		2		<0.01 g
	QD L14	Scirpus	seed		4		<0.01 g
	Unit 10	Bone	fragment			261	total
		Bone	fish			74	
		Lithic	flake			74	obsidian

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FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
173	432N 502E	Scirpus	seed		1		<0.01 g
	QD L14	Bone	fragment			565	total
	Unit 10	Bone	fish			45	
		Lithic	flake			74	obsidian
174	432N 502E	Cheno-Am	seed		2		<0.01 g
	QD L14	Scirpus	seed		4		<0.01 g
	Unit 10	Bone	fragment			618	total
		Bone	fish			44	
		Lithic	flake			61	obsidian
175	430N 502E	Bone	fragment			493	total
	QD L13	Bone	fish			18	
	Unit 11	Lithic	flake			106	obsidian
176	430N 502E	Atriplex	seed	1			<0.01 g
	QD L14	Bone	fragment			498	total
	Unit 11	Bone	fish			32	
		Lithic	flake			131	obsidian
177	430N 502E	Cheno-Am	embryo	1			<0.01 g
	QD L15	Suaeda	embryo	1			<0.01 g
	Unit 11	Scirpus	seed		8		<0.01 g
		Bone	fragment			528	total
		Bone	fish			14	
		Lithic	flake			124	obsidian
178	430N 502E	Chenopodium	seed			1	<0.01 g
	QD L15	Scirpus	seed		1		<0.01 g
	Unit 11	Bone	fragment			318	total
		Bone	fish			12	
		Lithic	flake			34	obsidian

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FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
179	430N 502E	Scirpus	seed		2		<0.01 g
	QD L15	Bone	fragment			610	total
	Unit 11	Bone	fish			52	
		Lithic	flake			96	obsidian
180	430N 502E	Cheno-Am	seed		3		<0.01 g
	QD L15	Bone	fragment			191	total
	Unit 11	Bone	fish			18	
		Lithic	flake			65	obsidian
181	428N 498E	Scirpus	seed		6		<0.01 g
	QC L10	Bone	fragment			198	total
	Unit 22	Bone	fish			9	
		Lithic	flake			36	obsidian
182	428N 498E	Cheno-Am	seed		1		<0.01 g
	QC L10	Scirpus	seed		1		<0.01 g
	Unit 22	Bone	fragment			224	total
		Bone	fish			42	
		Lithic	flake			66	obsidian
183	428N 498E	Cheno-Am	seed		2		<0.01 g
	QC L10	Bone	fragment			120	total
	Unit 22	Bone	fish			4	
		Lithic	flake			20	obsidian
184	428N 498E	Bone	fragment			303	total
	QC L10	Bone	fish			20	
	Unit 22	Lithic	flake			60	obsidian

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FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
185	428N 498E	Scirpus	seed		1		<0.01 g
	QC L11	Bone	fragment			212	total
	Unit 22	Bone	fish			24	
		Lithic	flake			41	obsidian
186	428N 498E	Scirpus	seed		5		<0.01 g
	QC L11	Bone	fragment			280	total
	Unit 22	Bone	fish			40	
		Lithic	flake			62	obsidian
187	428N 498E	Cheno-Am	seed		1		<0.01 g
	QC L11	Bone	fragment			136	total
	Unit 22	Bone	fish			12	
		Lithic	flake			28	obsidian
188	428N 498E	Scirpus	seed		1		<0.01 g
	QC L11	Bone	fragment			314	total
	Unit 22	Bone	fish			40	
		Lithic	flake			81	obsidian
189	432N 498E	Bone	fragment			262	total
	QC L8	Bone	fish			28	
	Unit 19	Lithic	flake			38	obsidian
190	432N 498E	Bone	fragment			325	total
	QC L8	Bone	fish			24	
	Unit 19	Lithic	flake			36	obsidian
191	432N 498E	Scirpus	seed		1		<0.01 g
	QC L8	Bone	fragment			252	total
	Unit 19	Bone	fish			28	
		Lithic	flake			44	obsidian

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FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
192	432N 498E	Cheno-Am	seed		2		<0.01 g
	QC L9	Scirpus	seed		4		<0.01 g
	Unit 19	Bone	fragment			182	total
		Bone	fish			32	
		Lithic	flake			16	obsidian
193	432N 498E	Cheno-Am	seed		2		<0.01 g
	QD L9	Scirpus	seed		4		<0.01 g
	Unit 19	Bone	fragment			102	total
		Bone	fish			16	
		Lithic	flake			24	obsidian
194	432N 498E	Scirpus	seed		3		<0.01 g
	QD L10	Bone	fragment			99	total
	Unit 19	Bone	fish			10	
		Lithic	flake			13	obsidian
195	432N 498E	Scirpus	seed		2		<0.01 g
	QD L10	Bone	fragment			242	total
	Unit 19	Bone	fish			32	
		Lithic	flake			22	obsidian
196	432N 498E	Scirpus	seed		1		<0.01 g
	QD L10	Bone	fragment			92	total
	Unit 19	Bone	fish			8	
		Lithic	flake			7	obsidian
197	432N 498E	Chrysothamnus	seed	1			<0.01 g
	QD L10	Bone	fragment			151	total
	Unit 19	Bone	fish			18	
		Lithic	flake			27	obsidian

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FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
198	430N 502E	Cheno-Am	embryo	1			<0.01 g
	QC L16	Cheno-Am	seed		11		<0.01 g
	Unit 11	Suaeda	seed	2	11		<0.01 g
		Scirpus	seed		24		<0.01 g
		Unidentified	seed	1			<0.01 g
		Bone	fragment			940	total
		Bone	fish			80	
		Lithic	flake			107	obsidian
		Ochre	fragment			2	
199	430N 502E	Cheno-Am	seed		4		<0.01 g
	QC L17	Suaeda	seed	2	1		<0.01 g
	Unit 11	Scirpus	seed		10		<0.01 g
		Artemisia	charcoal		1		<0.01 g
		Cercocarpus	charcoal		1		<0.01 g
		Chrysothamnus	charcoal		4		0.01 g
		Purshia	charcoal		2		<0.01 g
		Salicaeae	charcoal		1		<0.01 g
		Sarcobatus	charcoal		5		0.01 g
		Unidenifiable	charcoal		x		0.05 g
		Bone	fragment			556	total
		Bone	fish			41	
		Lithic	flake			32	obsidian
200	430N 498E	Cheno-Am	seed		2		<0.01 g
	QC L11	Scirpus	seed		6		<0.01 g
	Unit 9CC	Bone	fragment			254	total
		Bone	fish			12	
		Lithic	flake			45	obsidian

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FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
201	430N 498E	Cheno-Am	embryo	1			<0.01 g
	QC L11	Cheno-Am	seed		5		<0.01 g
	Unit 9CC	Scirpus	seed		9		<0.01 g
		Bone	fragment			342	total
		Bone	fish			32	
		Lithic	flake			32	obsidian
202	430N 498E	Bone	fragment			305	total
	QC L11	Bone	fish			36	
	Unit 9CC	Lithic	flake			70	obsidian
203	430N 498E	Scirpus	seed		7		<0.01 g
	QC L11	Bone	fragment			186	total
	Unit 9CC	Bone	fish			8	
		Lithic	flake			23	obsidian
204	430N 499E	Cheno-Am	seed		4		<0.01 g
	QD L12	Scirpus	seed		31		<0.01 g
	Unit 9DD	Bone	fragment			578	total
		Bone	fish			40	
		Lithic	flake			36	obsidian
205	430N 499E	Cheno-Am	seed		4		<0.01 g
	QD L12	Scirpus	seed		7		<0.01 g
	Unit 9DD	Bone	fragment			239	total
		Bone	fish			17	
		Lithic	flake			32	obsidian
206	430N 499E	Cheno-Am	seed		1		<0.01 g
	QD L12	Scirpus	seed		9		<0.01 g
	Unit 9DD	Bone	fragment			230	total
		Bone	fish			19	
		Lithic	flake			38	obsidian

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FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
207	430N 499E	Cheno-Am	seed		3		<0.01 g
	QD L12	Suaeda	seed	1			<0.01 g
	Unit 9DD	Scirpus	seed		16		<0.01 g
		Bone	fragment			255	total
		Bone	fish			16	
		Lithic	flake			18	obsidian
208	428N 500E	Cheno-Am	seed		5		<0.01 g
	QA L16	Scirpus	seed		8		<0.01 g
	Unit 4	Unidentifiable	charcoal		x		0.01 g
		Bone	fragment			1342	total
		Bone	fish			82	
		Lithic	flake			100	obsidian
		Ochre	fragment			1	
209	426 N 500E	Cheno-Am	seed		10		<0.01 g
	QC L10	Scirpus	seed		15		<0.01 g
	Unit 5	Bone	fragment			368	total
		Bone	fish			54	
		Lithic	flake			68	obsidian
210	442N 508E	Scirpus	seed		2		<0.01 g
	QA L10	Bone	fragment			150	total
	Unit 24	Bone	fish			20	
		Lithic	flake			24	obsidian
211	442N 508E	Cheno-Am	seed		1		<0.01 g
	QA L10	Scirpus	seed		1		<0.01 g
	Unit 24	Bone	fragment			216	total
		Bone	fish			18	
		Lithic	flake			48	obsidian

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FL=Flotation WH=Whole, Charred
FR=Frag, Charred UNC=Uncharred

FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
212	442N 508E	Scirpus	seed		1		<0.01 g
	QA L10	Bone	fragment			96	total
	Unit 24	Bone	fish			8	
		Lithic	flake			77	obsidian
213	442N 508E	Cheno-Am	seed		6		<0.01 g
	QA L10	Scirpus	seed		7		<0.01 g
	Unit 24		charcoal				
		Bone	fragment			195	total
		Bone	fish			29	
		Lithic	flake			70	obsidian
214	442N 508E	Bone	fragment			96	total
	QC L12	Bone	fish			6	
	Unit 24	Lithic	flake			20	obsidian
215	442N 508E	Bone	fragment			108	total
	QC L12	Bone	fish			4	
	Unit 24	Lithic	flake			17	obsidian
		Shell	whole			1	snail
216	442N 508E	Scirpus	seed		1		<0.01 g
	QC L12	Bone	fragment			142	total
	Unit 24	Bone	fish			30	
		Lithic	flake			20	obsidian
217	442N 508E	Bone	fragment			140	total
	QC L12	Bone	fish			20	
	Unit 24	Lithic	flake			68	obsidian

PET=Processed Edible Tissue
FL=Flotation WH=Whole, Charred
FR=Frag, Charred UNC=Uncharred

FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
218	438N 508E	Scirpus	seed		23		<0.01 g
	QA L10	Bone	fragment			184	total
	Unit 25	Bone	fish			30	
		Lithic	flake			34	obsidian
219	438N 508E	Cheno-Am	seed		1		<0.01 g
	QA L10	Scirpus	seed		4		<0.01 g
	Unit 25	Bone	fragment			357	total
		Bone	fish			41	
		Lithic	flake			54	obsidian
220	438N 508E	Bone	fragment			220	total
	QA L10	Bone	fish			20	
	Unit 25	Lithic	flake			72	obsidian
221	438N 508E	Scirpus	seed		15		<0.01 g
	QA L10	Bone	fragment			300	total
	Unit 25	Bone	fish			32	
		Lithic	flake			40	obsidian
222	438N 508E	Cheno-Am	seed		1		<0.01 g
	QC L10	Suaeda	seed		1		<0.01 g
	Unit 25	Scirpus	seed		6		<0.01 g
		Bone	fragment			373	total
		Bone	fish			46	
		Lithic	flake			46	obsidian
223	438N 508E	Cheno-Am	seed		3		<0.01 g
	QC L10	Scirpus	seed		9		<0.01 g
	Unit 25	Bone	fragment			331	total
		Bone	fish			60	
		Lithic	flake			58	obsidian

PET=Processed Edible Tissue
FL=Flotation WH=Whole, Charred
FR=Frag, Charred UNC=Uncharred

FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
224	438N 508E	Chenopodium	seed	1			<0.01 g
	QC L10	Scirpus	seed		6		<0.01 g
	Unit 25	Bone	fragment			303	total
		Bone	fish			60	
		Lithic	flake			47	obsidian
225	438N 508E	Chenopodium	seed	1			<0.01 g
	QC L10	Scirpus	seed		10		<0.01 g
	Unit 25	Bone	fragment			272	total
		Bone	fish			36	
		Lithic	flake			39	obsidian
226	436N 508E	Scirpus	seed		78		<0.01 g
	QA L18		charcoal				
	Unit 28	Bone	fragment			150	total
		Bone	fish			21	
		Lithic	flake			42	obsidian

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FR=Frag, Charred UNC=Uncharred

FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
227	436N 508E	Cheno-Am	embryo	1			<0.01 g
	QA L18	Cheno-Am	seed		5		<0.01 g
	Unit 28	Suaeda	seed	1			<0.01 g
		Scirpus	seed		58		<0.01 g
		Artemisia	charcoal		5		<0.01 g
		Cercocarpus	charcoal		3		<0.01 g
		Chrysothamnus	charcoal		12		0.01 g
		Sarcobatus	charcoal		6		0.01 g
		Unidentifiable	charcoal		x		0.02 g
		PET	tissue		1		starchy
		Bone	fragment			298	total
		Bone	fish			44	
		Lithic	flake			130	obsidian
		Ochre	fragment			2	
228	436N 508E	Cheno-Am	seed		8		<0.01 g
	QA L18	Suaeda	seed	2			<0.01 g
	Unit 28	Scirpus	seed		115		<0.01 g
			charcoal				
		Bone	fragment			457	total
		Bone	fish			36	
		Lithic	flake			58	obsidian
229	436N 508E	Cheno-Am	seed		7		<0.01 g
	QA L18	Scirpus	seed		89		<0.01 g
	Unit 28		charcoal				
		Bone	fragment			678	total
		Bone	fish			108	
		Lithic	flake			47	obsidian

PET=Processed Edible Tissue
FL=Flotation WH=Whole, Charred
FR=Frag, Charred UNC=Uncharred

FL No.	Provenience	Identification	Part	WH	FR	UNC	Weight/ Comment
230	440N 508E	Bone	fragment			225	total
	QC L10	Bone	fish			22	
	Unit 13	Lithic	flake			43	obsidian
231	440N 508E	Bone	fragment			179	total
	QA L10	Bone	fish			8	
	Unit 13	Lithic	flake			19	obsidian
		Ochre	fragment			1	
232	428N 502E	Bone	fragment			85	
	QD L12	Lithic	flake			12	obsidian
	Unit 12						
233	428N 502E	Bone	fragment			44	
	QD L13						
	Unit 12						
234	432N 498E	Bone	fragment			102	
	QC L12						
	Unit 19						
235	432N 498E	Bone	fragment			154	
	Unit 19	Lithic	flake			32	obsidian

PET=Processed Edible Tissue
FL=Flotation WH=Whole, Charred
FR=Frag, Charred UNC=Uncharred

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