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PREHISTORIC TIMBERLINE ADAPTATIONS IN THE EASTERN UINTA MOUNTAINS, UTAH

By

Michelle K. Knoll

A thesis submitted to the faculty of

Brigham Young University

in partial fulfillment of the requirements for the degree of

Masters of Arts

Department of Anthropology

Brigham Young University

August 2003

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GRADUATE COMMITTEE APPROVAL

of a thesis submitted by

Michelle K. Knoll

This thesis has been read by each member of the following graduate committee and by majority vote has been found to be satisfactory.

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As chair of the candidate's graduate committee, I have read the thesis of Michelle K. Knoll in its final form and have found that (1) its format, citations, and bibliographical style are consistent and acceptable and fulfill university and department style requirements; (2) its illustrative materials including figures, tables, and charts are in place; and (3) the final manuscript is satisfactory to the graduate committee and is ready for submission to the university library.

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ABSTRACT

PREHISTORIC TIMBERLINE ADAPTATIONS IN THE EASTERN UINTA MOUNTAINS, UTAH

Michelle K. Knoll
Department of Anthropology
Master's of Arts

Excavations at a high altitude archaeological site (3350 m) in the eastern Uinta Mountains, Utah, uncovered at least three ephemeral brush structures. These temporary timberline dwellings are the highest structures excavated in Utah to date. The periods of occupation range from the early Fremont period to the post-contact era.

It is believed that the Fremont occupations are logistical in nature, possibly representing male hunting parties. Logistical camps imply a departure from, and return to, a residential camp. Ethnographic studies show that most residential camps are located within proximity to culinary plants to facilitate collection by women. In the Uinta Mountains, residential camps were most likely located at mid-elevations for the procurement of Chenopodium seeds. In addition to the benefits women received by being close to an important economic resource, mid-elevation bases meant that logistical male hunting parties could access the upper-most elevations more efficiently.

A maximum transport distance model was tested for appropriateness at high altitudes. Maximum transport distance models measure levels of efficiency to and from a residential base (or, more correctly, to a point of consumption). They are mathematical models built on measures of caloric gain and expenditure.

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It is argued that efficiency models that focus on male economic tasks, typically expected at timberline sites, must also consider where the residential base will be located based on women's subsistence economies. In other words, in order to operate above a caloric loss the maximum return trip distance for a male hunter laden with a resource must reach the residential base. However, as stated earlier, the location of the residential base should be located where women could collect most efficiently, not at the male's maximum distance. Thus, the male logistical zone (from timberline to the residence) and the female residential zone must overlap, or the maximum transport model cannot be supported. In this case, other currencies, such as prestige and fatty meat, could have propelled an individual to travel farther that energy-based transport models allow.

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This project could not have been possible without the Ashley National Forest interns and volunteers from Passport in Time who donated their time and paid their own expenses to participate in the excavations this past summer. Even through inclement weather they held fast like troopers. Thanks to the Ashley National Forest for allowing the excavations to take place and for providing the pack animals when needed. I would also like to thank Byron Loosle for being my mentor in the field and for reminding me daily that archaeology can be fun.

I am grateful for the financial generosity of those who donated to the Graduate Research Fellowship Award, the Ella Jenson Carpenter Award, and the Shallot Award. Additional funding was also provided by the Ashley National Forest. Financial support paid for laboratory and excavation expenses.

This thesis is dedicated to Michael J. Martin, the best mountain climber I know, whose faithful encouragement and keen insight has inspired me through the years (even if he would have rather been climbing the mountains than mapping the hunting blinds).

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Chapter 1
Project Overview

Introduction

To date, most archaeological models concerned with timberline adaptations have focused on full-time hunter-gatherers. The Uinta Basin and the eastern Great Basin of Utah, which also sport mountain systems that reach the timberline ecotone, are unique because of the presence of farming groups who utilized the middle and upper montane zones for the procurement of wild resources. Based on data from a recently excavated Fremont-period site (Deadman Lake, 42Un2331) at 3350 m in the eastern Uinta Mountains, this thesis will attempt to accomplish the following objectives: (1) attain a better understand about mobility patterns of Fremont-period farmers as they pertain to montane settings; (2) identify the site type (logistical or residential), cultural affiliation (described here as a group's subsistence economy), and season of occupation; and (3) apply a maximum transport model, which will originate from the excavated site, to test the appropriateness of using efficiency models at high altitude sites.

The introduction of cultigens affected the mobility patterns of pre-equestrian horticulturalists to such a degree that they would have utilized the alpine zone differently than hunter-gatherers. Specifically, nutritional needs and the growing season of cultigens influenced a farmer's decision of *how* and *when* to use the high country. It is argued that full-time hunter-gatherers would have moved their residences to the alpine zone for the procurement of meat and carbohydrate-rich geophytes during the summer when farmers were tethered to the fields. After the fall harvest, farmers would be free to make short-term residential moves to mid-elevations to collect economic seeds from plants such as *Chenopodium* and *Amaranthus*. Mid-elevation residences near patches of important plants would have increased the collecting efficiency of women, while allowing greater accessibility to the upper-most elevations by logistically-oriented groups to hunt, collect medicinal plants, or perhaps participate in vision quests.

Until 2002, the only timberline archaeological site excavated in Utah was Chepeta Lake on the Ashley National Forest (ANF). In order to gain a better understanding of timberline land use by prehistoric populations, and to add to the Uinta Mountain data set, a site just above Deadman Lake (3350 m) was excavated in the summer of 2002. The result of two weeks of work is the identification of three ephemeral structures, one possible knapping station, a thermal feature, and one feature of undetermined function. Dates range from the Early Formative/Late Archaic period to the Numic occupation (historical). Cultural materials that were recovered from the site include debitage, utilized flake tools, Intermountain Brownware ceramics,

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a small amount of bone, and one decorative object. In general, the artifact assemblage was sparse, but that in and of itself is telling.

High Elevation Archaeology in the Western United States

While the Great Basin and Uinta Basin valleys have been studied extensively, our knowledge about human occupation of montane regions is relatively limited for a number of reasons. First and foremost, mountain zones generally do not contain the large, agriculturally-based sedentary villages, which were the main attraction for the archaeologists of the first half of the twentieth century (but see Metcalf et al. 1993). Second, sites at elevations above 2700 m are difficult places to conduct excavations; this is especially true if a site is only accessible by foot. Third, much archaeological work in the last 30 years has focused on lowland mitigation projects in response to urban development (Madsen and Metcalf 2000:ix). It is only since Benedict's work on the Colorado Front Range, and the discovery of alpine villages in California (Bettinger 1991b, 1999; Zeanah 2000) and Nevada (Thomas 1982), that studies of high altitude adaptations have been given their due recognition. Madsen and Metcalf (2000:x) see the growing interest in high altitude research, and a trend towards theory rather than description, as a sign of maturation into a "viable field of study."

The lure of the mountains has been enticing professionals and amateurs alike since the late 1800s. Some of the earliest field work (archaeological and ethnographical) conducted above timberline took place in the Colorado Rocky Mountains by pioneers such as Oliver Wolcott Toll (1891-1982), Jack Moomaw (1892-1975), Dorr Graves Yeager (1902-1996), Ronald Ives (1909-1982), and Mary Elizabeth Yelm (b. 1911). Benedict (2001:12) notes that during the 20s, 30s and 40s, archaeology was mostly descriptive, emphasized the discovery of new sites, and focused on the collection of artifacts for study and display. But because some of these earliest explorers took the time to record what they discovered, we now have what is many cases the only surviving record of North American timberline archaeology prior to WWII.

The Western Great Basin

Surveys and excavations in the mountains of the western Great Basin have revealed a prehistoric land use pattern that is different than anything found in the Intermountain West. Between 1981 and 1989 surveys and excavations led to the discovery of 13 intensively occupied sites located in the timberline ecotone (3150-3850 m) in the White Mountains of California and the Alta Toquima Range of Nevada. Four temporal phases have been delineated for the White Mountain alpine sites (Bettinger 1991b): Clyde phase

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(2500-1200 B.C.), Cowhorn phase (1200 B.C.-A.D. 600), Baker phase (A.D. 600-1300), and the Klondike phase (A.D. 1300-historic times). Occupations before A.D. 600 are classified as "pre-village sites," while those with stone structures have been classified as "village" sites. This division is based on lichonometric studies, which indicate that the stone ring structures were not constructed until sometime after A.D. 600. Predicated on the frequency and attributes of the material culture, Bettinger posits that the pre-village occupations were short term and mainly focused on the procurement of ungulates. Women were present at these pre-village sites mainly to assist with hunting activities. In contrast, village sites are characterized by circular stone rings that braced timber (or pole) and thatch dwellings. It is believed that these sites were intensively occupied during the warm season for at least one month by individual or multiple families. In the village phases, a sharp increase in groundstone and a decrease in ungulate remains suggest that the occupants switched economic strategies to one more focused on the procurement of plants and small mammals, such as marmots (Grayson 1991). While this relationship between pre-village and village phases is not absolutely clear-cut, there are some general trends in this direction.

Alta Toquima is an alpine village on Mount Jefferson, Nevada (3350 m). The site contains 31 rock ring structures, 18 of which were excavated by Thomas (1982). This site also has a temporal division between pre-village and village occupations, which occurred sometime around A.D. 1000. Like the White Mountain sites, the pre-village phase was a time when communal hunting of bighorn sheep was the main economic focus. A change in the artifact assemblages from a pre-village emphasis on chipped stone tools (over 200 projectile points from the Elko and Gatecliff series) to a focus on ceramics and groundstone after A.D. 1000, suggests that the economic strategy at the site had shifted to a greater focus on plant processing.

The Rocky Mountains

The Rocky Mountains region is another important area for the study of high elevation adaptations by prehistoric and historic period peoples. James Benedict is the foremost authority on Colorado timberline archaeology. The majority of his work is situated on the Colorado Front Range, which covers the Rocky Mountain National Park and the Indian Peaks area just south of the park. East of the Front Range are the High Plains and to the west are sagebrush basins; its central location encouraged use by prehistoric people from the Colorado Plateau and the Plains (Benedict 1992:1). Modern timberline ranges from 3300-3350 m. Occupational phases in the Rocky Mountains range from the Paleoindian period to historic times and are illustrated by a variety of site types. Game drive systems are probably the most common site type published

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(more than 50 as of 1992) (Benedict 1985a, 1996; Benedict and Olson 1978; Cassells 2000), but there is also ample evidence of primary butchering stations (Benedict 1990; Benedict and Olsen 1978), campsites (Benedict 1975, 1981,1985a, 1990), vision quest sites (Benedict 1985b), and women's work areas (Benedict 1993). Some campsites were strictly hunting camps, likely left by male hunting parties. Other campsites, such as Caribou Lake (Benedict 1985a), contained shallow hearths, stone-filled roasting pits, and domestic artifacts such as grinding tools, hideworking tools, woodworking tools, and pottery. This strongly suggests that family groups were present above 3000 m. Benedict (1992:9) notes that unlike the alpine villages of the Alta Toquima Range and the White Mountains, the Colorado Front range rarely provides evidence of long-term habitation structures. Although isolated tipi rings and the remains of wickiups reported by early white settlers illustrates that there was occupation in the high country, agglomeration by a group was not as extensive as it was in the mountain ranges of the western Great Basin.

The Northern Colorado Plateau and the Middle Rocky Mountains

Data from 336 sites on the northern Colorado Plateau have been compiled by DeBloois (1983:65-66) from the Dixie (Hauck et al. 1978), Fish Lake (Simms 1979), and Manti-LaSal (Hunt 1953) national forests. The sites range from 2440-3353 m, with a mean elevation of 2625 m. While most of the sites were lithic scatters, 13 percent had ceramics from Fremont, prehispanic Pueblo, and Shoshone (from greatest to lowest frequency) occupations. The upper elevational limit of the ceramics was not reported. Groundstone was rare (only in 7 percent of the sites), but when it was found it was usually the Utah-type metate. Elevations of the groundstone artifacts were not reported. Based on diagnostic traits of the lithic tools recovered and frequency of their occurrence, DeBloois believes that the heaviest to lightest occupation of montane zones was Archaic, Fremont, and Late Prehistoric (Numic), respectively.

The Ashley National Forest (ANF), where the Deadman Lake site is located, encompasses the eastern Uinta Mountains and the south end of the Green River Basin up to Rock Springs, Wyoming. Surveys in the upper elevations of the forest have located 108 Alpine, 128 Hudsonian, 246 Canadian, and 79 Transitional zone sites. It should be noted that the Canadian zone has the most extensive survey coverage because of impending timber sales (Loosle 2002a:1, 22). Occupation on the ANF was from Paleoindian to historic times. Loosle (2002b:20) argues that the most intensive use of the uplands was during the Archaic and Late Prehistoric periods, while the canyons and low benches were most often occupied during the Fremont period. However, the recent discovery of several Fremont-period sites in the middle to high elevation range (arbitrarily set at 2135 m and higher) suggests that Fremont occupation in the uplands was

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more extensive than originally thought. Of particular interest is Chepeta Lake (42Dc823), which is located only 13 km west of Deadman Lake. This site (3183 m) is situated in the Hudsonian life zone on the south slope of the Uinta Mountains. Chepeta Lake is a natural lake in a U-shaped glacial valley at the head of the Whiterocks River. To the north of the lake is a glacial cirque and talus slope, which rises to 3354 m. No dwellings were found, but a series of hearths, one associated with groundstone, represent a short visit in the summer to early fall. Two of the hearths date to the Archaic period (2140 B.C. and 1430 B.C.), two date to very late in the Fremont period (A.D. 1210 and 1285), while the last dates to the very early Fremont period (A.D. 250). Due to the concentration of groundstone (5 Uinta quartzite metates and metate fragments) both above and below the ground surface, Johnson and Watkins (2002:227) suggest that plant processing was an important activity at this site.

Environmental Context

Physiography of the Uinta Basin and Uinta Mountains

Between the western Great Basin ranges and the Colorado Rocky Mountain ranges lay the Basin and Range-Colorado Plateau Transition and the Middle Rocky Mountains (Figure 1.1). These landforms run from the southwest corner to the northeast corner of Utah dividing the Great Basin from the Colorado Plateau. The Uinta Basin is in the northernmost region of the northern Colorado Plateau. It trends east-southeast paralleling the direction of the Uinta Mountain range to the north, covers approximately 14,375 square km, and ranges in elevation from 1218-3353 m along the rim of the Tavaputs Plateau in the south (Clark 1957; Jones 1957). Clark (1957:18) has divided the Uinta Basin into six

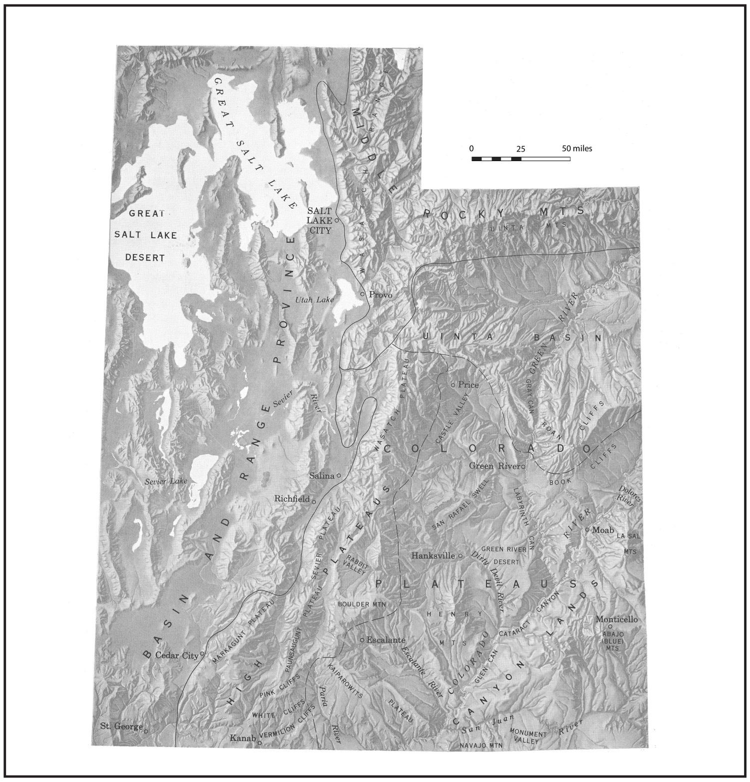

Figure 1.1. Physiographic landforms of Utah. (From C. Hunt 1953, Figure 85)

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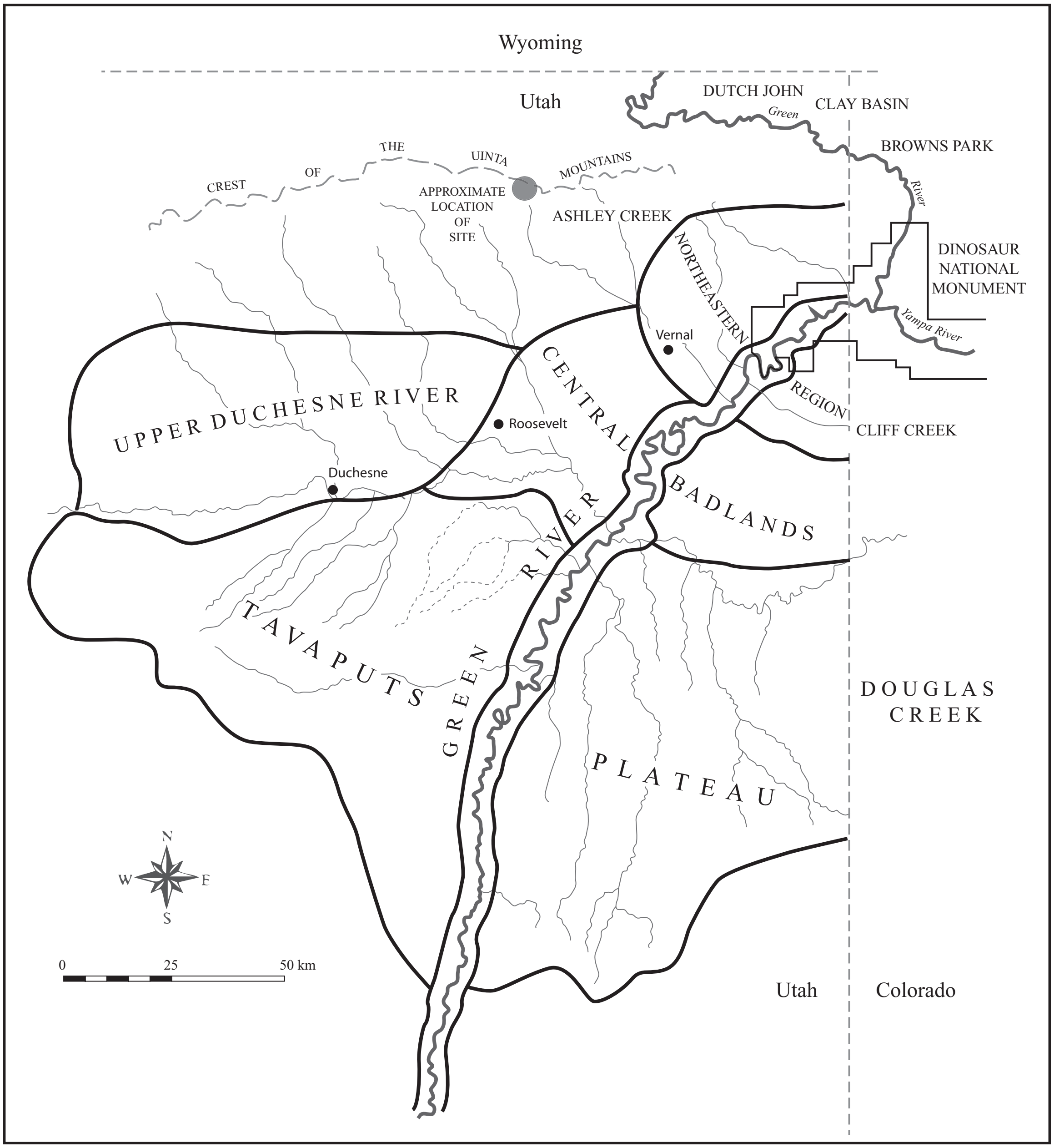

Figure 1.2. Six topographic units of the Uinta Basin (Modified from Clark 1957, Figure 1)

topographic districts: (1) Northeastern, (2) Central Badlands, (3) Tavaputs Plateau, (4) Upper Duchesne River Plateau, (5) Green River Valley, and (6) Douglas Creek (Figure 1.2).

The Uinta Mountains are located at the northernmost edge of the Uinta Basin. This east-west trending range was formed approximately 37-15 million years ago. It is considered part of the southern boundary of the Middle Rocky Mountains and occupies approximately 11,520 square km. Elevations range

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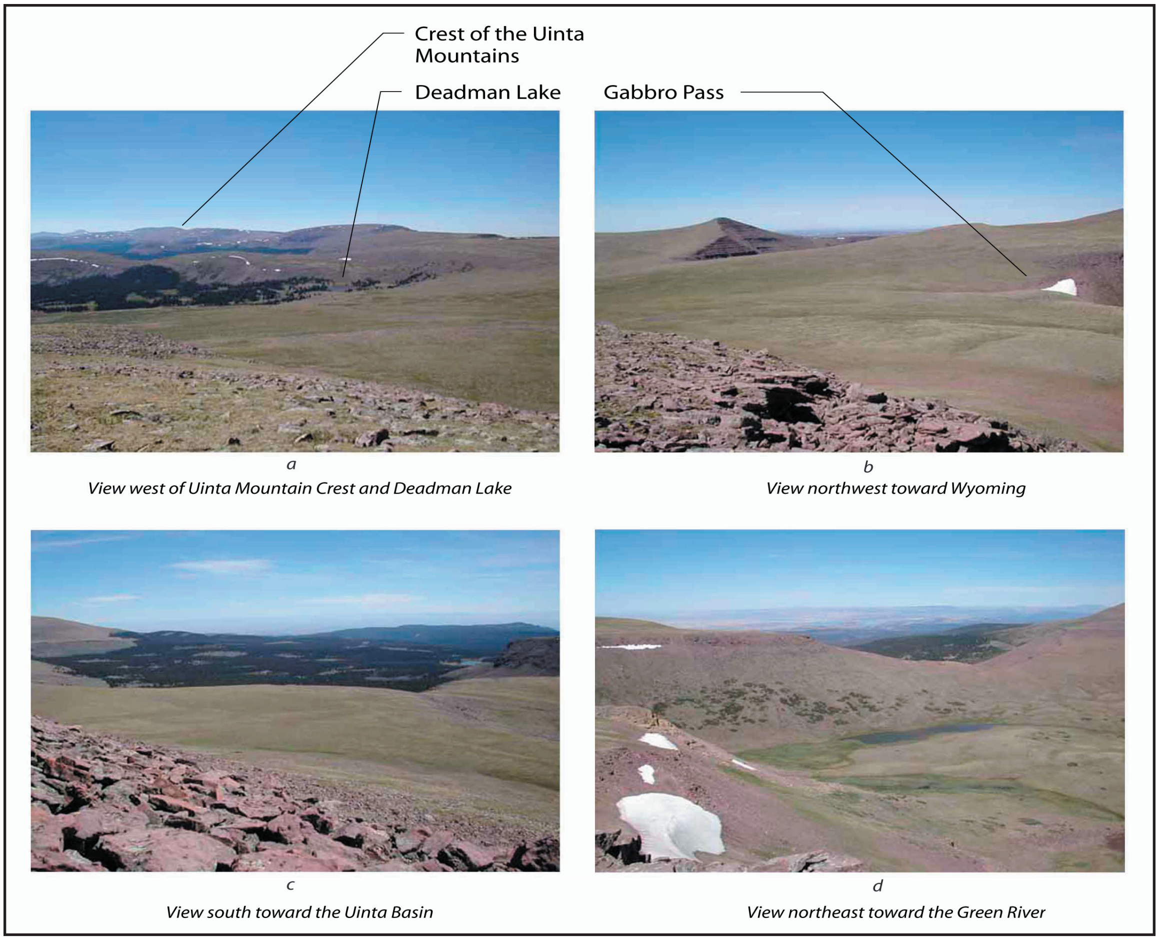

Figure 1.3. Views of the eastern Uinta Mountains: crest looking (a) west and (b) northwest, (c) toward the Uinta Basin, and (d) toward theWyoming Basin (Photos taken July 2002).

from 1700 m at the low benches (point taken from Steinaker Lake) to 4124 m at the highest peak (point measured at King's Peak). The main backbone of the Uinta Mountain range is a 195 km continuous alpine ridge (Figure 1.3*a, b*) that averages 3353-3658 m above sea level. The ridge runs from Hayden Peak on the west to Leidy Peak on the east (Eckerle 1996:149; Huber 1995:6; Morris and Stubben 1994:21). Loosle (2002a:3) describes the north slope as being fairly steep and short, with a rapid descent to mid-elevation benches toward the Green River Basin in Wyoming (Figures 1.3*d*). Along the Green River Canyon, bench elevations range from 1890-2195 m. In contrast, the south slope (Figure 1.3*c*) descends more gently toward the Uinta Basin with a large mid-elevation bench 2400-2900 m in elevation. Both sides are flanked by deep, steep-walled canyons that were carved by glaciers on the north slope and melt waters from glaciers and snowfields on the south slope (Loosle 2002a:3).

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Geologically, the Uinta Mountains are mostly comprised of Precambrian quartz sandstone and quartzite (Unterman and Unterman 1964). Much of the archaeological lithic materials used on Ashley National Forest sites are Bridger formation (Tiger) chert and Sheep Creek quartzite from the north slope. The small amount of obsidian noted in this region is usually from sources in northern Wyoming, eastern Idaho, and central Utah. While most are assumed to have been brought into the area via trade, water-worn obsidian pebbles from Phillips Pass in Wyoming have been recorded in the Green River as far south as Red Canyon (Johnson 2002:39).

The Uinta Mountain range is the major watershed for the Green River. The rivers of primary importance on the north slope are Henry's Fork, Black's Fork, and Smith's Fork. On the south slope they are the Uinta, Lake Fork, and Whiterocks rivers, and Rock and Ashley creeks. All ultimately drain into the Green River, which cuts through the eastern portion of the Uinta Mountain range and flows southwest through the Uinta Basin (Clark 1957:17; Huber 1995:7; Loosle 2002a:3) and the Colorado Plateau until it joins the Colorado River.

Paleoenvironment and Current Climatic Conditions

The terrain of the mountains creates microclimates that coincide with elevation gradients. While temperature decreases with increasing elevation, maximum precipitation levels usually reach their peak at 1200 to 2400 m (Petersen 1994:38). In general, most mountain biospheres are more mesic, cooler, and have a greater density of vegetation than the parched lowlands (Peterson 1994:38). As altitude increases, moisture and dust content, atmospheric density (which affects human physiology), atmospheric heat capacity, and barometric pressure diminish. There is an increase in the intensity of solar radiation and wind speed as elevation increases, and the occurrence of orographic precipitation becomes more likely (Petersen 1994:39-40).

A pollen record collected from Pollen Lake (Carrara et al. 1985), which is only 6.4 km from Deadman Lake, provides an excellent data set for reconstructing a paleoclimate for the eastern Uinta Mountains. Four radiocarbon dates were obtained from the core sample ranging from 6210 +/-250 B.P. to 1350+/-400 B.P.; the latter is within the general time frame of the Deadman Lake features. Carrara et al. (1985:5-7; see also Short 1990s) conclude that from 4600-2100 B.P. the forest was more closed than at present, suggesting conditions warmer than today. From 2100-600 B.P. there was a reduction of conifer pollen, which has been interpreted as either a trend towards a drier/cooler climate than the previous period (though still warmer than today) or the encroachment of bog vegetation to the area of the site, though it was

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stressed that these changes were minor. From 600-100 B.P. the climate was the coolest represented in the core (Carrara et al. 1985:1).

Currently, summers in the Uinta Mountains are short and mild, with winter conditions arriving as early as late August and lasting as late as early July. Temperatures in the summer range widely, rarely reaching above 80° F and usually dropping to 40° F or lower in the evenings. Thunder and lightening storms are a common occurrence, and summer precipitation can take the form of rain, hail, sleet, and snow. Based on data gathered from 1952 to 1978 (Whaley and Lytton 1979), precipitation is not evenly distributed along the Uinta Mountains. For example, watersheds on the west and north sides of the range receive 16-18 percent more precipitation than the east and south slopes.

Floristic Communities

As part of the Middle Rocky Mountains, the Uinta Mountains floral species common to the alpine areas are also found in both the northern and southern Rocky Mountains. "Zone jumbling," which occurs in the Uinta Mountains, is described as the aggregation of several zone-specific taxa growing in the same area (e.g., zone overlapping) (Cottom 1930; Cronquist et al. 1972; Graham 1937). Five life zones (called "locales") have been demarcated on the ANF (Loosle 2002a:7). Each has a different range of resources based on elevation and aspect that determines seasonal access by humans. They have been divided as follows: Canyons, Low Benches, Intermediate Benches, Mountain Benches, and High Lakes/ Uinta Divide. Each corresponds with conventional terminology for vegetation zones.

Canyons (1400-1800 m) are part of the Upper Sonoran life zone. Physiographic attributes in this locale are basins, canyon bottoms, flood plains, and stream terraces. This lowland area supports plant communities dominated by saltgrass (*Distichlis spicata*), greasewood (*Sarcobatus vermiculatus*), seepweed (*Suaeda*), alkali sacaton (*Sporobolus airoides*), fescue (*Festuca octoflora*), and rabbitbrush (*Chrysothamnus*). Western goldenrod (*Solidago occidentalis*), rushes, sedges, and cottonwood tree (*Populus fremontii*) communities are common along the floodplains, washes and riparian localities. The drier areas support extensive stands of the Chenopodiacea and Asteracea families. This locale, with an average annual precipitation of 15 to 20 cm, has mild winters and a potential growing season long enough to support horticultural activities, especially corn and squash (Goodrich and Neese 1986:iv; Loosle 2002a:7-8). The Steinaker Lake and Steinaker Gap farmstead sites are found here (see Talbot and Richens 1996, 1999).

Low Benches (1800-2000 m) are also associated with the Upper Sonoran life zone. This locale, which is extensive along the west side of the Green River along the north slope of the Uinta Mountains,

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encompasses the canyon bottoms and the large Intermountain basins. Vegetation communities are comprised of narrow riparian communities and widespread communities of shadscale (*Atriplex confertifolia*), bitterbrush (*Purshia tridentata*), fescue (*Festuca octoflora*), geophytes, and prickly pear cactus (*Opuntia*). Common grasses are indian ricegrass (*Oryzopsis hymenoides*), sandberg bluegrass (*Poa secunda*), muttongrass (*Poa fendleriana*), needlegrass (*Stipa comata*) and bluebunch wheatgrass (*Agropyron spicatum*). Common sagebrush varieties are black sagebrush (*Artemisia nova*), wyoming sagebrush (*Artemesia wyomingensis*), silver sagebrush (*Artemesia cana*), and mountain big sagebrush (*Artemesia tridentata vaseyana).* According to Huber (1995:19), sagebrush communities on the south slope of the Uintas trend towards the eastern end. Today the pinyon-juniper zone on the Uinta Mountains ranges between 1829-2286 m in elevation. On the south slope the community is dominated by juniper (*Juniperus osteosperma*) with pinyon (*Pinus edulis*) limited to the upper elevations. On the north slope pinyon is codominant with the juniper. While winters are generally mild, this locale has short growing seasons which makes horticulture unlikely (Goodrich and Neese 1986: iv, 191; Loosle 2002a: 8-9).

Intermediate Benches (2000-2200 m) coincide with the Transitional life zone. The benches in this locale are extensive on the south slope and surrounding Red Canyon on the north slope. Mountain brush plants are dominant, though ponderosa pine (*Pinus ponderosa*) and aspen (*Populus tremuloides*) will occur occasionally, especially along the south edge of Red Canyon on the north slope and between Lake Fork and Whiterocks drainages on the south slope. Ponderosa pine belts up to 2460 m are on Red Mountain and Blue Mountain, and these trees seem to have a strong attraction to areas with warmer temperatures similar to, though slightly cooler than, the pinyon and juniper communities. They are usually found in areas with mancos shale (Byron Loosle, personal communication 2003). Mixed in at this intermediate zone are bitterbrush (*Purshia tridentata*), green leaf manzanita (*Arctostaphylos patula*), sagebrush, prickly pear cactus, and tuber plants in the spring season. True mountain mahogany (*Cercocarpus montanus*) can be found in extensive stands across the slopes of the Uinta Mountains, especially the northeast slope and on Red Mountain near Vernal, but is rare on the south slopes (Goodrich and Neese 1986:v; Huber 1995:36; Loosle 2002a:10).

The Mountain Benches locale (2400-2700 m) lies mainly in the Canadian life zone and is extensive on the north and south slopes of the Uinta Mountains. The topography consists of small knolls, stream terraces, and ledges which could provide adequate shelter in proximity to perennial water sources. The main conifer species at this locality is the lodgepole pine (*Pinus contorta*) and mixed conifers (such as douglas fir (*Pseudotsuga*)) interspersed with wet meadows, small streams with riparian vegetation, and the

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occasional small lake or pond. When not devoid of understory plants, ground cover is dominated by grouse whortleberry (*Vaccinium scoparium*), elk sedge (*Carex geyeri*) or mountain snowberry (*Symphoricarpos oreophilus*) depending on elevation and/or soil conditions. The south and east slopes are comprised of an extensive sagebrush community with aspen groves occurring sporadically at elevations from 2300-2900 m. There is also a species of *Chenopodium* (*Chenopodium atrovirens)* in this zone that extends up to 2896 m. This area gets abundant winter precipitation beginning as early as late September, though daytime temperatures in the summer and early fall are warm (Goodrich and Neese 1986:v-vi; Huber 1995:41; Loosle 2002a:10)

High Lakes/ Uinta Divide (2923-3692 m) is a combination of the Hudsonian and Alpine life zones. Cronquist (1978:11) argues that in the Hudsonian and Alpine zones north of the Intermountain region (such as in the Rocky Mountains of Canada and the northwestern United States) a large percent of high mountain species can be traced to the arctic or the northern coniferous forest. For mountains located in the southwestern United States a larger proportion of the alpine taxa are derived from common local lowland species. However, in the Intermountain region both the arctic species and the lowland derivatives are represented in the upper life zones as well as some species that do not conform to either pattern. The Hudsonian zone (2923-3385 m) is dominated by lodgepole pine and engelmann spruce (*Picea engelmannii*), and less frequently subalpine fir, up to about 3353 m. Closer to timberline, englemann spruce trees are commonly reduced to the krummholz (stunted and twisted) condition. Subalpine meadows break up the dense coniferous forest. Hayden-Wing (1979a:40) maintains that mountain meadow vegetation in the Rocky Mountains provide a significantly large amount of high quality forage compared to the small fraction of the total summer range it comprises. For example, mountain meadows in Oregon and Washington make up only one to two percent of the summer range area, but potentially could provide up to 20 percent of the summer forage. Vegetation in these meadows ranges from oatgrass (*Danthonia*) to tufted hairgrass (*Deschampsia caespitosa*) to various species of sedges and willows as one moves from dry to wet conditions. Numerous grasses and forbes, especially elephant head (*Pedicularis groenlandica*), various gentians, and american bistort (*Polygonum bistortoides*), are common here.

The Alpine zone (3385-3658 m) on the ANF runs from the crest of the Uinta Mountain range to the wetlands at the uppermost end of the Hudsonian zone. Vegetation in the Alpine zone is comprised of low forbes, grasses, and herbs such as canada single-spike sedge (*Carex scirpoidea)*, tufted hairgrass (*Deschampsia caespitosa*), needlegrass (*Stipa comata*), alpine avens (*Geum rossii*), moss campion (*Silene acaulis*), alpine sagebrush (*Artemesia scopulorum*), alpine bistort (*Polygonum viviparum*), springbeauty

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(*Claytonia megarrhiza*), and indian paintbrush (*Castilleja pulchella)* (Goodrich and Neese 1986:vi; Huber 1995:46-47, 50; Loosle 2002a:3-4, 10-12). For a complete list of that grow over 3050 m in the Uinta Mountains see Appendix A3.1.

Faunal Communities

The number of mammalian species occupying a life zone is inversely proportional to elevation of that life zone. In other words, the higher one goes in elevation, the smaller the variety of taxa that will be encountered and this should be represented in the archaeological record (Grayson 1991:493; MacArthur 1972). The three ungulates that will be discussed here are those found in faunal assemblages on the Uinta Mountain benches: mountain sheep, deer, and elk. Also included is a brief mention of the yellow-bellied marmot, which occupies the alpine zone in great numbers, is represented in the ethnographic and archaeological record in the White Mountains, and may have some representation in the faunal assemblage at Deadman Lake. The discussion that follows will encompass animal food preferences, winter and summer habitats, and other facts deemed important to a discussion of prehistoric hunting and settlement.

Mountain Sheep

There are two species of North American mountain sheep that could have been present in the Uinta Mountains and adjacent foothills in prehistory; the Rocky Mountain bighorn (*Ovis canadensis canadensis*) and the desert bighorn (*Ovis candensis nelsonii*). It is difficult to demarcate their prehistoric geographic ranges because of the genus' ability to adapt in different climatic variations (Valdez and Krausman 1999: 13). Today, the desert bighorn is relegated to the southern fringe of the Great Basin in south-central Nevada (Hansen 1980:67), while the Rocky Mountain bighorn has a modern range closest to the Uinta Mountains. The latter can be found throughout the drier western mountain ranges from as far north as Alberta and British Columbia and as far south as northern New Mexico. However, this is greatly reduced from its range recorded in the early historical period (Shackelton et al. 1999:78).

The habitat of the bighorn sheep is characterized by rugged terrain such as canyons, gulches, steep slopes, mountain tops, and river benches. They can be found in desert to alpine conditions, and early historical accounts have placed the Rocky Mountain bighorn in river valleys and surrounding prairies east of the Rocky Mountains as well. The use of different elevations varies considerably based on the individual population. Some herds remain relatively sedentary while others participate on long annual seasonal migrations (Hansen 1980:78; Shackelton et al. 1999:78-79). In general, sheep choose habitats by the

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availability of escape terrain, followed by visibility, and then by vegetation community. In Colorado, slopes from 61 to 80 percent were used more often while slopes with gradients less than 20 percent were typically avoided, although this varied considerably between habitats and populations. In winter Rocky Mountain bighorn sheep will spend as much as 86 percent of their time within 100 m of rocky escape terrain and generally remain within 800 m of escape terrain at any time of the year. Dense coniferous forests that restrict vegetation are generally avoided by bighorn sheep and, when cold stress is not a concern, they will travel to north-facing, east-facing and west-facing slopes (Shackelton et al. 1999:81-84). In Utah, reintroduced bighorn sheep have been observed at 2500 m on the north slope of the Uinta Mountains during the summer, and historical accounts have placed them in the alpine zone during this season as well (Johnson and Loosle 2002a:61; Loosle 2001a:12).

Winter ranges are typically comprised of open grasslands with preferences towards wheatgrass (*Agropyron*), bluegrass (*Poa*), fescue (*Festuca*), mesquite grass, needle grass (*Stipa*), ricegrass (*Oryzopsis*), mixed forbes, and small shrubs. Most winter ranges are found in areas with relatively little snowfall or high winds (Shackelton et al. 1999:81). Stelfox (1975) argues that mountain sheep generally avoid snow depths exceeding 30 cm. Thus, steep south-facing, southwest-facing, or southeast-facing slopes are prime winter ranges in order to maximize heat gains, decrease chances of confronting deep snow, and increase their chances of being able to forage. The heaviest weight recorded for a male sheep was 137 kg while females usually reach around 90 kg (Shackelton et al. 1999:83, 98).

There is ethnographic evidence in the Colorado-San Juan river region that mountain sheep were often hunted by part-time agriculturists, while full-time agriculturists like the Hopi or Hohokom made little effort to do the same (Grant 1980:39); they likely acquired sheep meat via trade. The archaeological record has evidence of horns being used for grass-cutting sickles and hoes, and ethnographic accounts have recorded their use for bows, scrapers, flaking tools, digging sticks, and spoons (Grant 1980:36; Valdez and Krausman 1999:9). Aside from the obvious nutrients, bone, and horn tools that these animals provided, it is also likely that there was a prestige and/or mystical quality associated with the mountain sheep. For example, the Papago would ritually pile the horns close to watering holes to prevent the "air from leaving the place," and cultural rules stated if anyone were to remove them "that element would come out to molest everybody and cause them to experience great troubles" (Castetter and Bell 1942:67-68). Bighorn sheep effigies in hair pins, stone, ceramics, basketry, and petroglyphs suggest that the animal meant more to the prehistoric people than just "hide, horns, and meat" (Grant 1980:32).

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Mule Deer

Instead of rugged and open terrain, mule deer (*Odocoileus hemionus)* prefer to forage below timberline in the summer, and they may only come into contact with the mountain sheep when the latter's winter range forces it onto the more gradual slopes (Jones 1980:197-198). Deer show a preference for vegetation types over cover, although an area that provides both food and cover are considered optimal. In fact, it was observed in California that the preferred wintering range for mule deer had a maximum distance of less than 402 km between foraging and bedding areas (Klebenow 1965; Leopold et al. 1951; Loveless 1967:95, 101). A study conducted by Loveless (1967:96-101) in Colorado, found that deer preferred the slopes that contained big sagebrush and bitterbrush (in this particular study the south-facing and east-facing slopes). Mountain Benches and the High Lakes/Divide are used for summer foraging (Loosle 2002a:10-12).

Gradient, aspect, soil surface, and sunlight duration also play an important role in where deer will forage. As it is for the mountain sheep, south-facing exposures are preferred for the winter season. In Colorado, it was observed that the deer first arrive on their south-facing and west-facing winter range in early and mid-September (Loveless 1967:88-90). Deer in the northern Uinta Basin use the Canyons during harsh winters, while Low Benches and Intermediate Benches are preferred during mild winters. This is presumably in areas with snow depths less than 60 cm (Loosle 2002a:8-10; Loveless 1967:92; Robinette et al. 1952).

Elk (Wapiti)

Forage preferences of elk (*Cervus canadensis*) vary geographically depending on individual preference and local availability of plants. This can also vary for year to year depending on precipitation and early frost (Marcum 1979:59). Three studies that collected data about elk foraging habits in Idaho, Colorado, and Montana, reveal much variation in elk range and foraging preferences. The summer range of elk in Colorado was in the alpine and subalpine tundra communities with elevations ranging from 3000-3660 m (Hobbs et al. 1979:47). In Montana and Idaho, elk were observed to be foraging in mountain meadows and from within forested areas. In fact, Montana elk spent over 95 percent of foraging time in forested areas and 55 percent of that was within moderate to heavy timber stands (Marcum 1979:60). The Mountain Benches and the High Lakes/Divide locales are used for summer foraging in the Uintas (Loosle 2002a:8-12). In the summer, elk in Idaho and Montana preferred forbes, browse, and grasses, in that

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order. Elk in Colorado preferred grasses to shrubs and shrubs to forbes. Forbes most commonly chosen were arrowleaf (*Balsamorphiza sagittata*), western hedysarum (*Hedysarum occidentale*), mountain arnica (*Arnica*), alpine avens (*Geum rossii*), and white-flowered hawkweed (*Hieracium albiflorum*) (Hobbs 1979: 49; Marcum 1979:58). Browse includes various sedges and rushes such as spikerush (*eleocharis acicularis*), water sedge (*Carex aquatalis*), elk sedge *(Carex geyeri)*, prickly currant (*Ribes lacustre*), black elderberry, scouler willow (*Salix scouleriana*), western serviceberry (*Amelanchier*), and sometimes mallow ninebark (*Physocarpus malvaceus*). Grasses preferred by elk were bluejoint reedgrass (*Calamagrostis canadensis*), oatgrass (*Danthonia intermedia*), tufted hairgrass (*Deschampsia caespitosa*), kentucky bluegrass (*Poa pratensis*), timothy (*Phleum alpinum*), wood reedgrass, and pinegrass (*Calamagrostis rubescens*) (Hayden-Wing 1979a:43-44; Hobbs et al. 1979:47; Marcum 1979:58).

Elk in the northern Uinta Basin region use the Canyons during harsh winters while Low Benches and Intermediate Benches are preferred during mild winters (Loosle 200a:8-10). Hayden-Wing (1979b:127) observed very little overlap in the winter ranges between moose, elk, and deer in Idaho. Elk distribution appeared to be most heavily influenced by harassment by man and secondly by snow depths and condition of browse. Moderately deep snow was not as critical a factor as it was for deer. Elk occupied the winter range from December to April, arriving one month after the deer. In kind, the more robust elk had left their winter range by late-March/early-April, while the deer had not completely left until mid-April (Hayden-Wing 1979b:127). Elk weights up to 271 kg are common in Utah (Durrant 1952:454).

Marmots

The yellow-bellied marmot (*Marmota flaviventris*) and the hoary marmot (*Marmota caligata*) are the species of marmot that reside in the lower Rocky Mountains. They occupy a range of montane habitats that provide talus slopes, alpine and subalpine meadows, and rocky outcrops. Second only to the woodchuck *(Marmota monax*), the yellow-bellied marmot occupies the most diverse habitat in North America, which ranges from warm xeric sites to lush alpine and subalpine meadows. The hoary marmot, on the other hand, is limited to alpine and subalpine mountain slopes. When the two species exist in the same region, the yellow-bellied marmot will stay in the lower elevations. The species seen in the Uinta Mountains today is the yellow-bellied marmot. Marmots prefer to feed on grasses and forbes, though they have been known to consume meat when vegetation is not available. Marmots hibernate in the winter, thus they do not practice a seasonal movement between life zones. The length of hibernation varies according to elevation and age of species. At 2900 m in the Colorado Rocky Mountains and the White Mountains of California, yellow-bellied

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Fauna	Habitat	Preferred Browse found in Uintas	Uinta Mountain Vegetation	
			Elevation (ft.)	Zone(s)
Mountain Sheep	Summer: Hudsonian and alpine meadow. Rugged terrain with easy escape routes a priority over vegetation types. Known in desert to alpine conditions.	sedges	4,800-12,800	Canyons-Alpine
		serviceberry	6,000-9,000	Low Benches-Mountain Benches
		juniper	6,000-11,000	Low benches-Hudsonian/Alpine
		cinquefoil	7,000-11,500	Intermediate Benches-Alpine
		gooseberry	8,500-11,000+	Mountain Benches-Alpine
		kobresia	11,000+	Alpine
	Winter: Open grasslands, but within 100 m of rocky escape terrain. Generally avoid snow greater than 30 cm in depth. Prefer south-facing exposures.	wheatgrass	<6,000-11,000	Low benches-Hudsonian/Alpine
		bluegrass	6,400-13,000	Low Benches-Alpine
		fescues	4,900-10,500+	Canyons-Hudsonian
		needlegrass	4,800-11,500	Canyons-Alpine
		ricegrass	4,700-10,000	Canyons-Hudsonian
Mule Deer	Summer: Below timberline foraging, preferrably within 1/4 mile of cover. Mountain Benches and High Lakes/Divide lifezones	big sagebrush	4,700-10,000	Canyons-Hudsonian
		bitterbrush	5,600-9,000	Canyons-Mountain Benches
	Winter: Prefer south facing exposure. Canyons in harsh winters, Low and Intermediate benches in mild winters. Avoid snow greater than 24”.	bitterbrush	5,600-9,000	Canyons-Mountain Benches
Elk (Wapiti)	Summer: Mountain Benches and High Lakes Divide. Tundra, mountain meadow, and forested communities were all observed	serviceberry (Utah)	6,000-9,000	Low Benches-Mountain Benches
		bluegrass (not Kentucky)	6,400-13,000	Low Benches-Alpine
		hedysarum	6,800-11,000+	Intermediate Benches-Hudsonian/Alpine
		oatgrass	6,900-11,000+	Intermediate Benches-Hudsonian/Alpine
		arrowleaf	7,000-9,000	Intermediate Benches-Mountain Benches
		arnica (not mountian species)	7,200-11,000	Intermediate Benches-Hudsonian/Alpine
		mallow ninebark	7,000-10,000	Intermediate Benches-Hudsonian/Alpine
		bluejoint reedgrass	7,400-11,000	Intermediate Benches-Hudsonian/Alpine
		spikerush	7,000-11,000	Intermediate Benches-Hudsonian/Alpine
		water sedge	7,000-11,000+	Intermediate Benches-Hudsonian/Alpine
		tufted hairgrass	7,000-12,500	Intermediate Benches-Hudsonian/Alpine
		timothy	7,500-11,500	Mountain Benches-Alpine
		prickly current	8,000-9,000	Mountain Benches
		red elderberry (not black)	8,000-10,500	Mountain Benches-Hudsonian
		pinegrass	8,000-8,500	Mountain Benches
		white hawkweed	8,200-11,000	Mountain Benches-Hudsonian/Alpine
		alpine avens	11,000+	Alpine
	Winter: Canyons during harsh winters. Low benches and Intermediate benches during mild winters. Generally the same winter range as mule deer. Snow depth was not an issue.	muhly (not mountain)	5,800-10,500	Canyons-Hudsonian
		bluegrass (not Kentucky)	6,400-13,000	Low Benches-Alpine
		other willow	7,000-13,000	Intermediate Benches-Alpine
		aspen leaves	7,000-10,000	Intermediate Benches-Hudsonian
		black cottonwood	NA	Introduced from Europe
		elk sedge	7,000-9,000	Intermediate Benches-Mountain Benches
		cheatgrass	NA	Introduced from Europe
		scouler willow	7,600-9,300	Mountain Benches
		timothy	7,500-11,500	Mountain Benches-Alpine

Table 1.1. Faunal Habitat and Browse in the Uinta Mountains

marmots were observed to be active from the first week in May until mid-September. In lower elevations in the Sierra Nevada Range they emerge about one month earlier. Just before hibernation the marmot’s body mass increases while its metabolism and food consumption decreases. They also become approximately 40 percent more lethargic as the summer progresses (Barash 1989; Carey 1986). Because marmots rely entirely

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on body fat during their hibernation period they are a good source of fat-laden meat, especially if taken just before hibernation when they reach their highest yearly weights (Armitage et al. 1976; Barash 1989:26). The average weight of a marmot is approximately 2.7 kg, though they can weigh as much as 4.5 kg (Hall 1946). Based on cut marks on marmot bones from the White Mountain villages, Grayson (1989) argues that marmots were an important resource for fur as well.

Conclusion

This section has been a cursory look at geography, climate, plant communities, and animal behavior in the hope of finding patterns that would have influenced prehistoric hunting and settlement decisions. For example, if mountain sheep prefer a fall/winter range on the southeast slope of the Uinta Mountains, then perhaps human fall/winter camps are also located there.

Habitat and forage preferences for mountain sheep, deer, and elk, vegetation elevations in the Uinta Mountains, and corresponding life zones are illustrated in Table 1.1. While both the north and south slopes of the Uinta Mountains have the steep canyons that the mountain sheep prefer, they should tend towards the south slope for the warmth and more agreeable snow conditions in the winter. The grasses preferred by sheep could range from the Canyons to the Alpine zone, making it difficult to demarcate a fall/winter habitation zone with more precision. However, they likely did not go higher than the Intermediate Benches because of the snow accumulation. Thus, mountain sheep may have wintered on the south or southeast slopes, preferably on rocky escarpments, at elevations from 1433-2200 m. However, mountain sheep do exhibit great variability (even between herds) and this must be taken into consideration. Deer prefer gentle south-facing slopes with snow less than 60 cm. On the south slope of the Uinta Mountains, bitterbrush (a preferred browse for deer) is extensive 2027 m, within the range where mule deer have been observed in their fall/winter habitat. Elk are not as concerned about snow or choices of food, making it slightly more difficult to place them based on vegetation patterns. However, elk may have been more apt to wander to the north slope than the mountain sheep or the deer would because elk sedge and aspen leaves are both dominant on the north slope from 2134-2743 m. Surprisingly, almost all the fall/winter forage listed for elk is higher in elevation in the Uinta Mountains than the elk have been recorded to occupy during the winter. Fall and winter hunting of deer and mountain sheep should have been better (but not exclusive) on the south slope or southeast slope on the mid to low elevation benches. Ungulates are typically at their leanest during this time. In contrast, marmots are at their fattest in the late summer early fall (before they go into hibernation).

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In the late spring/summer the Alpine and Hudsonian zones offer easy escape terrain in the form of talus slopes, as well as an abundance of browse. In the summer the prehistoric hunter at Deadman Lake would have been more likely to encounter, mountain sheep, marmots, and elk than a deer, which preferred to forage below timberline. However, this is not all inclusive as some herds of mountain sheep may have foraged at much lower elevations as well. Ungulates are at their prime weights during this time.

The Uinta Basin Cultural Sequence

The Uinta Basin has been the subject of archaeological study for over 100 years. To give a complete cultural history of the Uinta Basin is beyond the scope of this thesis, but the interested reader is directed to Spangler (1995; see also Loosle 2002a:12-16) for a complete discussion of the region. Although the Uinta Basin was occupied continuously from Paleoindian to Historic times, the focus of this discussion will be on the "Fremont Period," the time period in which most of the Deadman Lake occupations occurred. This paper will follow Madsen and Simms (1998) who state that the Fremont are defined by farming in the sense that farming affects both farmers and foragers. Thus, the Fremont were horticulturists as well as those people who were indirectly affected by the introduction and continuance of horticulture in the region. Madsen and Simms (1998:255) call this mixture of farming and foraging the "Fremont Complex" to "convey this notion of a behavioral mix and to direct attention away from cultures as autonomous units."

Late Archaic/Early Formative Phase

The earliest phase (A.D. 1-A.D. 550) is considered by some (Spangler 2000:52) to be the Late Archaic because of the dominant role hunting and gathering still played in the local subsistence economy. Other scholars (Loosle 2002a:15; Talbot and Richens 1999:132) consider the arrival of maize (A.D. 50), and its rapid acceptance into the subsistence economy (by A.D. 250) by some groups, as sufficient evidence for designating this phase Early Formative. In addition to maize, the Late Archaic/Early Formative is characterized by the introduction of the bow and arrow (A.D. 0-200), an increase in sedentism (both at farmsteads and hunter-gatherer camps), an increase in permanent pithouse architecture with compact floors and fire pits (A.D. 50), and an increasing complexity in storage strategies. During this time a continuation of a hunter-gatherer lifestyle is mainly found in the Browns Park, Clay Basin, Douglas Creek, and Dinosaur National Park areas. Horticulture, mixed with hunting and gathering, developed along the Green River tributaries of Nine Mile Canyon, Dutch John, Cliff Creek, Ashley Creek, and possibly the Yampa River (Loosle 2002b:18; Spangler 1995:453, 847; Spangler 2000: 54-55) (Figure 1.2). The frequency of

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radiocarbon dates rose steadily during this phase until A.D. 450-550 when there was a sudden drop in dates, which may have been caused by a temporary cessation of growth or a migration of farmers out of the Uinta Basin (Talbot and Richens 1999: 132).

Uinta Fremont/Middle Agricultural Phase

The Uinta Fremont phase, also known as the Middle Agricultural Period (Talbot and Richens 1999: 132), ranges from about A.D. 550-1050 (Spangler 1995, 2000). Horticulture intensified along the Green River tributaries, while the eastern periphery areas continued to support hunting and gathering base camps. Exceptions to this general trend are along Cub Creek at the western edge of Dinosaur National Monument where two pithouse villages dating to 1310 +-50 B.P. and 1340 +- 50 B.P. (Truesdale and Hill 1999:27) were identified. Only Wholeplace Village (the earlier site) mentioned maize in the archaeobotanical report (Breternitz 1970). This phase is considered by some (Spangler 1995, 2000) to be the beginning of the Formative stage because of the increased (perhaps dominant) role horticulture played for some groups (A.D. 650-800 in the Steinaker Basin, Talbot and Richens 1999:132; see also Coltrain 1997:120). During this phase storage structures became larger and more complex, coursed masonry structures were introduced into residential architecture, populations were aggregating in small villages and farmsteads with possible ceremonial architecture, an elaborate figurine and rock art complex developed, and ceramics were introduced around A.D. 550 (Loosle 2002a:15; Spangler 2000: 60, 1995:453). Hunting and gathering continued in the Dinosaur National Monument, Browns Park, Yampa Canyon, and Douglas Creek areas, but these regions begin to show evidence of foraging camps with maize and ceramics.

Late Agricultural Phase

This final phase in Fremont history in the Uinta Basin is known as the Late Agricultural Period and ran roughly from A.D. 1050-1500 (Talbot and Richens 1999:133). It was at this time that there was a drastic reversal in economic strategies from one focused on horticultural activities to near abandonment of the “core area,” or the Uinta Basin proper, by A.D. 1300. This is generally accepted as the end of the most active phase in the Fremont period (Loosle 2002a:15; Talbot and Richens 1999:133). While a small population of farmers remained even as late as the 15th century, they were the minority and were typically located outside the “core area” in the northern and eastern peripheries. Five sites left by farmers living north of the Uinta Mountains (A.D. 1050-1445) illustrate a continuity of a horticultural subsistence economy outside of the Uinta Basin (Loosle and Johnson 2002:295). From the 13th to 15th centuries, Fremont and Numic sites co-existed in the Douglas Creek, Dinosaur National Monument, and Browns Park areas (Talbot and Richens

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1999:133; Spangler 2000:58). A subsistence economy based on farming may have even extended as late as A.D. 1650 in northwestern Colorado (Creasman and Scott 1987).

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Chapter 2
Prehistoric Mobility

Definitions

The first objective of this thesis is to build a foundation for modeling prehistoric mobility patterns of those who both farmed cultigens and foraged for wild foods. Mobility is the movement of a group on a landscape, and is typically described as degrees of mobility on a continuum. Nomadism and sedentism (at opposite ends of the continuum scale) define degrees of mobility. Yet, degrees of nomadism exist as do degrees of sedentism, so that while one group might be classified as semi-nomadic another might be labeled as semi-sedentary. Categories of mobility, which were first introduced by Murdock (1967; see Binford 1980: 13; Kelly 1995:117), are typically divided as follows: nomadic (fully migratory), semi-nomadic (members are mobile for at least six months of the year, but have a fixed residential base at some season or seasons), semi-sedentary (members are sedentary for at least six months of the year, or some members stay put while the majority depart seasonally), and fully sedentary (year-round occupation of a village, which may move every few years).

Residential mobility and logistical mobility are intertwined with one another. *Residential mobility* (Binford 1980) is when a group periodically moves its residential camp to a new location. As defined by Binford (1980:9), the residential camp is the locus of activity and the point from which logistically organized task groups originate and to which they return. *Logistical mobility* occurs when people (either in groups or individually) travel from the residential camp to procure resources, and is usually described in terms of distance from a residential camp. Field camps are temporary sites occupied by task groups who are too far away from the residential camp to return the same day. Another factor that influences human mobility is the mobility of a sought after resource. As the mobility of a resource increases or the aggregation size decreases, the search, pursuit time, and risk increase as well. Being able to predict the location of a resource (i.e., stored materials) will help to minimize this risk (Jochim 1976:27). The mobility (or lack of mobility) of a resource can be a strong predictor of settlement decisions.

Prehistoric Settlements
Settlement Types

Settlement patterns refer to the pragmatic and/or ideological way in which people place themselves on the landscape, the way homes are constructed and arranged, the spatial relationship between residences,

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and the implications these factors have on the exploitation of resources (Castetter and Bell 1951:43). According to Fish (1999:203-204), the settlement pattern is:

> a set of culturally significant locations, each of which occupies a specific position within an array that makes up a coherent distribution. Settlement patterns represent an enduring conceptual vehicle that enables archaeologists to efficiently relate large bodies of data to complicated assumptions in a widely comprehensible manner.

Garner (cited in Chorley and Haggett 1967:304-305) defines six basic premises concerning settlement locations. They are (1) human activity reflects an ordered adjustment of distance from one another, (2) locational decisions are made to minimize distance to resources, (3) all locations are accessible, though some more than others, (4) there is a tendency for human activities to agglomerate to take advantage of scale economies, like farming, (5) the most accessible locations tend to generate the largest and most successful settlements, (6) human occupancy is focal in character, which is fundamental to the core-periphery concept.

Settlements can last a few days, several weeks, several months, several years, and several generations (Roberts 1996:21). Some key determinants of settlement locations are economic, social, and political factors (Figure 2.1). Economic factors consider major goals (survival, change, stability, and wealth) and an economic base (agriculture, crafts, industry, fishing, etc.). Social factors address locational regulators (access to resources by physical or cultural means), size regulators (physical environment, food supply, social factors, population density), and population

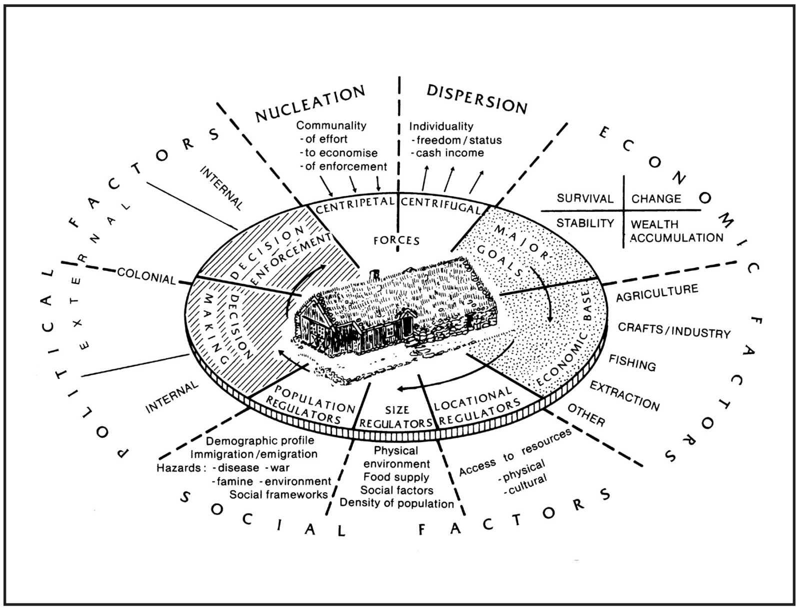

Figure 2.1. Attributes of rural settlements. (From Roberts 1996, Figure 1.5)

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regulators (immigration, emigration, natural hazards, disease, war, etc.). Political factors are internal and external decision making and enforcement factors (Roberts 1996:12). In addition to economic, social and political factors, ideological factors (how social space and landscape is perceived by a group) may be an important consideration as well. For example, a landform labeled as taboo by a community may be avoided regardless of its resource potential.

Bettinger (1999:42) argues that regional settlement pattern analysis can mean different things to different scholars, depending on whether one is studying hunter-gatherers or agriculturalists. Studies of agricultural settlements usually center on the relationship between settlements (or between core and periphery groups), which transfers to the social and political institutions that govern these relationships. In contrast, those who study hunter-gatherers typically focus on the relationship between single groups and the procurement of resources. Those scholars who study farmers that forage must find their explanations somewhere in the middle ground.

Central Place Foraging

Reasons for moving a residential camp may be economical, social, or political, though when discussing hunter-gatherer groups many scholars lean toward economics. An economic theory popular among Great Basin scholars is optimal foraging theory (OFT). Optimal foraging theory argues that under certain circumstances human decisions are made to maximize net energy gain while minimizing energy output. Models of diet choice (diet breadth), foraging location (patch choice), foraging time, demographics of foraging groups, and settlement location are typically built upon OFT (Bettinger 1991a:84). While currencies other than energy gain (i.e., storage, prestige, ease of transport) have been argued as equally influential under certain conditions, many Great Basin settlement models are built upon the assumption that people will attempt to optimize returns on their energy investments by locating residential camps where they can obtain critical resources in the most efficient manner possible.

Central place foraging (CPF) models argue that the desire to procure certain resources in the most efficient manner possible influences where residential base camps (core locations) should be located, and when they should be relocated. As a subset of optimal foraging theory, CPF is modeled as a trip with a given point of departure and return that directly affects diet breadth. In other words, as round trip time and/or distance increases from the central place, time spent in a patch, minimum acceptable prey size, and expected prey size should increase as well. Choices about prey type are dependent upon the energy expected from the prey in relation to the travel and handling time to return with that prey to the central place (Bettinger

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1991:96; Kelly 1995:134). Central place foraging models are believed to be especially germane to studies of hunter-gatherers who practiced collecting strategies in temperate zones (Kelly 1995:117).

Some scholars (Jochim 1976:54-55) argue that the importance of resources to settlement locations structures spatial organization into three zones. These zones, described as concentric circles around a locus, are: the immediate area at the camp, the "female" logistical zone, and the "male" logistical zone (Watanabe 1968:75). According to Tindale (1972:242; see also Campbell 1968; Jochim 1976:49), shelter, access to water and fuel, texture of ground surface, and a view seem to determine the immediate location of the residential base. This zone is also known as the "biodeterioration zone," where the area immediately surrounding the residential camp is generally devoid of resources during the period of occupation (Hamilton and Watt 1970).

The "female" logistical zone is determined by resources that have low mobility and high security (plants and small animals). Ethnographic cases from Africa (see Kelly 1995:133) record women traveling as much as 30 km round trip and as little as 10 km round trip from the residential base to procure plant resources. Interestingly, these distances are less than the women's physical potential, and is said to do with choice; the women simply did not want to walk any farther. However, in order to understand the extent of a female logistical zone in past societies, and to minimize variability inherent in the decisions of individuals, it is helpful to reconstruct women's collecting tactics using an optimal foraging model. According to OFT, the return rate of a resource must not be less than the energy used to procure that resource, or one will be operating at a caloric loss. Thus, the distance of a logistical activity, and the energy required to procure, transport, and process that resource, is directly related to the return rate for that resource. As a woman's exploitation "circle" becomes larger, she must spend more time and effort (energy) procuring plants. Based on CPF, when the caloric return from a distant resource is less than the energy expended collecting that resource, the distance at which she is willing to travel from camp should be reduced (see Kelly 1995:133).

The farthest zone is the male logistical zone and is usually defined by the procurement of the high-risk, low-security, big game (Jochim 1976:55). The actual size and shape of the zone will depend on density of game, topography, and anticipating grazing grounds. Central place foraging models also apply to men's economic activities, but they may be greatly affected by immeasurable currencies such as prestige.

Moving a Residential Base

Both farmers and hunter-gatherers in temperate zones had to choose between remaining where food was stored or traveling to distant resource patches. Kelly (1995:146) argues that for collectors, choices

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of where to locate residential bases depends on the expenditure of energy expected from moving a set of stored resources versus the return rate anticipated from a new location's resources. A clearer understanding of transport costs of stored materials may help scholars to rethink how semi-sedentary farmers seasonally exploited the uplands. Possible research questions include: (1) Did groups take their stored maize with them and, if so, how much? (2) If they did not cache their maize at the new residential base, how far away should the cache be? (3) How did cached resources affect mobility once in the uplands? In other words, were people be fluid in their foraging movements or were they restricted to an up-down pattern? (4) What was the relationship between stored maize and upland wild plant resources that were collected, and how did this affect how far women were willing to forage in a daily trip?

As resources become depleted in the area around the central base, collectors of wild resources must decide whether it is more prudent to make daily (or longer) logistical trips farther than before or to move the residential base. Jochim (1976:54) argues that resources vary in how they influence settlement decisions based on their level of security, when security is defined by the mobility of a resource. The lower the mobility of the resource the greater its predictability and security. High security resources (such as plants) affect a greater "pull" on settlement decisions. Conversely, the more prestigious resources (such as large mammals) tend to be higher risk and thus do not exert as much "pull." Whenever sites provide general access to high-ranked prestigious resources, residential camps will be located in areas of low-prestige, high-security resources (Jochim 1976:53-54). This concept is in accord with Rhode's (1990) model, which suggests that the maximum profitable distance of a resource must be considered with the profitability of resources available locally. He (Rhode 1990:417) argues that it is, "never profitable to transport distant resources that rank lower in return rate than local resources. A group may sometimes be better off residing in a resource patch with a relatively low return rate and using other resource patches with higher return rates on a logistical basis."

Because plant foods are low return/ high security resources, the effective foraging distance is generally lower than that for large game. Thus, in general, women's foraging activities should determine where and when camp is moved (Kelly 1995:140). Kent (1989: 9) observes, "It is the mundane supposedly low risk socially insignificant plants that determine where and when people move in many societies, not the animals." Other variables that likely affected where and when to move are difficulty of the terrain, amount of time required to break down and set up camp (Kelly 1995:137-138), the transportation of stored materials (Kelly 1995:146), risk associated with the natural availability of resources upon arrival (Jochim 1976), and the possibility that other groups will already be in a particular patch (Bettinger 1999). For those who made

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seasonal rounds, decisions to move were also likely based on previous knowledge about highly productive areas, thus lowering the risk associated with moving the residential camp. If all other variables (social, demographic, and/or political factors) remain constant, when moving costs are perceived to be greater than foraging costs a longer foraging distance from the extant base camp should be tolerated (Kelly 1995:138). In other words, as residential mobility decreases and storage dependence increases, acceptable distance for logistical travel will increase as well. For example, the men of the residentially mobile Kua of the Kalahari typically do not travel for a logistical task farther than 6 km from camp, while men from the Kua villages would travel as far as 50 km (Binford 1980:15; Kelly 1995:148).

Mobility in the Mountains

Current Models

The mountains present unique challenges to hunter gatherers because of their patchy biomass. Madsen and Metcalf (2000:xi) note that between the productive upland and lowland zones there can be dense coniferous forests where there are few food resources. Other mountainous areas may support patchy distributions of mountainbrush and sagebrush where resources tend to be high ranking. However, their patchy distribution will increase search and pursuit time. Thus, a choice must be made by the collector of wild foods to either stay in the lowlands or travel to the highlands. Using caloric return rate measurements and ranking of resources, Madsen and Metcalf suggest that hunter-gatherers could employ several strategies. One is for logistic hunters to travel from their base camps in the lowlands to procure high-ranked resources in the uplands, but this strategy is only viable when high-ranked hunted resources have been depleted in the lowlands. Another is for a group to move their residence to high elevations in the summer when they can forage on high-ranked plant and animal resources. While this has the advantage of increasing caloric return (because the procured resource is relatively close to the residential base), it also has the disadvantage of, "producing limited amounts of storable material" (Madsen and Metcalf 2000:xi). However, if important plant resources (such as *Chenopodium* seeds or pinyon nuts) will be collected in the fall for winter storage, then residential movement in the high altitude zones may be the most logical choice for hunter-gatherers. A third option is to move residences to the foothill areas where winter snow accumulation and temperatures are tolerable yet allow logistical access to both upland and lowland resources. Madsen and Metcalf argue that this strategy is a compromise in which higher ranked resources can be logistically procured, but the transport costs are not so high that lower ranked resources would be favored instead.

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Archaeologists who study high elevation settlement and subsistence patterns are finding that there is considerable variability from region to region (sometimes within a single region), and that there can be no single explanation for how people utilize the high country. Zeanah (2000:13) remarks, "We are probably misleading ourselves when we seek to develop a single model of hunter-gatherer land use for the entire Intermountain West." In general, most Rocky Mountain archaeologists believe that mobile hunter-gatherers residentially mapped onto resource patches in high elevation zones when montane biota were more productive than their lowland counterparts. They caution against assuming high elevation sites to be conducive to logistical mobility because the environmental conditions of the Rocky Mountains should have encouraged seasonal (residential) mobility (Zeanah 2000:1). For example, Bender and Wright (1988: 626) argue that hunter-gatherers from the central Rocky Mountain region seasonally scheduled trips to the high country to procure a wide variety of resources as part of a "broad spectrum" economic strategy. They (Bender and Wright 1988:627) identify three site types that should be present in the high country: "residential base camps," "stations," and "field camps" (sensu Binford 1980). Few areas in the high country are suitable for residential base camps, so those that are habitable and accessible should be visited repeatedly. The archaeological record of a base camp should reflect domestic activity, should be larger, have more debris, and have more variability in tool types than other two site types (Bender and Wright 1988:629). Logistical forays should emanate from the residential camp thereby creating the remaining two sites mentioned. Base camps recorded in the northern Tetons at 2741 m are characterized by grinding stones and roasting pits.

In contrast, Benedict (1992) maintains that the hunter-gatherers of the Colorado Front Range were more narrowly focused on following game. Few plants in the alpine zone that have economic value can be harvested in great quantities, with the exception of tubers and limber pine seeds. This leaves little variation in plant resources that could account for a "broad spectrum" strategy. In this sense, Benedict is probably correct in asserting that the main reason for occupying alpine areas was for the procurement of specific resources (i.e., mountain sheep and geophytes). Sites found above 3000 m on the Colorado Front Range are game drive systems, primary butchering stations, and hunting camps with groundstone, hideworking tools, woodworking tools, pottery, and roasting pits (Benedict 1992:7). The presence of groundstone, roasting pits, and hide working tools argues for the presence of women at these sites, and thus a locus of domestic activities. Many multicomponent camps on the Colorado Front Range are located in the timberline, suggesting that people were returning to areas well suited for habitation; e.g., shelter, protection from the wind, fuel, good visibility, and fewer insects. Two mobility systems have been argued for the Colorado Front Range (Benedict 1992:12-13). The first is an "Up-down System," which describes an up and down seasonal

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migration between lowland winter camps and upland summer camps. This system is best documented in the Mount Albion Complex (5800-5350 B.P) during the Early Archaic, and is argued to be the result of new groups moving into the region who were not yet familiar with the local habitat. The second mobility system is the "Rotary System," which is an annual round of 300-400 km that brought people to the alpine zone during the highly productive summer months. It also placed hunters near the Front Range at the season most suited for communal game drives and only a few days from the winter base camps in the foothills. This system is believed to have been in place during the Hog Back Phase (1430-765 B.P.), suggesting that people had learned to adapt to the local environment through cultural tradition and memory.

The mountain ranges of the western Great Basin exhibit a very different settlement-subsistence pattern. Based on extensive studies in the Inyo-Mono region of California, Bettinger (1991b, 1999) argues for a shift in montane economic strategies sometime around 1350 B.P. Three time periods (early, middle, and late) were studied for patterns in material remains and extent of foraging range. Although all three time periods contained groundstone at upland (over 2000 m) sites, groundstone was mostly concentrated in the lowlands during the Middle Period (3500-1350 B.P.). This suggests that plant procurement was typically confined to residential camps in the valley, while hunting grounds in the mountains or foothills were accessed logistically. Bettinger (1999:49) posits that the separation of hunting and gathering was a time-saving mechanism when both resources were simultaneously abundant (see Rhode 1990). The Late Period (post-1350 B.P.) was a time of increased population in the valleys. This proposed increase in population may have caused a decrease in residential mobility and an increased emphasis in plant procurement and processing. During the Late Period, plant processing tools are dominant or typical at both lowland and upland sites. Bettinger also argues that the Late Period occupants had increased their diet breadth and decreased their mobility so that valley villages were used all year, with some groups relocating to the high altitude zones once or twice a year for at least one month (alpine villages). Procurement was focused on high ranked resources, such as pinyon nuts in the mid-elevations, or alpine plants and small game in the high elevations. Macrobotanical remains suggest that while some resources were carried between satellite villages few, if any, resources were transported back to the residential bases in the valley (Bettinger 1999: 50). While it has been argued that the pre-1350 B.P. groups were more focused on hunting, it is clear that both the previllage and the village sites were created by residentially mobile people, though to different extents. In other words, the presence of groundstone, battered cobbles, lowland carbonized seeds, large numbers of marmot bone, and cores found in both time periods argue against a highly mobile, task-focused, group of logistical hunters (see Zeannah 2000). However, mountain sheep dominate the early assemblages

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and marmots overwhelm the village assemblages, suggesting that hunting ungulates was more important in the pre-village occupation than the village occupation.

Farmers in the High Country

Thus far, all models of high altitude land use have centered on settlement-subsistence strategies of full-time hunter-gatherers. Like the Rocky Mountains and the White Mountains, it is generally agreed that if residential occupation occurred in the Uinta Mountains, it would have taken place in the summer to early fall, between the snowmelt and snowfall. The eastern Great Basin and the Uinta Basin are unique because of the presence of farmers adjacent to high altitude montane ecosystems. The challenge for archaeologists studying these regions is trying to determine if farmers would have used the timberline ecotone differently than full-time hunter-gatherers.

The introduction of cultigens to an extant hunter-gather economic system certainly affected when and how people moved over the land. Based on seasonal botanical remains recovered from excavations at mid-elevation sites, Loosle and Johnson (2002:286-287) argue that Fremont period farmers logistically utilized the Uinta Mountain uplands in the fall (after the harvest). I believe that the introduction of cultigens also modified people's nutritional needs such that they no longer needed to establish residential camps in the timberline zone. In other words, the nutritional properties of maize freed women from having to travel to the uppermost elevations to procure alpine plants. Thus, the combination of seasonal constraints caused by horticulture (that limited residential mobility to the fall), and the ability of maize to replace the nutritional benefits of geophytes (summer residential mobility to the mountains was no longer needed), was a necessary symbiotic relationship.

Nutrition and Mobility

Did the introduction of maize give farmers enough of a nutritional edge such that they would have utilized the timberline zone differently than hunter-gatherers? I believe so. The basis of this argument is the dietary relationship between meat and plants in conjunction with the economic relationship between men's and women's tasks. A diet comprised mostly of lean meat can have detrimental effects on the human body. Speth and Spielmann (1983) argue that a lean meat diet (such as would be the case for prehistoric ungulate hunters in the fall, winter, and early spring) could lead to caloric and other nutritional deficiencies (also see Driver 1990:14-15). They illustrate how a diet dependent on lean meat would elevate the total energy need of a group of hunters at a time when resources are at a seasonal low. For example, a diet of

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almost all lean meat requires at least 9 percent more calories to satisfy basic metabolic and physiological needs. This equates to about 1.8 kg of meat per day for the average male, and could go as high as 3.5 kg if there is any physical activity. On a lean meat diet, protein consumed is immediately converted to energy (in the form of glucose and fat), leaving the body protein-deficient. However, when carbohydrates and fat are also consumed, protein from meat remains intact. Speth and Spielmann (1983:15) note that when both protein and calories are in short supply, such as during the winter and early spring, fat and carbohydrates (in particular) will be nutritionally significant. In fact, they argue that hunter-gatherers may even place more emphasis on building up storable carbohydrates in the fall than on hunting (Speth and Spielmann 1983: 18, 20). Examples of plant foods that are good sources of carbohydrates are geophytes, pine nuts (*Pinus monophylla* and *Pinus edulis;* Madsen 1986), limber pine nuts (*Pinus flexilis*) (Janetski, personal communication 2003), and maize. To date there is no archaeological evidence of pine nut use on the ANF (Loosle, personal communication 2003).

Geophytes were an extremely important source of nutrition for many North American indigenous groups as reflected in ethnographic accounts, lunar calendars, special ceremonies, and myth. Tubers and bulbs were harvested (traditionally by women) in the spring before flowering, during flowering, and during seeding depending on species, use, tribe, and individual preferences (Anderson 1997:153-154). Geophytes were an important source of carbohydrates, vitamins, minerals, and fiber, which buffered the deleterious effects of a high protein diet from lean animal meat by increasing metabolic efficiency (Lieberman 1987: 231-235; Speth and Speilman 1983). In the Uinta Mountains, the season for tubers such as springbeauty (*Claytonia*), bistort (*Polygonum viviparum*), and bitterroot (*Lewisia*) is from May to August (sometimes September). Other geophytes in the area are dogtooth violet (*Erythronium violet*), which has edible corms, Rocky Mountain cow lily (*Nuphar ploysepalum*), which was important for its seeds and rhizomes, and valerian (*Valeriana acutiloba*), which has edible roots (Goodrich and Neese 1986). The elevation range of most of these plants is from 2134 m to the alpine zone. If geophytes were an important part of a group's diet, and there is ample ethnographic evidence to suggest they were, then full-time hunter-gatherers should have utilized the alpine patches during the summer season when they were available. In addition, if ethnographic accounts regarding the woman's role of tilling for tubers are correct, the presence of women should be demonstrated by residential base camps at (or within one day's journey of) the alpine zone.

Another food source that is high in carbohydrates that could offset the effects of a lean meat diet is corn. About 73 percent of the maize kernel is carbohydrate, which is present in the forms of starch, sugar, and fiber (cellulose). Another nutritional benefit of corn is the high amount of linolin in maize oil, which is a

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good source of linoleic acid (Food and Agriculture Organization 1992). Hunter-gatherers surviving on a lean meat diet are deficient in these essential fatty acids, and food such as corn and oil-rich seeds can offset any negative effects (Speth and Speilman 1983:15). I argue that the availability of corn, and its ability to replace geophytes as a good source of carbohydrates, affected how part-time farmers utilized the alpine zones. Put simply, the presence of carbohydrate-rich corn freed women from having to collect large numbers of tubers. This allowed farmer groups to locate their residential bases in areas that provided other important storable wild resources, such as *Chenopodium*. Thus, it is suggested that residential camps of part-time farmers who were collecting wild plants in this region should not be located any higher in elevation than where a reasonable central place foraging strategy can operate. This argument does not presume that female farmers did not travel to the alpine zones, only that it would have been inefficient for the group to transport the entire camp to an area that could be reached much more efficiently in a logistical manner. This is especially germane if alpine plant resources were not nutritionally necessary. Though there is a paucity of excavated sites in the upper montane zones (two, as of this report), this strategy of logistical use of the timberline during the Fremont period seems to be supported by survey and excavation data throughout Utah (Johnson and Watkins 2002; Madsen et al 2000:23; McDonald 2000:131; Spangler 1995:489). In other words, what is currently lacking is evidence of alpine residential sites during the Uinta Fremont period when horticulture was an important lowland economic activity.

Seasons and Mobility

According to Jochim (1976:12), studies of hunter-gatherer economic activities can be summarized as follows: resource use schedule, site placement, and demographic arrangement. Decisions regarding resource procurement and scheduling structure the spatial and demographic arrangements of people into "economic seasons" (Jochim 1976:44-45). In other words, procurement schedules must take into account a combination of critical resources, seasonality of resources, locations of resources, time, and number of people needed to procure resources.

Seasonality is especially germane to a discussion of farmers and mobility because of the restrictions horticulture can place on a group's ability to procure wild resources. Successful horticulturists cannot treat their domestic crops with indifference. Maize has at least two critical physiological requirements that are necessary for survival: length of maturation (usually 120 frost-free days in temperate latitudes) and sufficient soil moisture (Classen and Shaw 1970; Harrill 1983:203; Winter 1983:3). Because the domestication of maize has created a species with seeds that cling to the rachis, maize also requires human intervention in

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order to propagate; this is done by planting in the spring and harvesting in the fall. During the growing season seeds must be selected for next year's crops (Wills 1988:39), weeds must be controlled, irrigation (if not dry farming) must be maintained, and the crops must be protected from insects, birds, and other animals (Coltrain 1997:121). Maize experiments in the Southwest (Mackey 1983; Toll et al. 1986) and the Uinta Basin (Johnson 1997) illustrate that few plants are likely to survive without constant attention. Thus, it is not surprising that many ethnographic examples reveal that maize horticulture involves nearly continuous monitoring as well (see Castetter and Bell 1942; Cushing 1974; Forde 1931; Kelly 1964; Kirkby 1973; Page 1940; Wills 1988:40).

Wills (1988:41) also suggests that casual cultivation of maize may cause evolutionary changes in the structure of the plant. If farmers planted in the spring, left the plants to fend for themselves during the growing season, and then returned to harvest in the fall the species (over time) will begin to take on protective traits. In other words, the plant will be putting all its energy into primary biomass by incorporating traits such as a heavier investment in maintenance structures rather than expose the reproductive (edible) parts. Speth and Scott (1989:77), following Ford (1968), agree that the seasonality of maize may be a likely factor in explaining why ethnographically documented horticultural groups in the Southwest restrict much of their large game hunting to the late fall and winter after the harvest. Flowers also (1983:358) observed that Amazonian groups who depend on root crops (like manioc) are not as constrained by time budgets as people who depend on seasonal crops (such as maize) and thus are free to engage in long distant hunts more often than their temperate zone counterparts.

Ethnographic Examples of Semi-sedentary Farmers

Ethnographic examples of four horticultural groups in the Southwest illustrate how part-time horticulturists practiced a seasonal mobility strategy in order to incorporate both domestic and wild foods into their diet. The Piman and Papago, the Yuman, the Havasupai, and the Southern Paiute all practiced horticulture to differing degrees. This not only illustrates variability among horticulturists in general, but variability among those who can be classified as seasonally mobile as well (see Hill 1938, 1982 for more examples not discussed here). However, it is unclear whether variations in the ethnographies are truly representative of variability in settlement-subsistence systems, or variability in ethnographic styles.

The Yumans

In the late 1930s to early 1940s the Yuman speakers lived in the region of the Lower Colorado River (Mohave, Yuman, and Cocopa) and the Gila River (Maricopa). While Castetter and Bell's (1951)

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ethnography focused on the river groups, a mention was made of the desert groups who practiced some horticulture, but not to any great degree. Horticulture accounted for about 50 percent of the Yuman and Mohave diet and 30 percent of the Cocopa diet, while collecting wild foods comprised the remainder. Most of the planting was done at the end of May to beginning of June, but it could also occur as early as April if there was early flooding of the river. At least one major crop and one or two lesser crops were grown every season. There was a gender division assigned to tasks; men planted the crops while women were in charge of harvesting. Crops were harvested in late October to early November. No description of a seasonal residential pattern was described in the ethnography, though there was mention of people temporarily moving to certain resource areas. Whether these moves were consistent from year to year, and how they affected the tending of the crops, was not entirely clear. Screwbeans and mesquite pods were very important wild plants and women could spend several weeks collecting them from June to early September, even camping away from the residential base for several nights (Castetter and Bell 1951:182). Wild rice was another important wild resource because of its early maturation, and whole families of Cocopa would travel to the Gulf of California for three weeks in April to collect it (Castetter and Bell 1951:193). In the fall and winter, individuals or small groups of men hunted deer in the mountains, valleys, and canyons. They occasionally hunted antelope and mountain sheep in the mountains during the spring season, though these did not hold the importance they did in prehistoric times. Another important source of protein was fish (Castetter and Bell 1951:215-219); fishing was likely practiced most seasons of the year.

The Piman and the Papago

The Piman territory is in the Sonoran desert of Arizona. At the time of the ethnography by Castetter and Bell (1942), the Pimans were the “River People” and the Papago were the “Desert People,” though it is certain that modern conditions have disrupted this pattern to some extent. The Piman were more committed to agriculture than the Papago were. Domestic plants comprised 50 percent of the Piman diet, as opposed to the Papago who only cultivated about 20 percent of their food supply. This was likely becuase the Pimans settled adjacent to a perennial river, which not only facilitated horticulture but also encouraged a more sedentary lifeway. In fact, Castetter and Bell (1942:41) argue that it was the need for water, more than the hunting or agriculture, that dictated where the Papago would live and for how long. Like the Yuman, planting, cultivating, and tending maize was considered men’s work among the Pima and Papago. Women only played a minor role until the October harvest, at which time they played a major role (Castetter and Bell 1942:180).

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The Papago, living in a marginal environment, were forced to live a semi-sedentary lifestyle which entailed farming during the growing season and hunting and gathering the remainder of the year. The Papago were said to have two villages between which they moved in their seasonal migrations. One village, located adjacent to cultivated fields, was the summer village. Families generally did not return to the field villages until the heavy rains ensured that they could find drinking water when they arrived. The winter village, always located near a permanent source of water in the mountains or foothills, was located about 32-48 km from the summer village (Castetter and Bell 1942:40, 43). This redundancy in a settlement pattern is known as "tethered nomadism" (Taylor 1964) and is usually brought about by the scarcity of critical resources, so that while some areas are used repeatedly others are rarely used at all. The Papago stored their crops in several places. Most were kept at the field village in a storehouse, while a supplementary cache was stored in a pit not far from the base of the mountains within reach of the winter village. During the winter, men were sent down to the supplementary cache to get food, but they tried to leave the field village cache alone until the spring when it was most needed (Castetter and Bell 1942:184). In earlier times their destination may not have been so predictable. An early Spanish explorer named Anza (Bolton 1930) claimed that the Papago almost completely deserted their fields in the winter to hunt deer, sheep, rats, and collect roots in the Sierras, the plains, and the arroyos. Others observed in 1774 that the Papago always camped in the Cabreza Prieta Range at the height of the dry season to hunt mountain sheep (Castetter and Bell 1942:67), suggesting that there may have been considerably more variety in settlement and subsistence strategies in the historic past than has been recorded more recently.

In general wild plants were procured more often than game in a ratio of 3:1 for the Pima and 4:1 for the Papago. The more sedentary Pima would procure more rabbit (usually the job of young boys) than the more mobile Papago, who favored deer over rabbit. However, a symbiotic relationship did exist between the two, and it is likely that the Papago got much of their corn from the Pima just as the Pima got much of their deer from the Papago (Castetter and Bell 1942:57-58).

The Havasupai

The Havasupai were not as committed to their crops as some of the previous groups were. Even though they had been planting at the bottom of Cataract Canyon for centuries, they were never truly committed cultivators, even as late as 1941 when the ethnography was recorded. Weber and Seaman (1985: 34) argue that unlike their neighbors the Hopi, the Havasupai fields were not well tended and they took no interest in crop varieties. In short, the Havasupai thought of agriculture as incidental to their hunting and

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gathering. The importance of agriculture likely varied from year to year and from household to household. If it was a good season for wild seeds, domestic crops were neglected or stored for future use. Unlike the Hopi who gained nearly two-thirds of their food from domestic produce, maize comprised about half of the Havasupai diet (Weber and Seaman 1985:27). Before the Havasupai were restricted to the reservation they had a seasonal round similar to that of the previously mentioned groups, though with some variation. In the spring, family groups would congregate in the canyon bottom to plant maize in their garden plots. After the seeds were planted and the fields irrigated once or twice, the family groups made their way back to the plateau to hunt, collect fresh greens and visit one another. The occasional trip would be made to the canyon bottom to check on the fields, irrigate, and weed. When green corn was ready and the plateau water holes began to dry family groups returned to their fields to guard the crops, though they still participated on the occasional hunting or mining trip. By late August, most families had gathered in their fields for the harvest. After food was cached in granaries above the flood waters people returned to the plateau, especially by fall when the pinyon crop was ready. The groups fissured in the winter into small family groups (it is not clear where), but usually within a short distance from one another. Men would hunt in the winter and make the occasional trip to the granaries for more food (Weber and Seaman 1985:9-11). Weber and Seaman (1985:11) note that while there was considerable variation from family to family, they more or less followed a pattern every season that was known to other members of the group (for communication purposes).

The Southern Paiute

The Southern Paiute are currently located in southern Utah and northern Arizona. Horticulture reached the Southern Paiute sometime in the mid-1800s. A few Southern Paiute were seasonal horticulturists, but most remained full time hunter-gatherers (Kelly 1964:36). Those who did choose to plant usually occupied the Moccasin Spring area (about the same elevation as the Steinaker Basin), planted around June 1 and a second planting later, left until the corn was about eight inches high, and then returned for the remainder of the season to tend the plots (Kelly 1964:12). In contrast to the Yuman, the Piman, and the Papago, both sexes worked in the field, and men harvested the crops. The Southern Paiute also practiced seasonal mobility between their summer and winter habitation areas. In the summer people lived at the foot of the plateaus at privately owned springs. They harvested valley seeds, and those who practiced agriculture would plant. In the fall many households made trips to the plateaus for yucca fruit, pinyon nuts, and to hunt deer. Late winter and early spring were starvation times, and many people traveled to the rim of the Grand Canyon to procure mescal, cacti, and juniper berries (all considered starvation food by the Southern

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Paiute) (Kelly 1964:22). It is assumed that those who casually farmed also followed this seasonal round, though this was not clarified in the ethnography. While deer (usually found on the higher plateaus) were sometimes hunted year round, winter snows made traversing difficult. Thus, much deer hunting took place in the late summer and fall. Men would travel as far as 40 km (probably on horseback), one way, to procure a mountain sheep on the rim of the Grand Canyon and Upper Zion Creek. Hunting was not constrained by seasons (Kelly 1964:48, 50).

Discussion

Despite the lack of consistency in the ethnographies, a few patterns can be drawn from the previous examples that have some bearing on seasonality, part-time farmers, and land use. First, people did not appear make exceptionally long residential moves between the field residences and the winter residences, although the Papago record was the only one that gave a specific distance. Papago and Havasupai crops were stored in village granaries and at supplementary caches in the uplands, both accessible from the winter base. It is possible that other horticultural groups who seasonally changed residences did the same. Second, Piman, Papgo, and Yuman men were the planters and the tenders of the crops while women were the harvesters. This should have tied the men down to the fields during the growing season, though it is not clear if they still hunted logistically or obtained their meat more opportunistically during this time. In contrast, both sexes of the Southern Paiute tended the crops, but men were the ones who harvested.

Prehistoric Uinta Basin Farmers

There are many examples in the archaeological record of prehistoric farmers in the Uinta Basin. Sites range from large sedentary villages to seasonal brush structures with evidence of irrigation canals. Two sites in particular will be discussed here because of their proximity to a proposed access route into the Uinta Mountains. The Steinaker Gap (Talbot and Richens 1996) and Steinaker Lake (Talbot and Richens 1999) sites are located in the foothills (1646 m) on the eastern slope of the Uinta Mountains in the Steinaker Basin. They are close to numerous small springs and seeps that provide a perennial, though limited, water source. Ashley Creek, a major drainage from the southeast slope of the Uinta Mountains, flows toward the Green River adjacent to these sites. The Steinaker Gap site (A.D. 250-400) was a series of seasonal, multifamily brush dwellings (e.g., wickiups). Irrigation canals were recorded, indicating an intensive horticultural strategy. Only 138 fragmented bone specimens were recovered from excavations (closely even in distribution between large and small mammal), suggesting that hunting was not an important

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activity while the site was occupied (Richens et al. 1996:96). Talbot and Richens (1996:220) belive that the Steinaker Gap peoples were three season sedentary and one season (winter) mobile to hunt bison on the Plains. Furthermore, they argue, following Wills (1988:39), that the subsurface pits were used for corn storage during the winter while they were away. In contrast to the Steinaker Gap site, the nearby Steinaker Lake sites (A.D. 443-1000) illustrate a more substantial habitation area. Several pithouses were uncovered with central hearths, corn, and numerous storage facilities, suggesting a possible year-round occupation by at least a portion of the population (Talbot and Richens 1999:90). The Steinaker Lake faunal assemblage is also sparse, and there is a lack of lithic tools normally associated with processing meat and hides. In contrast, wild plants were gathered extensively, either for immediate and/or future use. They (Talbot and Richens 1999:102) argue that task groups exploited the mid-elevations to high-elevations in the summer when the fields were still in production, or slightly before or after. It is at this time that there is an "explosion of resources," making mountain areas attractive to both full-time and part-time hunter-gatherers (Madsen and Metcalf 2000:x). Based on the nutritional and seasonal arguments presented earlier, the Steinaker Gap and Steinaker Lake farmers may have moved soon after the harvest rather than the winter, and stayed relatively close to their stores of maize. This strategy is reminiscent of the Papago, who usually stayed with 32-48 km of their winter stores at the field villages in case they needed access to the food. Given the proximity of upland resources to the Steinaker Basin, it is also possible that some family groups may have chosen to stay relatively close to their winter stores.

Loosle (2002b:22-23) believes that in the fall, the seasonally mobile Fremont farmers repeatedly exploited upland sites, specifically in the nearby Uinta Mountains in a pattern known as "embedded mobility" (Binford 1983). A tabulation (Table 2.1) of all Formative upland sites found in the Ashley National Forest (taken from Loosle 2002:253, Figure 10.2) has been divided into two time periods: the Early Fremont/Late

	Early Formative/ Late Archaic (2000-1400 B.P.)	**Uinta Fremont** (1400-650 B.P.)
Intermediate Benches (2000-2200 m)	0%	26.40%
Mountain Benches (2400-2700 m)	16.60%	17.60%
High Lakes/Divide (2923-3692 m)	16.60%	14.70%

Table 2.1. Occupation of Mid-elevation to High-elevation Zones in the Uinta Mountains During the Formative Period.

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Archaic period before ceramics and a “dependence” on maize and the Uinta Fremont period after ceramics and a “dependence” on maize. The only significant difference is the sudden appearance of sites in the Intermediate Benches after 1400 B.P., which may indicate a tendency to make seasonal residential moves to the mid-elevations. Nine structures were excavated at elevations ranging from 1976-2085 m. Six had hearths, three had storage pits, one had a prepared floor, five had groundstone, five had ceramics, and large mammal usually dominated the faunal assemblage. The presence of Cheno-ams and seasonal berries suggest a post-harvest occupation for most of the sites (Johnson and Loosle 2002b:254, 287).

It is argued here that some of these mid-elevation sites may have been temporary residential sites established for the procurement of fall resources by farmer groups. This is in contrast to many current hypotheses that suggest the Fremont period farmers hunted in the mid-elevations logistically from lowland residential bases. With the availability of new data from Deadman Lake, an “up-down” mobility system between the timberline zone and the mid-elevations can now be modeled and tested.

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Chapter 3
The Deadman Lake Site

Site Introduction

Deadman Lake is a small timberline lake at approximately 3350 m above sea level. Topographically, the site is located in a sub-alpine cirque (Figure 3.1) with a large, steep talus slope immediately to the north/ northwest. The talus slope reaches its apex at the crest of the Uinta Mountains 1 km north of the lake with a gradient of 45 percent. At the crest the landscape is a mix of moraine deposits, alpine grasses, and forbes. Gabbro Pass is 2.4 km southeast of the lake, and beyond that Leidy Peak and Marsh Peak represent the easternmost peaks on the main backbone of the range. Approximately 25.6 km to the northeast of these peaks are the Green River and Red Canyon landforms. Approximately 38.4 km to the southeast is Steinaker Reservoir. Due south of Deadman Lake is the Dry Fork River drainage, which leads to the Uinta Basin (Figure 3.2).

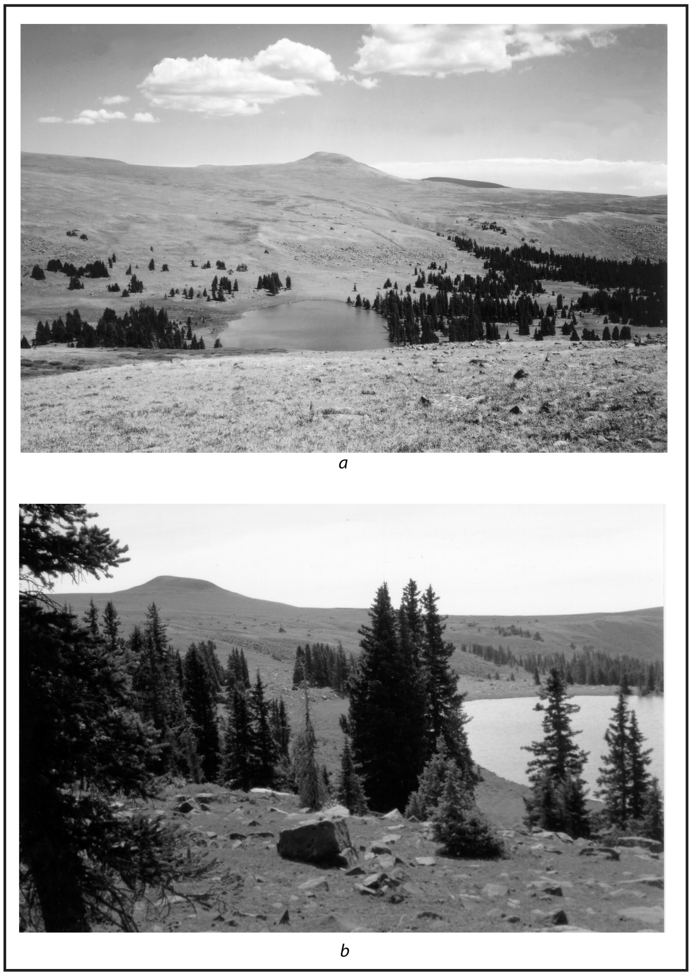

Figure 3.1. View of Deadman Lake (a) looking southeast towards Gabbro Pass and (b) vegetation near the site.

The Deadman Lake site was first recorded in 1996 by Ashley National Forest (ANF) archaeologists. A depression in the ground with a metate near the center was tested for cultural activity in 2001. A piece of obsidian shatter was recovered 4 cm below the ground surface and a thin charcoal lens was recorded at 20 cm below ground surface. Soil color and texture remained consistent from 3-36 cm below ground surface. In 2002, 18 possible cultural areas were identified. Of the 18 areas tested, 12 were noted to have charcoal,

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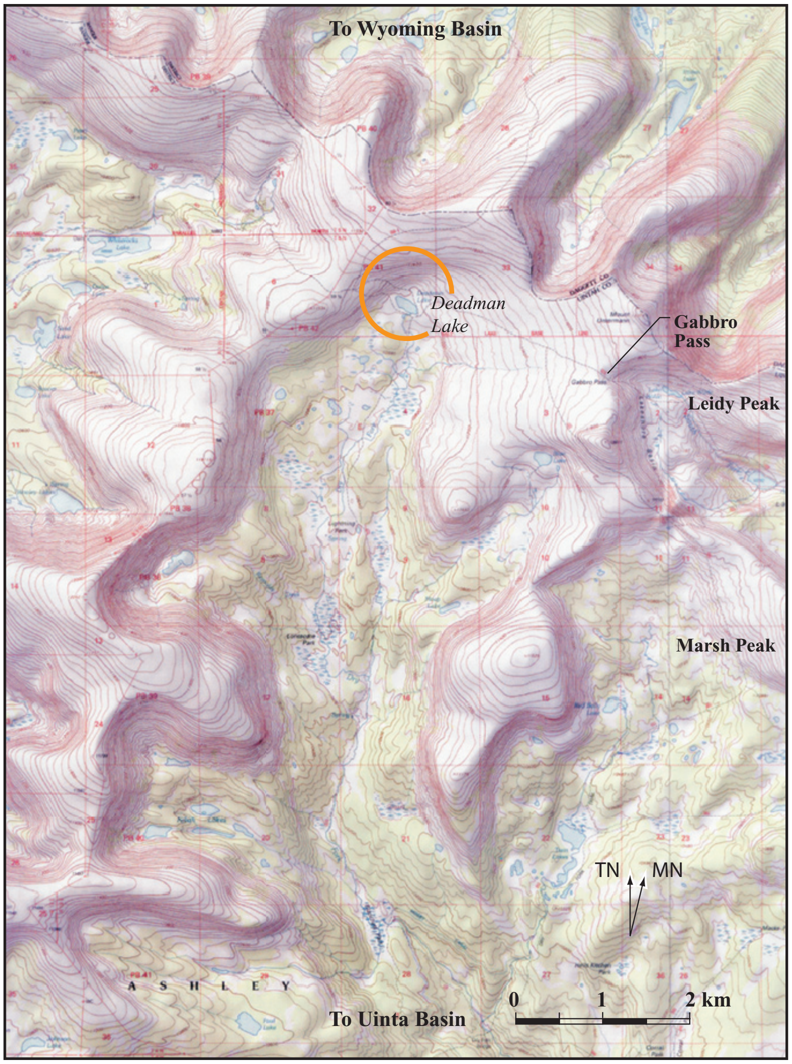

Figure 3.2. Topography near Deadman Lake.

and six were chosen for test excavations (Figure 3.3). The mean depth of the charcoal bands or flecks was 8.6 cm below ground surface.

In the summer of 2002, ANF archaeologists and volunteers from Passport in Time (PIT) excavated six areas. Four radiocarbon dates in total were obtained from Structures 1, 2, and 3, and Hearth 1 (the latter was from a test pit excavated outside of, and believed to be associated with, Structure 1). The calibrated intercept dates range from AD 405-1890. All areas excavated are associated with indigenous peoples, although the most recent structure does contain post-contact material remains.

According to the ANF land system inventory, the Deadman Lake area is classified as an AM3, or Alpine Moraine 3 (Sherel Goodrich, personal communication, 2003). AM3s are located from 2805-3415 m in elevation with gradients from 1-15 percent, and encompass all aspects. It is a hummocky ground moraine land type located below alpine cirques that contains lakes, ponds, wet depressions, and forested knolls. There are three types of ground in this unit: (1) wet meadows in the swales, (2) dry meadows on the hummocks, and (3) conifer-covered areas on larger hummocks. The dominant soils here are well-drained. This land type is stable in an undisturbed condition, but can erode badly if the groundcover is removed. In the immediate vicinity of Deadman Lake, the vegetation zone is classified as an AM3M, which is meadow with less than

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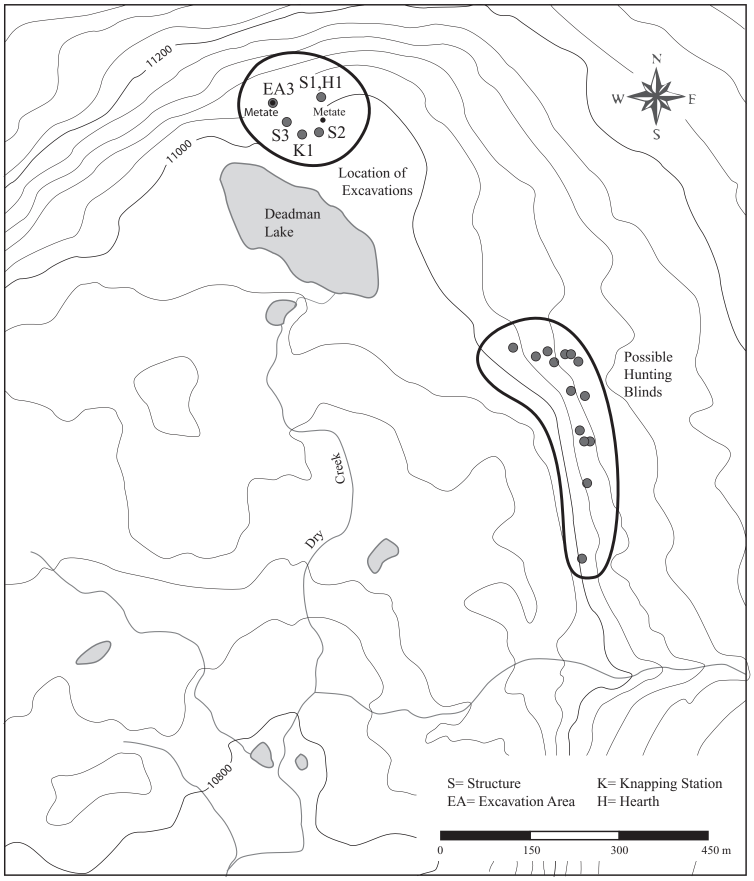

Figure 3.3. Approximate locations of features.

10 percent tree cover. Levels of soils, as described by Goodrich, are overlain by a 1– 2.5 cm thick duff layer. The first level of soil (surface soil) is a discontinuous reddish brown cobbly fine sandy loam about 2.5 cm thick. The subsurface is dark reddish gray cobbly loam about 63.5 cm thick. The third level is reddish brown in color and can be a cobbly sandy loam, cobbly loamy sand, or stratified loamy sands and sandy loams. At this land type, timber oatgrass (*Danthonia intermedia*) is the most common species of the Poaceae family in the dry meadows. Tufted hairgrass (*Deschampsia caespitosa*) is common as well, but decreases in numbers with increased dryness. The forested community around Deadman Lake is dominated by engelmann spruce and krummholz trees. Grouse whortleberry (*Vaccinium scoparium*) is the dominant understory brush. Goodrich (personal communication 2003) argues that species composition and age structure of the forests at AM3 land types have a low fire risk due to high water tables, green plants, the low stature of plants, cool temperatures, and high humidity. Another factor suppressing the fire hazard in the Uinta Mountains is that it is not uncommon at high elevations for the summer monsoon season to closely follow the snow melt. Therefore, while lightning is common in this land type relatively few fires actually start (and even fewer spread beyond the ignition stage). This low frequency of natural fires may have some bearing on the cause of the charred wood in the archaeological record. In other words, it is possible that pieces of charred wood found in the structures were more likely the result of arson than natural causes.

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Excavation Methods

Many of the excavation methods employed at 42Un2331 followed ANF guidelines for excavation (Johnson 2002: chapter 3). A brief discussion of the methods used for excavation, collection of field specimens, and documentation follows.

The identification and extent of subsurface features were determined using an AMS soil probe. Prior to excavation of a selected area, a surface datum was placed on the highest point in the immediate area and a one meter square grid system was established on a true north meridian. Initial grids took the form of either a trench or a single 1 x 1 m test pit, but were subject to change as features were exposed. Trenches could run west-east or north-south as determined by the excavator. Addresses assigned to each feature area were determined by each excavator working in that area and are independent of the other feature areas (Appendix A1.1).

Ground surface elevations and level depths for each square were measured from the southwest corner, unless otherwise noted. Initial excavations always proceeded downward in 5 cm levels until a cultural or natural feature could be identified (such as a compact surface). Where cultural features were interpreted to exist, excavators attempted to identify the areal extent of the feature and then excavate half of the feature to expose a profile for documentation. The second half of the feature was collected as a soil sample.

All lithics, bone, ceramics, and other culturally altered materials were collected during excavation and screening. All collected materials were identified by feature numbers (i.e., F50 in F1), grid coordinates (address), and excavation level and depth (i.e., Level 2, 20-25 cmbd). All sediments were screened using a 1.5 cm (1/8") stainless steel mesh hand screener. Surface artifact collection proceeded excavation of an area. If a surface collection was made outside of a feature area, a GPS coordinate was taken (this also applies to those artifacts that were not collected, like metates).

Sediment, pollen, and charcoal samples were collected during excavation. A modern pollen sample was collected in "pinch" form with a trowel from several areas around the site and combined. Charcoal and charred wood samples from subsurface contexts were gathered using a clean trowel or tweezers and packaged in aluminum foil. Samples were routinely collected where charcoal was observed. Charcoal samples selected for radiometric dating were typically those believed to be associated with structure floors, activity area surfaces, and strata within surface features. Thermal features were dated using charcoal selected from the lowest possible level to avoid mixing.

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Processing of Soil Samples

The presence of groundstone at the Chepeta Lake site suggests that women were present at high altitudes (see Johnson and Watkins 2002). Therefore, large amounts of soil were collected to determine if plant processing took place at Deadman Lake as well. The goal of each excavator was to collect from each one-square meter five one-gallon bags (if possible) of soil for macrobotanical analysis 0-2 centimeters above any compact surface identified. One small bag for pollen and starch analysis was scraped from the top of any compact surface or hearth as well. Due to the large amounts of soil generated from six excavation areas, 80 percent of the soil collected for macrobotanical analysis was floated on site. Pearsall's (2000) book *Paleoethnobotony: A Handbook of Procedures* was used as a guide for manual flotation. The bottom of a galvanized stainless steel hand bucket was replaced with a #20 stainless steel mesh with .5 mm openings. A large garbage can was used to hold lake water. The stainless steel bucket was lowered into the larger bucket until it was filled halfway with water. A second person slowly poured a 1-gallon bag of soil into the steel bucket while the first person rapidly twisted the bucket at a 90 degree angle. When the bucket was considered empty of sediment, the light fraction floating on the top was scooped out with a steel micromesh scooper, wrapped in muslin, tagged, and hung up to dry. The heavy fraction was dumped into a separate muslin pouch and also tagged and hung up to dry. This was repeated with every 1-gallon bag of soil for 80 percent of the total soil samples collected (the remaining 20 percent were sent to Paleo Research Institute for machine flotation and analysis). Water in the large bucket was replaced, and the galvanized bucket was cleaned thoroughly after each set of samples to avoid contamination between features.

Weather during the first week of excavations was exceptionally wet and cold, so the botanical samples never fully dried until we returned to the valley. It is not known at this time whether this affected the quality of the samples or not. The second week was dry and warm during the day, and thus the samples floated in the first few days were able to dry out before we transported them off the mountain. When we returned for the second week of excavation, we discovered that the hand sieve for scooping the light fraction had been stolen. Thus, we were unable to separate on site the heavy fraction from the light fraction for flotation samples 18-46; they were separated in the laboratory instead (Appendix A1.2). Fortunately, one bag from every square where soil was collected was retained intact to send to PaleoResearch Institute, although the inconsistencies in the data collection may still lead to inaccuracies in the botanical assemblage.

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Figure 3.4. Structure 1 before excavation, looking north.

Features

Structure 1

Structure 1, located on the northeast edge of the site, is an earthen depression located on an open meadow just below a large talus slope to the north (Figure 3.4). Pre-excavation outside dimensions of the feature were 6.9 by 6.2 m. Five flat stones of unknown purpose are presumed to have been deliberately placed somewhat in the center of the depression. A soil probe sample taken from the center of the depression revealed a band of light gray charcoal-like soil approximately .5 cm in thickness 10 cm below the ground surface. A second sample from the southwest quadrant revealed a dark charcoal lens 11 cm below the ground surface. Structure 1 radiocarbon dated to 1660 +/- 40 B.P. (cal A.D. 265-290 (p = .95) and cal A.D. 365-425 (p = .95); Beta 170460; wood charcoal; $\delta^{13}C = -22.4^{0}/_{00}$; Table 4.1), with an intercept date of A.D. 405, placing it in the Late Archaic/Early Formative period. A continuous trench running west to east (Figure 3.5) was excavated in addition to one square meter to the north adjacent to the trench and one square meter outside the depression.

At 55 cmbd (or 22 cm below the ground surface) charcoal stains (F20) were uncovered adjacent to two medium sized rocks protruding from the western profile in 5N 5E. A bulk soil sample was collected from the charcoal stains. The floor, a compact light tan surface, was uncovered 2 cm below the charcoal stains. Several amorphous charcoal stains and stains that resemble cross-hatched superstructure were present on the compact surface. A pollen sample was collected from the top of the compacted surface. There was evidence of bioturbation from 44-49 cmbd at the south end of the square. At the east end of the square on this level the soil begins to change to a red/orange color (7.5 YR 4/4), which may be a natural post-occupation deposition, and was typically the lens just above the floor.

The sloping floor continued for 25 cm eastward into 5N 6E but then began to lose compactness upon encountering a group of medium-sized flat slabs. A circular charcoal stain with small charcoal chunks (F24) and an ash stain (F25) that extended into 5N 7E were uncovered at 73 cmbd (Figure 3.5). On the north profile, at approximately 68 cmbd and 160 cm from the westernmost edge of the trench, was a 30 cm long charcoal lens (F26) with ashy gray sediment below (Figure 3.6). Embedded in this charcoal lens was a large sheep creek quartzite flake. At 6N 6E, one square north of the charcoal lens, a compact surface was

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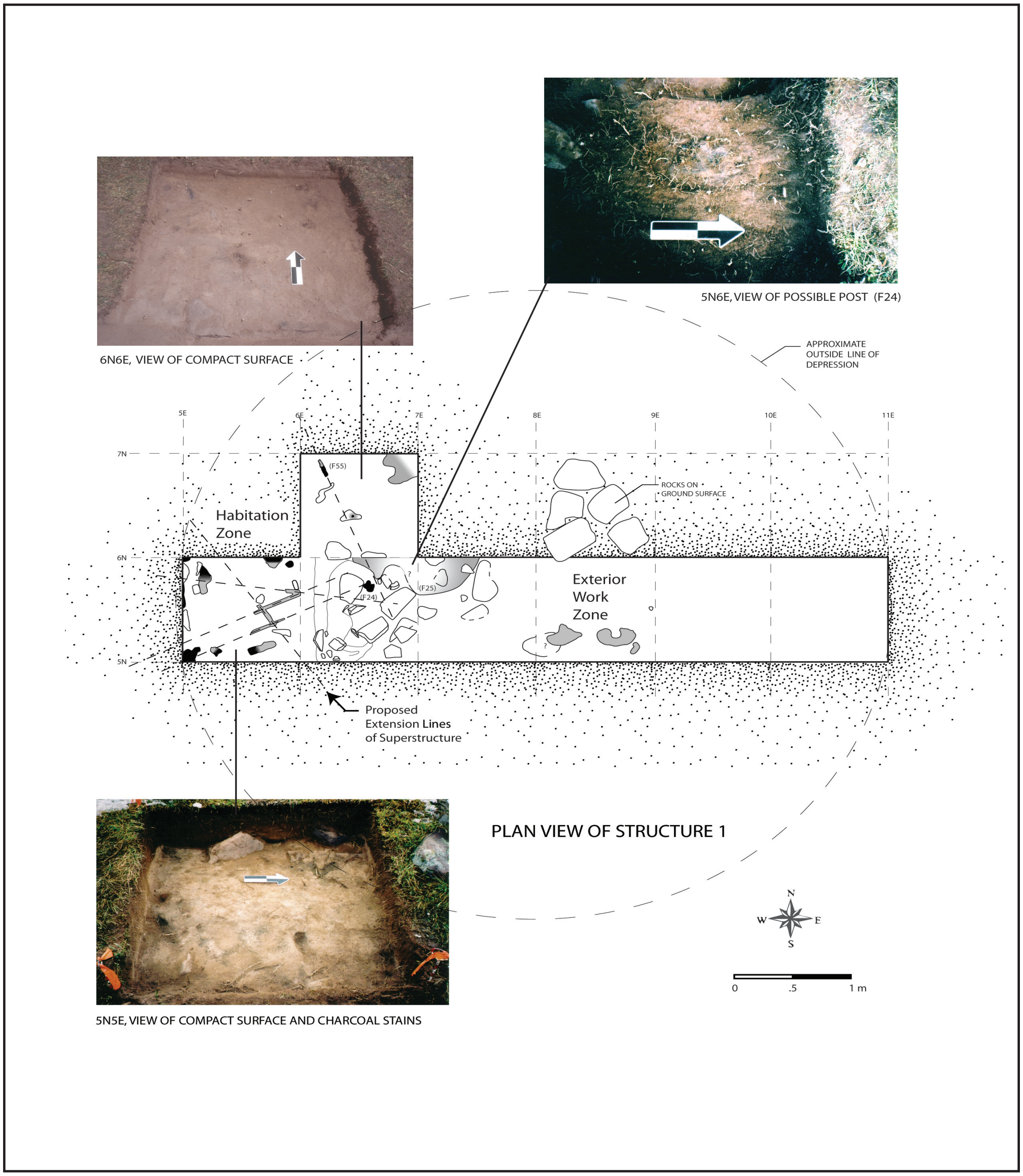

Figure 3.5. Plan view of Structure 1

uncovered at 66 cmbd. A small amount of charcoal staining was present not only above the charcoal lens, but also in several isolated spots in the square. However, it was not sufficient in quantity to confirm that a hearth was present. Also present was a charred piece of wood (F55) pointing northwest-southeast towards

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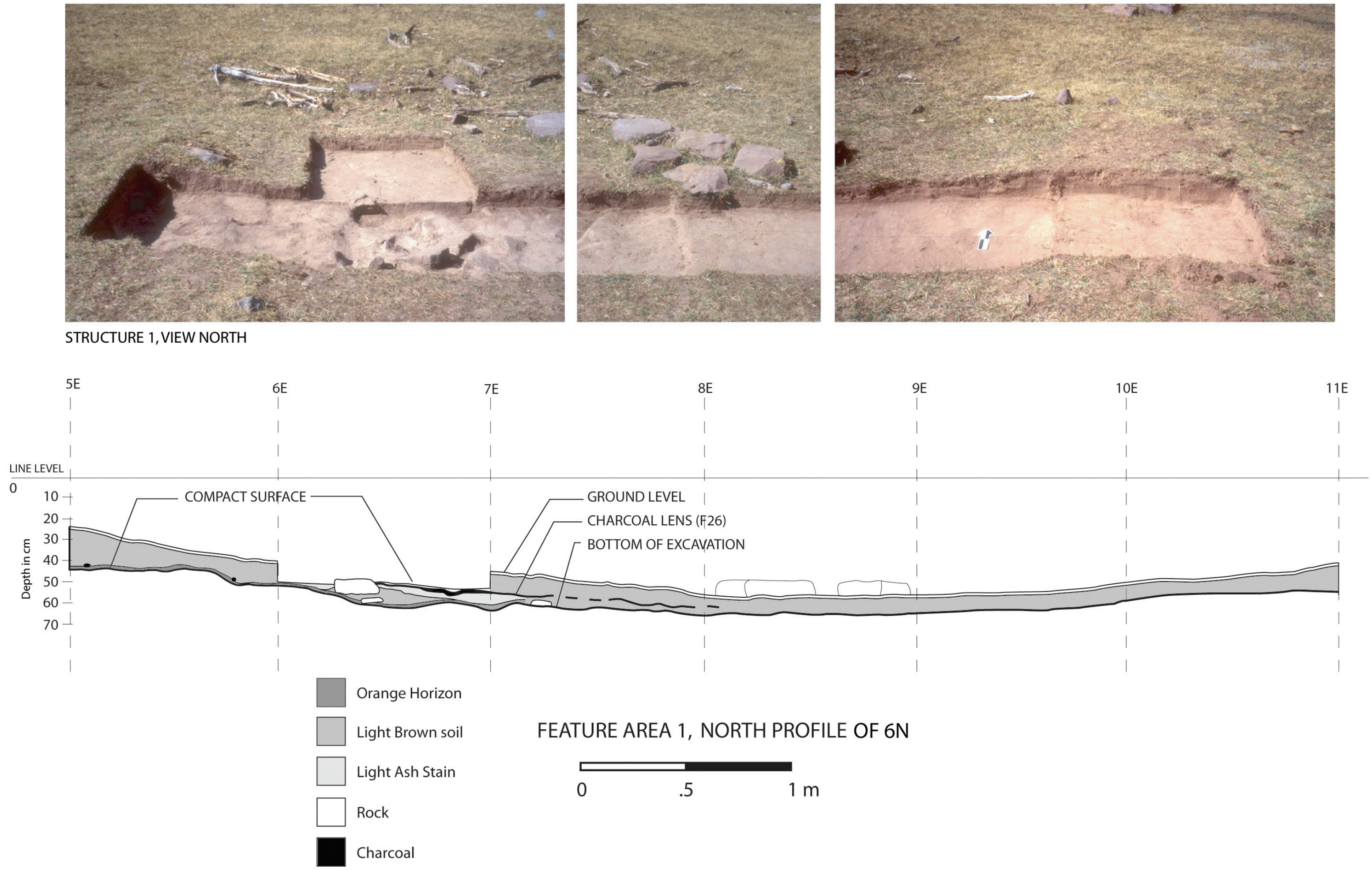

Figure 3.6. Final photo of north view and section of north profile

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the center of the depression, which was collected for ^{14}C sampling. The charred wood may be the remains of the superstructure.

The trench continued to the easternmost end of the depression, but there was no indication of a compact surface east of 5N 6E. In addition there were no rocks below the ground surface east of 5N 7E. The soil tended to be soft in 5N 8E, but more compact in 5N 9E (though not to any degree that would indicate a floor). At the eastern-most end of the depression (5N 10E) the soil was soft, free of rocks, and generally devoid of charcoal. One small piece of vitrified wood was found at the easternmost edge of the depression in 5N 10E, but there was no indication of a superstructure. Artifacts recovered include 10 pieces of debitage, one utilized flake tool, seven pieces of bone, and one piece of vitrified wood. The botanical assemblage suggests that some processing of plants may have occurred.

In conclusion, the west end of the depression at Structure 1 is likely the remains of a shallow brush structure dating to 1660 +/-60 B.P. This would place the occupation in the early half of the Fremont period. The structure was fairly well defined by the rocks, compact surface, and charcoal in the western two meters, but became increasingly difficult to define to the east. On the floor surface at the western edge of the depression there are medium-sized rocks and charcoal stains in a pattern expected for burnt superstructures with rock supports. The charred wood in 6N 6E is also thought to be a small piece of superstructure. No thermal features could be positively identified. Because the eastern end had no compact surface, very few artifacts, charcoal stains, and curiously placed flat slabs (on the ground surface), it is possible that this may have been an exterior work area affiliated with the brush structure. This suggests that the depression may be a natural phenomenon and that the prehistoric occupants simply took advantage of a pre-existing edge to support their temporary brush structure. This argument is also more fitting for wickiup size expectations for a temporary camp. Unfortunately, time did not permit a full excavation of the depression.

Structure 2

Structure 2 is located in an open stand of engelmann spruce trees (Figure 3.7). The structure dates to 60 +/- 60 B.P. (Beta 171596; wood charcoal; $\delta^{13}C = -25.0^{0}/_{00}$; Table 4.1). This places it during the historic Numic occupation of the Uinta Basin. The Uintah Valley Indian reservation was established in 1861 (Lyman and Denver 1969:66), and by 1904 the Uintah and Ouray Indian reservations encompassed much of the Uinta Basin, some of the Uinta Mountains, and the Tavaputs Plateau (Smith 1992:xiii). Today, the Uintah-Ouray Reservation closest to Deadman Lake is on the south benches of the Uinta Mountains from the Duchesne

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Figure 3.7. Structure 2 before excavation, looking north.

River to just west of the Dry Fork River. Therefore, it is likely that this site was created by local Utes, during the historic period.

A soil probe test revealed a 2-14 cm light colored layer below the organic surface layer with charcoal flecks and one piece of debitage. A 1 x 1 m test pit was placed in 1N 1E (Figure 3.8) where a dark gray charcoal stain (F43) at 25 cmbd (approximately 1 ½ cm below the ground surface) spread over almost half of the square. The remaining half of the square was orange-brown soil. Rounded charcoal stains (F45) were found in almost all the squares. The charcoal was removed from these stains in 2N 2E and most were found to be less than a centimeter deep. However, charcoal stains in the southern half of the structure, which averaged 2.8 cm in depth (with a median depth of 3 cm), were likely postmolds. Also in this structure was a lithic wedge in postmold #3. There was charcoal staining throughout squares 1N 1E and 1N 0E. Several burned branches were noted in 1N 0E inclining toward the center of the structure, one of which was crossed by a smaller charred branch (Figure 3.8).

The east and west profiles in 1N 1E had 4-5 cm of charcoal and duff, below which sat 6-9 cm of tan sediment with charcoal flecks. Below this tan lens was 1 cm of a white sterile layer. It is believed that the tan sediment lens might be a cultural layer below the historic-period layer because of the existence of charcoal as well as the cultural material that was extracted from this square in levels below the Numic occupation. Artifacts recovered include 56 pieces of debitage, two utilized flake tools, five pieces of bone, a globule of melted metal, a metal bangle, 12 Intermountain Brownware ceramic sherds, and charred botanical remains.

In conclusion, Structure 2 is a Numic brush structure dating between 1830 and 1890, with a strong possibility that it is Ute. The excavated circular charcoal stains on the south side of the site are likely postholes; the shallow stains on the north are less easily interpreted. At least two scenarios are possible: either the north half was subjected to more severe erosion or the structure was a half dome. No hearth could be positively identified in this structure, although there are ashy stains in 2N 1E and 1N 1E. In addition, there was soil oxidation in 1N 0E and 0N 0E, but no hearth could be positively identified there either. The Numic period structure ends at Level 1. However, the relatively large amount of debitage found in Level 2

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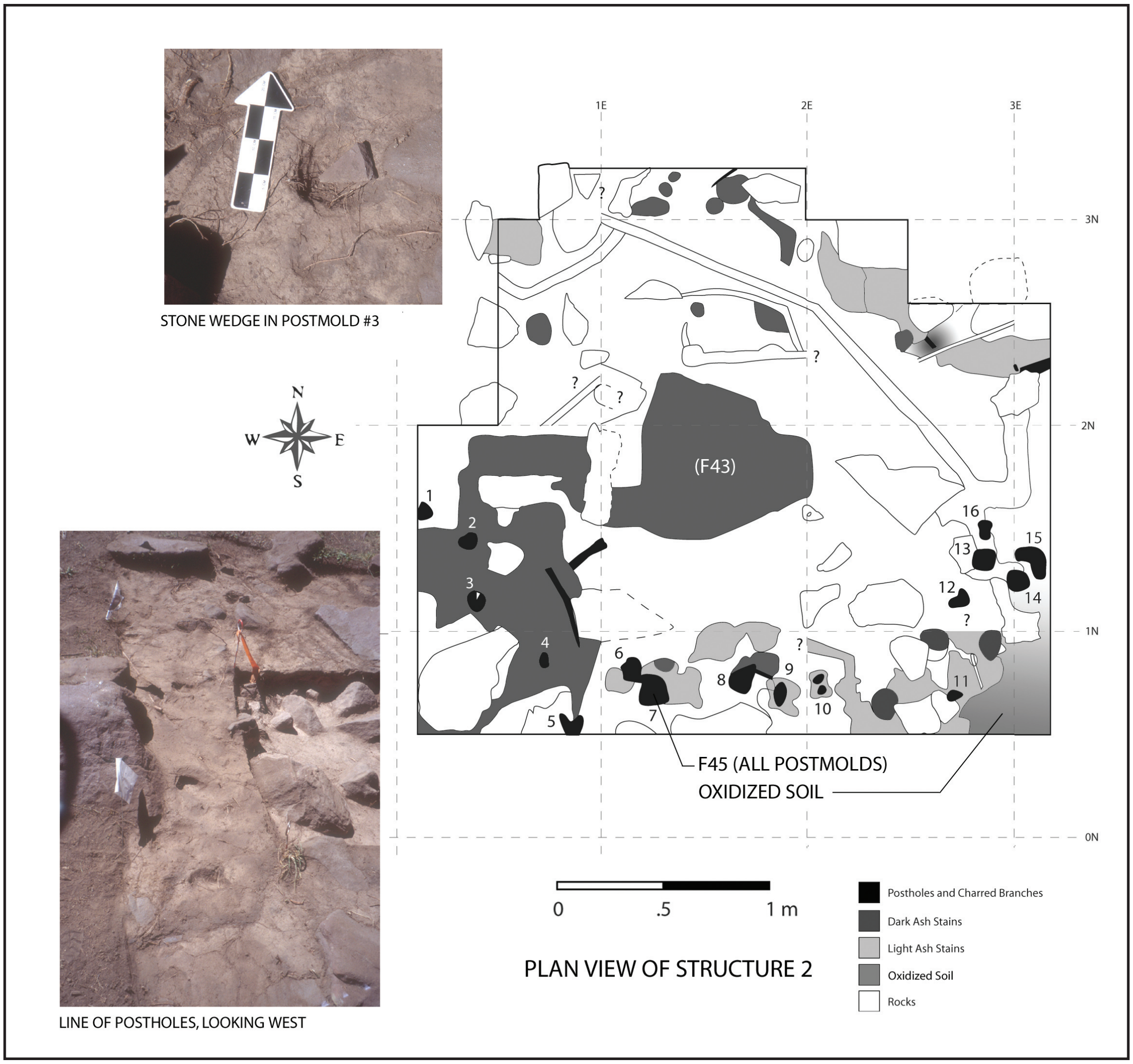

Figure 3.8. Plan view of Structure 2.

in 1N 1E (50 percent of the total lithic assemblage) could represent an earlier occupation below that which was uncovered or a shallow pit into which debris was swept.

Structure 3

Structure 3 is located in an open meadow. A soil probe test indicated a light tan layer 3-8 cm below the organic duff followed by 8-10 cm of dark charcoal and then 10-12 cm of sterile sediments. The pre-excavated feature size was estimated at 3 x 3.3 m. The date of this feature area is 1350 +/-40 B.P. (cal A.D. 635-720 (p = .95) and cal A.D. 745-760 (p = .95); Beta 170459; wood charcoal; $\delta^{13}C = -24.2^{0}/_{00}$; Table

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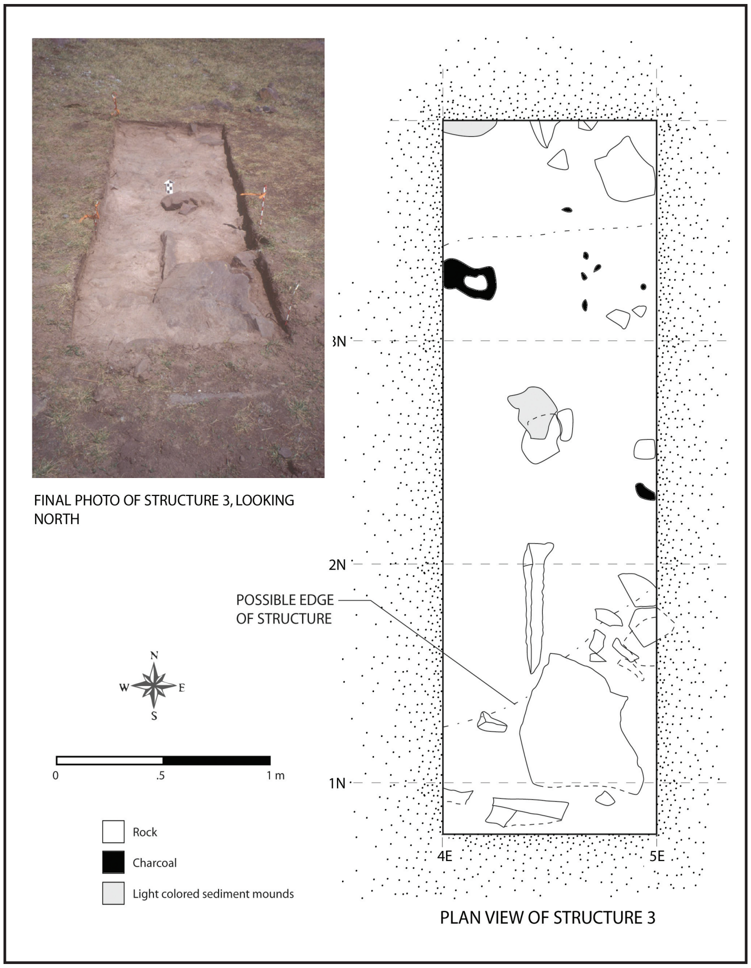

Figure 3.9. Plan view of Structure 3

4.1), with an intercept date of A.D. 670. This places Structure 3 in the Uinta Fremont/Middle Agricultural period.

Three and one-quarter square meters were excavated in a north-south trending trench (Figures 3.9, 3.10). Levels were removed in 5 cm increments until a cultural feature was recognized. Level 2 (25-27 cmbd), was approximately 8 cm below the ground surface in 2N 4E. A layer of mottled orange-brown sediments in varying shades, uneven pockets of charcoal, and an undulating surface were found at this level. A compact surface (F41) was reached at 33 cmbd at both 1N 4E and 2N 4E, but it sloped upward in 3N 4E. The compact surface was light tan in color, but it was not uncommon to find pink and orange hues mixed in at isolated areas. A charcoal sample was collected from a charcoal stain (F42) on floor contact in 2N 4E for ^{14}C dating. The edge of the structure is well defined by rocks in the middle of 1N 4E and less so in the north half of 3N 4E. In the latter, the floor tends to drop off at about 30 cm from the north edge of the square, which coordinates with a cluster of rocks in the northeast corner. Whether or not this indicates the edge of the structure is not known. An earthen "shelf" (20 x 8 cm) was located in the northwest corner of 3N 4E while a modulating charcoal stain (F57) surrounding a rock was discovered in the southwest corner (Figure 3.9). Artifacts recovered include eight pieces of debitage, 16 pieces of bone, and botanical remains. About 86 percent of the debitage and all of the bone were found from 6-13 cm above the compact surface. This is significant enough to question whether a second compact surface (or floor) existed above F41.

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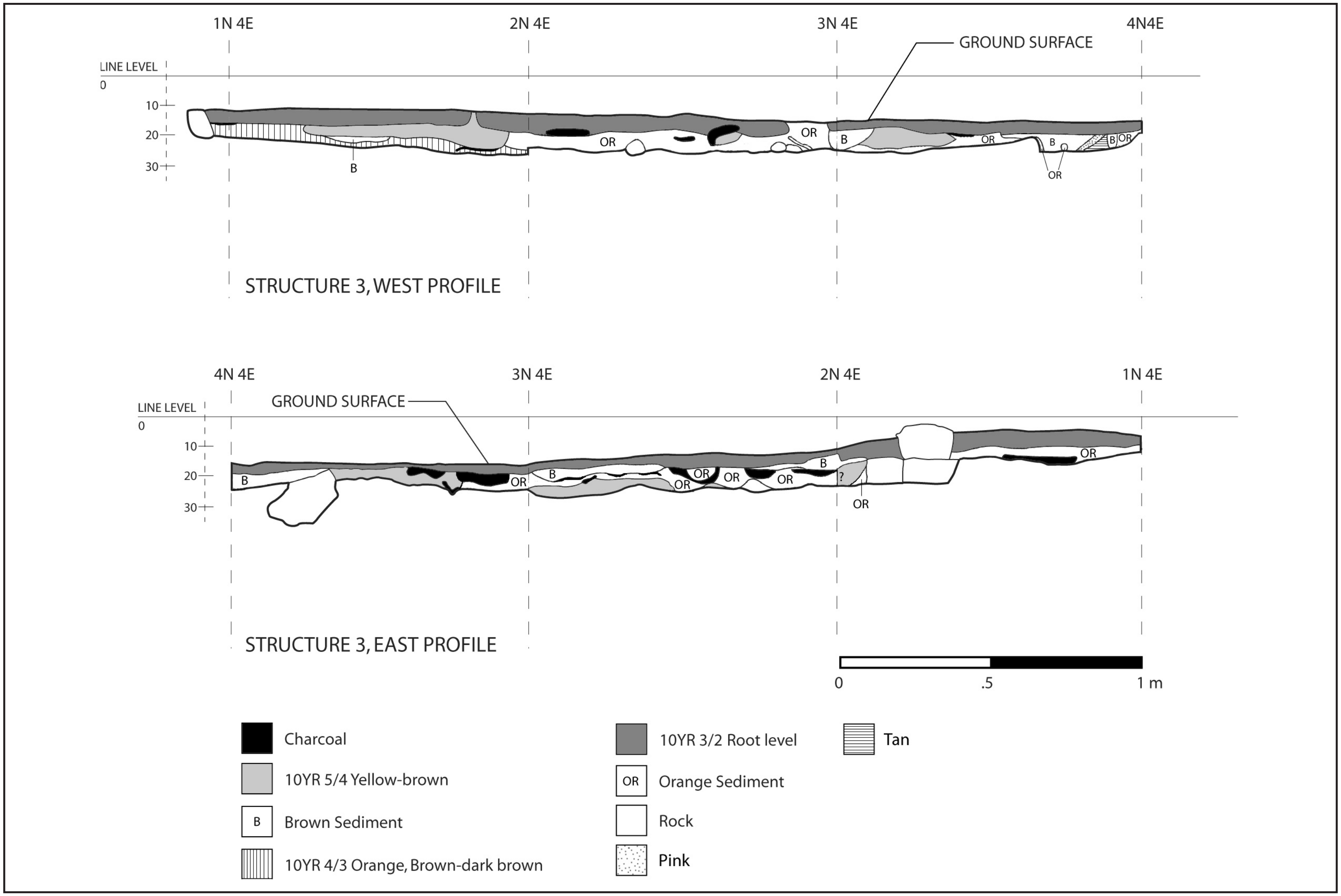

Figure 3.10. Sections of Structure 3

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In conclusion, this feature is interpreted to be a structure. Rocks clearly form an arched pattern in 1N 4E, and a ridgeline and a small cluster of rocks at 30 cm from the north edge of 3N 4E may be the northernmost extent of the structure. As with the other structures, no evidence of a hearth was noted. A compact surface, which was light tan in color and ran fairly consistently at 30-33 cmbd, is believed to be a floor contact surface. There is some charcoal staining (possibly the remains of a superstructure) similar to what was encountered in Structure 1, but it is not as extensive as in Excavation Area 2 or Structure 2.

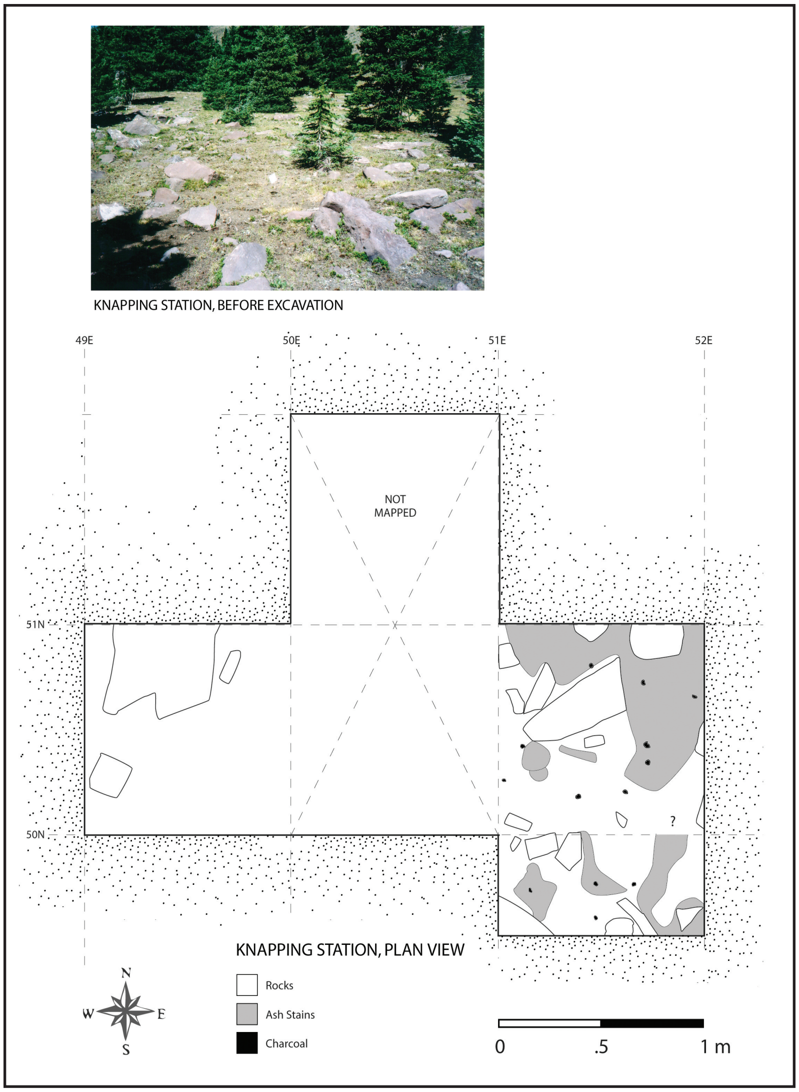

Figure 3.11. Plan view of Knapping Station 1.

Knapping Station 1

Knapping Station 1 is located in an open stand of Engelmann spruce trees (Figure 3.11). On the surface several rocks appeared to be placed in a circular pattern (2.7 x 2.5 m) and several soil probes revealed 8-10 cm of gray-dark brown mottled sediment and charcoal. Charcoal was collected throughout but not ^{14}C dated. The datum was set at 20 cm above the ground surface. Four and one-half square meters were excavated at this feature in 5 cm levels until a cultural feature was encountered. At 50N 49E, 1 cm below the dark organic layer just below the ground surface, the sediments immediately changed to a tan color and were rootless. At the lowest level to contain any cultural materials (Level 2 in 50N 49E, 51N 50E and 50N 50E; Level 1 in

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50N 51E and north half of 49N 51E), the sediments were mottled (light tan to dark reddish brown in color) with large tree roots throughout. There is evidence of burning at 50N 51E from the surface to 3 cm below the surface in the form of burned tree roots, charcoal mixed with the duff layer, and oxidized soil. Whether or not it was natural is unknown at this time. According to the excavator's field notes, there is more evidence of burning as one moves south and east, with emphasis on the south end of the excavation area. The amount of charcoal and debitage decreases at 51N 50E, suggesting that Knapping Station 1 ends somewhere in the south half of this square. Artifacts recovered include 46 pieces of debitage (22 of which were concentrated in Level 1 of 50N 50E) and the distal tip of a Tiger chert biface. In fact, 75 percent of the total lithic assemblage from Excavation Area 2 was concentrated in Level 1 of 50N 50E and 50N 49E.

In conclusion, Knapping Station 1 was likely not a habitation site, though there is evidence of cultural activity present from 0-10 cm below the ground surface. Because of the lack of a compact surface, the high concentration of debitage in 2 square meters, and the deposition of two types of lithics to the exclusion of any other artifacts, I suggest this area was used for retouching at least two stone tools.

Excavation Area 3

Excavation Area 3 is an earthen depression recorded in 1996 (42Un2305) and tested in 2001 (Figure 3.12). Charcoal was collected throughout but not sent out for ^{14}C dating. The depression is located on an open meadow adjacent to a modern stand of engelmann spruce trees. The inside dimensions of Excavation Area 3 are 4.1 x 4 m. A lightly utilized metate made from a slab of Uinta quartzite was found near the center of the depression. One and one-half square meters (n-s) were excavated from the center of the feature (Figure 3.13). Ground level was established at 50 cmbd. The first level (50-57 cmbd) of 5N 5E contained several clusters of charcoal flecks with red-orange sediments, though a lighter, more compact surface was uncovered in the southwest quadrant. Although the test pit was taken down four more levels, the first level was the only one that contained cultural material. The test pit was extended north to 6N 5E and excavated to below the fine-grained compacted soil in order to view the profile more clearly. Artifacts recovered include a utilized flake tool made of obsidian and two pieces of quartzite.

In conclusion, Excavation Area 3 contained some scattered charcoal staining, but little else. There was no definitive evidence of a structure, although this may be the result of the location of the test pit in the center of the depression. I believe this area was not explored to its full potential. In other words, another test pit at the rim of the depression may yield features similar to those found at the western rim of Structure 1 such as a compact surface, rocks, and charcoal staining.

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Figure 3.12. Excavation Area 3 before excavation, looking north

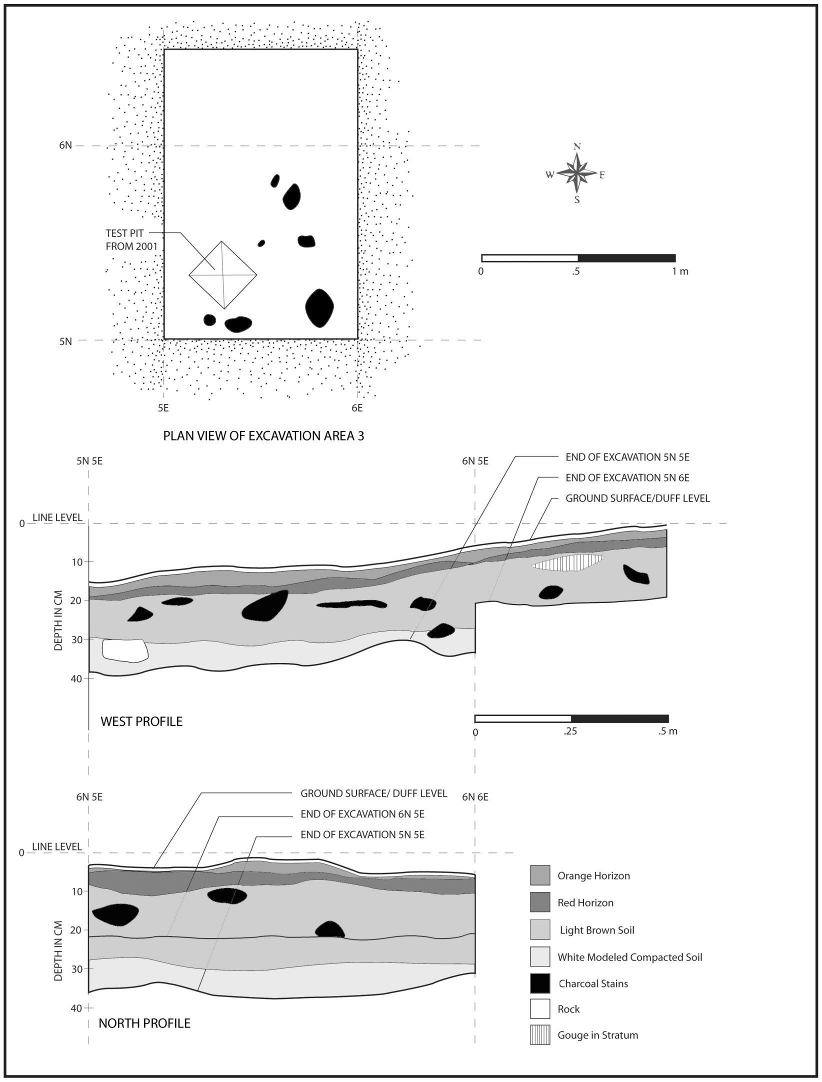

Figure 3.13. Excavation Area 3, plan view and sections.

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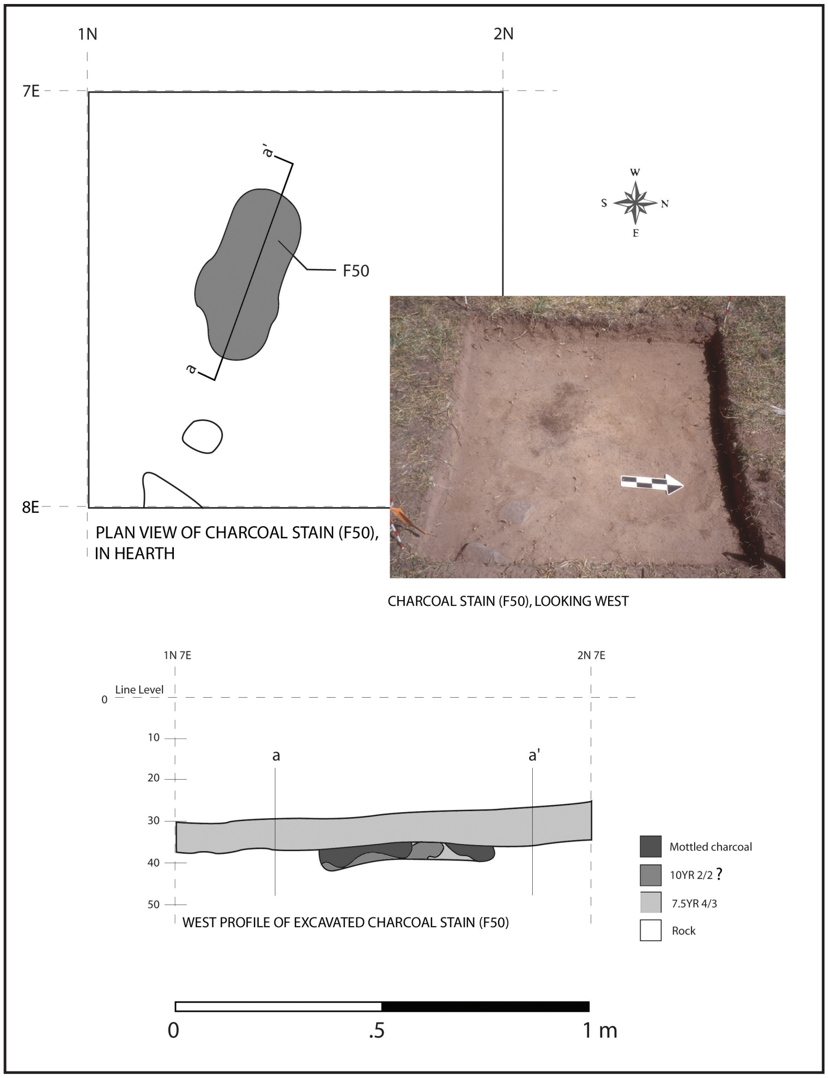

Figure 3.14. Charcoal stain (F50) in Hearth 1

Hearth 1

Hearth 1 is a 1 x 1 m test square excavated approximately 1.5 m south of the outer edge of the depression of Structure 1. The purpose of this test square was to locate an exterior work area or midden that could be associated with Structure 1. This feature dates to 1360 +/-70 B.P. (cal A.D. 570-785 (p = .95); Beta 170461; wood charcoal; $\delta^{13}C = -25.0^{0}/_{00}$; Table 4.1), with an intercept date of A.D. 665. This places Hearth 1 in the Uinta Fremont/Middle Agricultural period, and not in temporal association with Structure 1. However, it is contemporaneous with Structure 3.

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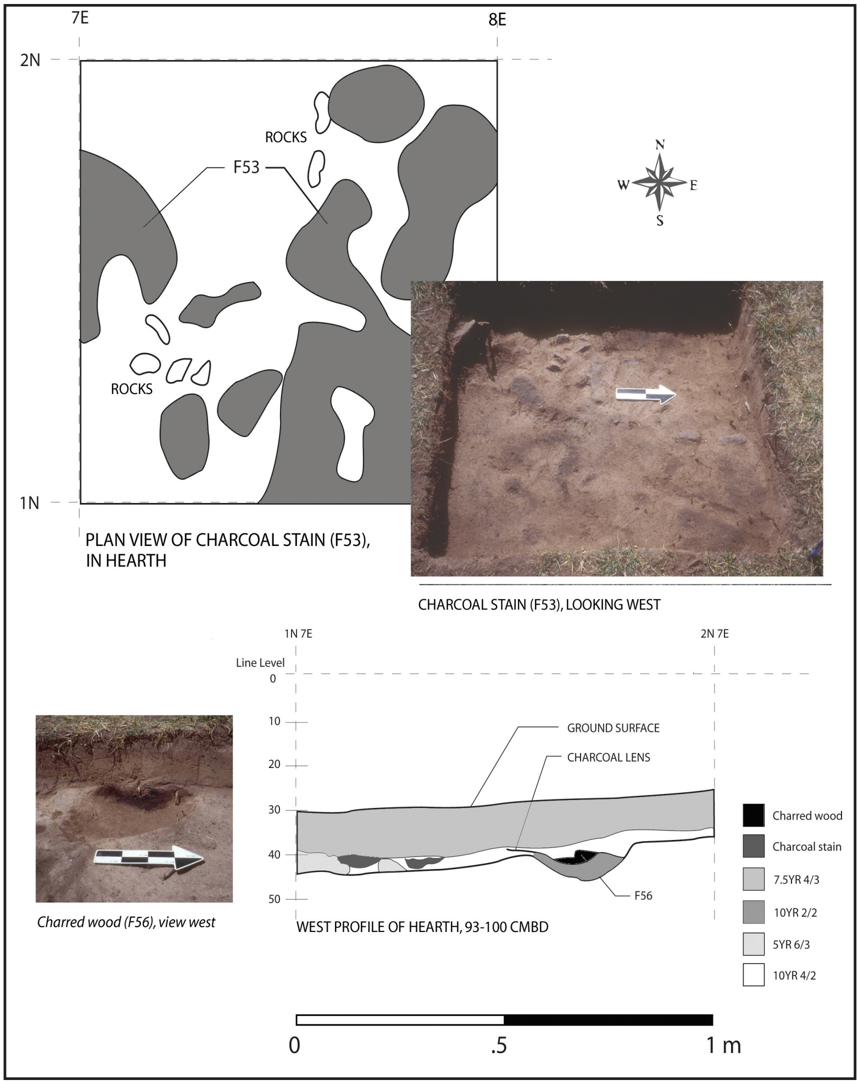

Figure 3.15. Charcoal stain (F53) in Hearth 1

Five centimeters below ground level (88 cmbd) a large charcoal stain (F50) surrounded by a red-brown soil was discovered in the center of the square (Figure 3.14). Three one-gallon bags of soil were collected in addition to one pollen bag sample from 0-2 cm below this feature. In general, the soil throughout the square was mottled with charcoal flecks. A bulk soil sample was taken from F50 as well. Five centimeters below F50 we reached a southward sloping level with a significant amount of charcoal staining (F53) throughout the square at 93-100 cmbd (Figure 3.15). The charcoal from this level was collected for flotation. A large piece of partially-charred wood (F56) was discovered in the west profile at 92 cmbd. It was collected for ^{14}C testing (Beta 170461). Artifacts include 44 pieces of debitage, one piece of bone, and charred botanical remains. All came from the levels associated with the charcoal staining (F50 and F53).

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While the test excavation did not expose a work area, storage, or midden associated with Structure 1, I believe that this was an area where tool maintenance and possible food preparation took place during the Uinta Fremont period. Unfortunately, time restraints prevented any expansion of the test pit, so it is not known whether there is a structure in association with the thermal features.

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Chapter 4
Material Culture: Methods and Results

Radiocarbon Dates

All radiometric dating was performed at Beta Analytic Inc., which consisted of both standard radiometric analysis and Accelerator Mass Spectrometry (AMS) analysis. Beta Analytic estimated the 13C/12C ratio (est. C13/C12 = -.25: lab. mult = 1) based on typical values for the material type unless indicated otherwise. Table 4.1 lists results by field specimen number (FS), provenience, Beta Analytic Inc. analysis number. Age is displayed as the measured conventional radiocarbon age (years B.P.) with a 1-sigma range, a calibrated 2-sigma calendar date range (p = .95), and the intercept between the average radiocarbon age and the calibrated curve time scale. Calibration was calculated based on reports from Stuiver and van der Plicht (1988), Stuiver et al. (1998), and Talma and Vogel (1993). If the sample was dated by AMS it is noted after the sample's laboratory number.

Provenience	Charred branch/ Structure1	Floor/Structure 3	Floor/Structure 2	Charred wood/ Hearth 1
FS #	142	66	128 or 130	143
Material	Charcoal	Charcoal	Charcoal	Charcoal
Conventional ^{14}C Age (BP)	1660+/- 40 B.P.	1350+/- 40 B.P.	60 +/- 60 B.P.	1360 +/- 70 B.P.
Range 2-sigma (cal)	A.D. 265-290 & 325-445	A.D. 635-760	none	A.D. 570-785
Intercept date (cal)	A.D. 405	A.D. 670	none	A.D. 665
Beta Analytic # (year)	170460 (2002) AMS	170459 (2002) AMS	171596 (2002)	170461 (2002)

Table 4.1. Radiocarbon Dates for 42Un2331

Database used
Intcal 98
Calibration Database
Editorial Comment. Stuiver, M. van der Plicht, H. 1998, *Radiocarbon* 40(3): xii-xiii
INTACL98 Radiocarbon Age Calibration. Stuiver , M. et al 1998, *Radiocarbon* 40 (3): 1041-1083
Mathematics
A Simple Approach to Calibrating C14 Dates. Talma, A.S, Vogel, J.C., 1993, *Radiocarbon* 35(2): 317-

Debitage
Classification

All debitage and chipped stone tools were analyzed by Michelle Knoll (with assistance from Dr. John Clark) at Brigham Young University based on guidelines set forth by the Ashley National Forest (Johnson 2002: Chapter 3). Specimens were listed by field specimen number, feature number(s), depth, and grid location. Characteristics of the debitage assemblage were recorded and coded as follows.

Flake type defines the artifact as a bifacial thinning flake, pressure flake, shatter, or angular debris. A *bifacial thinning flake* is defined as a flake that was removed by percussion in the manufacture or thinning of a bifacially flaked stone tool. Sullivan and Rozen (1985:758) argue that attributes which define a bifacial thinning flake have not been consistently applied by researchers, although this problem is beyond the scope of this paper. Bifacial thinning flake attribute definitions used here are a combination of Clark's (personal

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communication, 2003) identifications and Andrefsky's (1998) criteria. Debitage produced by this procedure are characterized by a medium to large flake size (relative to a pressure flake), greater thickness and width (relative to a pressure flake), flake curvature, the presence of scars on the dorsal side, a bulb of force and choncoidal fractures on the ventral side, and a striking platform. Scholars have used variations in striking platforms to infer the type of hammer used, the stage of biface production, and the type of objective piece being modified (Andrefsky 1998:88). In most cases bifacially flaked objective pieces will have multifaceted striking platforms while flat platfoms are the result of knapping unidirectional cores and sometimes flake blanks (Andrefsky 1998:89, 95).

Andrefsky (2001:7-8) argues that most studies do not provide good definitions of a *pressure flake*. While some scholars (Ahler 1989:91; Root 1992:87) define them as smaller, thinner, and lighter than percussion flakes, others (Ammerman and Andrefsky 1982:162; Andrefsky 1998) have shown that lighter flakes can be produced with a percussion technique as well. Despite this discrepancy, pressure flakes are defined here following Ahler (1989) and Root (1992). *Shatter* is defined here as pieces that are very small in size, lightweight, and do not exhibit any traits characteristic of a pressure or a percussion flake. *Angular debris* is defined here as a non-flake fragment.

Flake Type Code

BF	Bifacial Thinning flake
PF	Pressure flake
SH	Shatter
AD	Angular debris

Material source and type are defined using an uppercase two letter code. The first letter is the material source and the second is the material type.

Cortex is recorded as defined in the Intermountain Antiquities Computer System (IMACS) guide. A primary flake (100-50 percent cortex present) is labeled as 1, a secondary flake (50-1 percent cortex present) is labeled as 2, and a tertiary flake (0 percent cortex present) is labeled as 3. In general, the amount of cortex is meant to indicate the stage of reduction; the more cortex present the earlier the stage. However, Sullivan and Rozen (1985:756; see also Andrefsky 2001:10-11; Sievert and Wise 2001:93) argue that variations in cortical presence are only indirectly related to technology and stage of reduction. In other words, variations in cortical amount could also be reflective of raw material type, core size, intensity of reduction, and type of artifact being produced. They also argue that there are no methods for consistently and accurately measuring cortex amount, thus there is an incompatibility between interpretations of lithic assemblages. However, because the cortex amount listed here is meant to be descriptive and not interpretive the IMACS classification will still be used.

Condition codes record evidence of heat alteration. The one letter code is U for unburnt and B for burnt. Coding as burnt depends on presence of potlids, heat fractures, and/or unambiguous variability of color or luster. This category does not differentiate between various degrees of heat alteration, which is based on visual identification and is highly subjective.

Dorsal scars are counted when they are present. If no ridgeline is noted on a pressure flake or bifacial thinning flake, the number of dorsal scars is recorded as 1. Angular debris and shatter are recorded as 0. Flake completeness defines the level of completeness and which half of the flake is represented

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Material source (prefix) codes

Code		Code		Code	
O	unsourced	E	Teton Pass, WY	M	Malad, ID
A	Topaz Mountain, UT	J	Jemez area, NM	N	Obsidian Cliff, WY
B	Bear Gulch, ID	K	Kelly Canyon, ID	P	Phillips Pass, WY
D	Dutch John, UT	L	Black Rock area, UT	R	Red Creek, UT

Code	
S	Sheep Creek, UT
T	Tiger (Bridger Formation) WY, UT, CO
U	Uinta Formation
W	Wild Horse Canyon, UT

Material Type (suffix) codes

Code		Code		Code	
B	obsidian	H	shale	R	quartz
C	chert	M	limestone	S	sandstone
G	igneous (basalts, etc)	Q	quartzite	T	slate

Code	
X	unknown

Flake Completeness Codes

FC	complete flake; perimeter essentially complete
FP	proximal flake; includes bulb of percussion and/or platform, missing distal margin
FM	medial flake; missing proximal and distal ends
FD	distal flake; includes distal margin, missing proximal end platform and bulb of percussion

Striking platform is coded as a single letter code. A single platform is represented as S (platform core reduction). A multiple platform is represented as M (bifacial core reduction) (Andrefsky 2001:9; Sievert and Wise 2001:92; Whittaker and Kaldahl 2001:54). X represents an absence of platform.

Flake length, width, and thickness are recorded in centimeters to one decimal place (0.0 cm). Length is maximum length along the flake axis perpendicular to the proximal end platform. Width is the maximum flake width at right angles to the length. Thickness is the maximum flake thickness. Flake

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weight is recorded in grams to one decimal place (0.0 g). Because so many individual flakes were less than .1 grams, and thus would not register on the electronic scale, the flakes have been grouped by feature. For example, F22 in F1 at 5N 8E had two flakes, but were weighed as one (.2 g).

Quantifying Debitage

Andrefsky (1998, 2001) suggests at least three ways to review a debitage assemblage; at the aggregate or population level, as individual types, and at the attribute level. *Aggregate analysis* of debitage classifies the assemblage based on a particular criterion, usually a size class, and then compares the proportion of debitage in each class to determine the size of the objective piece. Despite the mixed assemblage problem that occurs, Andrefsky (2001:5) believes that this type of analysis is an appropriate tool to identify various stages of tool production (*contra* Pecora 2001:180). *Typological analysis* classifies debitage into types that have technological meaning, such as a bifacial thinning flake, a channel flake, or a notching flake. It is hoped that by identifying where the flake originated, the kind of tool that was being produced or maintained can be identified even if the tool is not present at the site. However, Andrefsky (2001: 7) argues that there is a lack of consistent and replicable definitions, and some, such as "pronounced bulb of force," are highly subjective and probably immeasurable. *Attribute analysis* records individual debitage characteristics (size, weight, platform morphology, dorsal scars, etc.) and compares the distribution of the attribute over some defined category. It is used to make inferences about artifact type, reduction stages, and technology. However, it too can be highly subjective or have problems in measurement replicabilility. For example, Andresfsky (2001: 10) argues that platform morphology is very effective for understanding the kind of technology used in chipped stone tool production and maintenance, but they are hard to replicate and measure reliably. The analysis for this project uses both the attribute and typological analysis methods.

Analysis

Debitage was analyzed from all six excavation areas based on the criteria outlined above. Results are tabulated in Table 4.2. Structure 1 (Cal. A.D. 405) has ten pieces of debitage. Five were classified as bifacial thinning flakes, four are pressure flakes, and one piece of shatter was recovered. All flakes from this feature are Sheep Creek quartzite. The mean length is .89 cm, with a median of .65 cm. The total weight of the debitage assemblage from Structure 1 is 2.4 gms. None of the specimens exhibited cortex and one specimen was heat treated. Most of the flakes (80 percent) were fractured. Given the lack of diversity in material type, it is possible that this assemblage is the result of the retouching of one tool. However, because the debris was scattered over six meters, this cannot be stated unequivocally.

Structure 2 (60+-60 B.P.) has 56 pieces of debitage. Most (64.3 percent) were classified as a pressure flakes, bifacial thinning flakes comprise 21.4 percent, and shatter comprises 14.3 percent of the assemblage. Tiger chert is the dominant material type (78.6 percent), while Sheep Creek quartzite (19.6 percent) and unknown quartzite (1.8 percent) make up the remainder. Mean length is .87 cm with a median of .8 cm. Total weight of the debitage assemblage Structure 2 is 6 gms. Two of the specimens exhibit cortex and five of the Tiger chert flakes were heat treated. Most of the flakes (71.5 percent) were broken.

Structure 3 (Cal. A.D. 670) has eight pieces of debitage. Pressure flakes and shatter comprise 37.5 percent of the assemblage each, while bifacial thinning flakes (25 percent) constitute the remainder. Material types include Tiger chert (50 percent), Sheep Creek quartzite (12.5 percent), Uinta quartzite (12.5 percent) and unknown quartzite (25 percent). Mean flake length is .83 cm, with a median of .75 cm. The total

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weight of the debitage assemblage from Structure 3 is 3.7 gms. None of the specimens exhibits cortex, and one Tiger chert flake was heat treated. All of the flakes are incomplete.

Knapping Station 1 (no date) has 46 pieces of debitage. Pressure flakes (52 percent) are the most common followed by bifacial thinning flakes (33 percent), shatter (11 percent), and angular debris (4 percent). Tiger chert is the dominant material type (89 percent) with the remainder (11 percent) being Sheep Creek quartzite. Mean flake length is .8 cm, with a median of .7 cm. The total weight of the debitage assemblage is 7.1 gms. None of the specimens exhibited cortex, and six of the Tiger chert flakes were heat treated. Most of the flakes (93 percent) were broken. Seventy-eight percent of the flakes were concentrated at one level in 50N 50E and 50N 49E with the remainder spread out in the adjacent squares, suggesting that the most intense (relatively speaking) tool maintenance or manufacture was occurring here.

Excavation Area 3 (no date) has two pieces of debitage. One flake is a bifacial thinning flake and the other is a pressure flake. The debitage assemblage is comprised of Sheep Creek quartzite. Mean flake length is .85 cm. The total weight of the debitage assemblage from Feature Area 3 is .3 gms. Neither of the specimens exhibited cortex or heat treatment. Both of the artifacts are broken. The entire debitage assemblage was recovered in one square meter at 50-57 cmbd, so it is possible that this assemblage is the result of the retouching and use of two tools; one obsidian and one Sheep Creek Quartzite.

Hearth 1 (Cal. A.D. 665) has 44 pieces of debitage. The assemblage is comprised of pressure flakes (41 percent), bifacial thinning flakes (36.4 percent), shatter (20.4 percent), and angular debris (2.2 percent). More than half the lithic material is Tiger chert (52.4 percent), while Sheep Creek quartzite (38.1 percent) and unknown quartzite (9.5 percent) constitute the remainder. Mean flake length is .76 cm. Total weight is 9.8 gms. None of the specimens exhibits cortex, and five were heat treated. Eighty-four percent of the flakes are incomplete.

Chipped Stone Tools

Classification

This category includes all tools of stone altered by flaking, and flakes altered by use. Chipped stone tools include utilized flakes, clearly modified flakes, choppers, bifaces, projectile points, scrapers, knives, drills, tested pebbles or cobbles, and cores. Chipped stone tools collected on the surface (FS 152, FS 153, FS 154) are not directly associated with any of the features described in Chapter 3. Regardless, they are presented here in order to show the full range of tool types found in this timberline setting. Categories and codes for chipped stone tools follow the guidelines of the ANF (Johnson 2002: Chapter 3).

Tool material name and type are defined using upper case two letter codes identical to those used for the debitage analysis. The first letter is for the material source and the second is for the material type. Tool material color and opacity are combined using a two letter code. The prefix identifies the color and the suffix represents the opacity. There is a continuum between transparency and opacity. Luedtke (1992: 68-69), following Ahler, rates translucency by holding chert flakes 8 cm from a 75 watt bulb backlight and measuring the thickness of material where light ceases to visibly pass through the chert. This thickness ranges from .5 mm for “very opaque” to more than 20 mm for “very translucent.” A simplified analytical procedure followed by the ANF defines material as translucent if backlight passes through at least 1mm of material and opaque if backlight does not pass through a 1 mm thickness of material.

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FS #	Address	Feature (primary)	Feature (secondary)	Depth	Specimen Number	Flake Type	Material Type	Cortex	Condition	Number of dorsal scars	Completeness	Platform	Length (cm)	Width (cm)	Thickness (cm)	Weight (grams)
Structure 1																
12	5N6E	F01	F22	57-70	1	PF	SQ	3	U	4	FC	S	.6	.4	.1	<.1
15	5N5E	F01	F23	55-57	1	BF	SQ	3	U	4	FD	X	1.4	.8	.2	.2
16	5N7E	F01	F26	75-78	1	BF	SQ	3	U	4	FD	X	1.8	1.8	1.5	.9
39	5N5E	F01	F22	55-57	1	BF	SQ	3	U	4	FM	X	1	.8	2	
					2	BF	SQ	3	U	1	FM	X	.4	.5	2	
					3	SH	OX	3	B	0	X	X	.3	.3	<.1	.9
75	5N8E	F01	F22	72-77	1	BF	SQ	3	U	3	FM	X	1.5	.6	.1	
		F01	F22		2	PF	SQ	3	U	3	FP	S	.6	.5	<.1	.2
77	6N6E	F01	F22	59-63	1	PF	SQ	3	U	5	FD	X	.7	.6	<.1	<.1
78	5N9E	F01	F23	76-79	1	PF	SQ	3	U	4	FC	?	.6	.4	<.1	<.1
Structure 2																
68	1N1E	F12		19-26	1	PF	TC	2	U	6	FC	S	.6	.8	<.1	
		F12			2	PF	TC	3	U	4	FM	X	.5	1	<.1	
		F12			3	PF	TC	3	U	1	FM	X	.8	.5	<.1	
		F12			4	PF	TC	3	U	7	FC	S	.5	.6	<.1	.1
72	1N1E	F12	F43	19	1	BF	SQ	3	U	3	FC	M	1.7	1.2	.2	.4
74	1N1E	F12	F43	26-31	1	PF	TC	3	U	6	FD	X	1.6	1	1.5	

Table 4.2. Debitage from 42Un2331

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		F12			2	PF	TC	3	U	4	FC	S	1.6	1.2	1	
		F12			3	BF	TC	3	U	3	FP	M	.6	.9	<.1	
		F12			4	PF	TC	3	U	3	FM	X	.9	.6	<.1	
		F12			5	PF	TC	3	U	2	FM	X	1	.9	<.1	
		F12			6	PF	TC	3	U	4	FM	X	.6	.5	<.1	
		F12			7	PF	TC	3	U	5	FP	S	.8	.5	<.1	
		F12			8	BF	TC	3	U	3	FC	M	.7	.5	<.1	
		F12			9	PF	TC	3	U	2	FD	X	.8	.4	<.1	
		F12			10	PF	TC	3	U	4	FC	S	.9	.5	<.1	
		F12			11	BF	TC	3	B	6	FC	M	1.6	1.4	.3	
		F12			12	PF	TC	3	U	3	FM	X	1	.6	.1	
		F12			13	PF	TC	3	U	3	FP	S	.8	.7	.3	
		F12			14	PF	TC	3	U	6	FP	S	.8	1	.1	
		F12			15	PF	TC	3	U	4	FM	X	1.1	1	.1	
		F12			16	PF	TC	3	U	3	FC	S	.9	1	.1	
		F12			17	PF	TC	3	U	4	FC	S	1	.4	<.1	
		F12			18	PF	TC	3	U	5	FD	X	1	.5	.1	
		F12			19	PF	TC	3	U	2	FP	S	.5	.8	<.1	
		F12			20	SH	TC	3	U	1	X	X	.4	.4	<.1	
		F12			21	PF	TC	3	U	3	FC	S	.8	.4	<.1	
		F12			22	PF	TC	3	U	2	FM	S	.7	.4	<.1	
		F12			23	PF	TC	3	U	3	FM	X	.4	.4	<.1	
		F12			24	BF	SQ	3	U	9	FP	M	.7	1	.2	
		F12			25	PF	SQ	3	U	5	FC	S	.9	.8	.1	
		F12			26	PF	SQ	3	U	5	FM	X	.6	1.5	.1	

Table 4.2. Debitage from 42Un2331 (cont.)

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FS #	Address	Feature (primary)	Feature (secondary)	Depth	Specimen Number	Flake Type	Material Type	Cortex	Condition	Number of dorsal scars	Completeness	Platform	Length (cm)	Width (cm)	Thickness (cm)	Weight (grams)
		F12			27	SH	SQ	3	U	0	X	X	.5	.3	<.1	
		F12			28	PF	SQ	3	U	1	FM	X	.7	.4	<.1	2.9
85	1N2E	F12		25-29	1	SH	SQ	1	U	0	X	X	.6	.4	.1	<.1
86	3N1E	F12	F44	17-23	1	SH	SQ	3	U	0	X	X	1	.4	.1	<.1
87	2N1E	F12	F44	18-23	1	SH	SQ	3	U	3	X	X	1	.6	.1	
		F12	F44		2	PF	TC	3	U	1	FD	X	.7	.4	<.1	
		F12	F44		3	PF	TC	3	U	2	FM	X	.5	.4	<.1	
		F12	F44		4	PF	TC	3	U	2	FM	X	.5	.4	<.1	.1
91	2N2E	F12	F44	23-26	1	BF	TC	3	U	5	FP	M	1.2	1.1	<.1	
		F12	F44		2	PF	TC	3	U	2	FP	S	.8	.7	<.1	
		F12	F44		3	SH	TC	3	U	0	X	X	.6	.5	<.1	.9
94	1N1E	F12		31-36	1	BF	TC	3	B	5	FC	S	1.6	1	.1	
		F12			2	PF	TC	3	B	2	FD	X	.8	.7	<.1	
		F12			3	SH	TC	3	U	0	X	X	1.2	.5	.1	
		F12			4	BF	SQ	3	U	2	FP	S	.9	.8	.1	.6
111	0N0E	F12	F44	13-17	1	SH	TC	3	B	0	X	X	.2	.5	<.1	<.1
112	1N0E	F12	F44	12,16	1	PF	TC	3	U	2	FC	S	.5	.5	<.1	
		F12	F44		2	PF	OC	3	U	2	FM	X	.4	.4	<.1	<.1
113	3N0E	F12	F44	17-20	1	BF	TC	3	U	6	FD	X	1.6	1.2	.1	.4

Table 4.2. Debitage from 42Un2331 (cont.)

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114	3N1E	F12	F44	23	1	PF	TC	3	B	3	FC	S	1	.7	<.1	
		F12	F44		2	BF	TC	3	U	6	FC	S	1.5	1.3	<.1	
		F12	F44		3	PF	TC	3	U	6	FC	S	1.2	.5	<.1	
		F12	F44		4	BF	TC	3	U	0	FM	X	1.2	.5	.2	
		F12	F44		5	PF	TC	3	U	3	FM	X	.7	.6	<.1	
114	3N1E	F12	F44	23	6	BF	SQ	3	U	2	FP	S	.9	1.3	.1	1.2
Structure 3																
3	1N4E	F17		14-20	1	PF	OQ	3	U	1	FP	S	.8	.5	.1	<.1
5	2N4E	F17		18-25	1	PF	SQ	3	U	1	FM	S	1.4	1.4	.2	.4
19	3N4E	F17	F41	25-30	1	SH	TC	3	B	0	X	X	.3	.2	<.1	
41	2N4E	F17	F41	32-37	1	BF	UQ	2	U	2	FD	X	2.2	2.3	5	3.2
155	2N4E	F17	F41	L2	1	BF	TC	3	U	4	FD	X	1	.8	.1	
		F17			2	PF	TC	3	U	2	FM	X	.7	.6	<.1	
		F17			3	SH	OC	3	U	0	X	X	.3	.3	<.1	
		F17			4	SH	TC	3	U	0	X	X	.2	.2	<.1	.1
Knapping Station 1																
96	50N49E	F08		29-32	1	BF	TC	3	U	4	FM	X	1.5	1	<.1	
		F08			2	PF	TC	3	U	3	FP	S	.5	.6	<.1	
		F08			3	PF	TC	3	U	6	FP	S	.6	1	.1	
		F08			4	PF	TC	3	U	3	FP	M	.6	.7	<.1	
		F08			5	PF	TC	3	U	3	FP	M	.5	.8	<.1	
		F08			6	SH	TC	3	U	2	FM	X	.4	.4	.1	
96	50N49E	F08		29-32	7	BF	SQ	3	U	2	FP	S	.6	.6	.1	
		F08			8	SH	SQ	3	U	0	X	X	.5	.5	<.1	.5
97	50N49E	F08		29-32	1	BF	TC	3	U	3	FP	S	.7	1.2	.1	
		F08			2	BF	TC	3	U	5	FD	X	.9	1.1	<.1	

Table 4.2. Debitage from 42Un2331 (cont.)

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FS #	Address	Feature (primary)	Feature (secondary)	Depth	Specimen Number	Flake Type	Material Type	Cortex	Condition	Number of dorsal scars	Completeness	Platform	Length (cm)	Width (cm)	Thickness (cm)	Weight (grams)
		F08			3	BF	TC	3	B	3	FM	X	1.2	1	.1	
		F08			4	PF	TC	3	U	3	FP	S	.6	.7	.1	
		F08			5	BF	SQ	3	U	2	FM	X	1.3	1	.1	
		F08			6	BF	SQ	3	U	2	FM	X	.7	1.1	.1	
		F08			7	SH	SQ	3	U	0	X	X	.4	.4	<.1	1
98	50N49E	F08		32-38	1	PF	TC	3	U	3	FM	X	.9	.4	.1	
98	50N49E	F08		32-38	2	PF	TC	3	U	5	FM	X	.5	.5	.1	.1
99	50N51E	F08		39-41	1	SH	TC	3	U	2	FM	X	1	.8	.1	
		F08			2	BF	TC	3	U	2	FP	S	.7	.9	<.1	.1
100	51N50E	F08		34-38	1	PF	TC	3	U	2	FM	X	.7	.1	<.1	.6
101	51N50E	F08		34-38	1	BF	TC	3	B	9	FD	X	1	1.9	.2	
		F08			2	PF	TC	3	U	1	FM	S	.9	.7	<.1	
		F08			3	PF	TC	3	B	1	FM	X	.9	.9	.1	
		F08			4	BF	TC	3	U	2	FD	X	.5	.9	<.1	.6
102	51N50E	F08		38-42	1	PF	TC	3	U	3	FM	X	.9	.9	<.1	.7
103	50N50E	F08		33-40	1	BF	TC	3	U	5	FM	X	1.5	1.1	.3	
		F08			2	BF	TC	3	U	5	FM	X	1.3	1	.3	
		F08			3	PF	TC	3	B	3	FM	X	.5	.9	.1	
		F08			4	BF	TC	3	U	6	FP	S	1.3	1	.1	

Table 4.2. Debitage from 42Un2331 (cont.)

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		F08			5	BF	TC	3	U	4	FP	S	1.7	1	.1	
		F08			6	PF	TC	3	B	1	FP	S	.6	.9	<.1	
		F08			7	SH	TC	3	U	0	X	X	.3	.4	<.1	
		F08			8	BF	TC	3	U	4	FP	S	.6	1	<.1	
		F08			9	PF	TC	3	U	4	FM	X	1	.6	.1	
		F08			10	PF	TC	3	U	5	FM	X	1	.7	.1	
103	50N50E	F08		33-40	11	PF	TC	3	U	3	FD	X	.7	.6	<.1	
		F08			12	PF	TC	3	B	1	FM	X	1	.6	<.1	
		F08			13	AD	TC	3	U	0	X	X	1	.9	.2	
		F08			14	AD	TC	3	U	0	X	X	.8	.5	.1	
		F08			15	PF	TC	3	U	0	FM	X	.6	.6	<.1	
		F08			16	PF	TC	3	U	3	FC	S	.5	.6	.1	
		F08			17	PF	TC	3	U	4	FM	X	1	.7	<.1	
		F08			18	PF	TC	3	U	6	FC	S	.7	.7	<.1	
		F08			19	PF	TC	3	U	0	FM	X	.7	.3	<.1	
		F08			20	PF	TC	3	U	1	FP	S	.6	.4	<.1	
		F08			21	PF	TC	3	U	4	FC	S	.5	.5	<.1	3.5
Excavation Area 3																
7	5N5E	F03		50-57	1	BF	SQ	3	U	8	FM	X	.8	1.5	.2	
		F03			2	PF	SQ	3	U	1	FM	X	.9	.5	<.1	.3
Hearth 1																
76	1N7E	F58	F50	88-90	1	BF	TC	3	B	4	FP	?	.7	1.2	.1	.1
79	1N7E	F58	F52	88-90	1	BF	TC	3	U	4	FM	X	1.3	1.3	.1	.9
81	1N7E	F58	F29	88-92	1	PF	SQ	3	U	2	FD	X	1.2	1.6	.1	
		F58	F29		2	PF	TC	3	U	7	FD	X	.5	.5	<.1	
		F58	F29		3	PF	OQ	3	U	1	FM	X	1.5	.7	.2	

Table 4.2. Debitage from 42Un2331 (cont.)

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FS #	Address	Feature (primary)	Feature (secondary)	Depth	Specimen Number	Flake Type	Material Type	Cortex	Condition	Number of dorsal scars	Completeness	Platform	Length (cm)	Width (cm)	Thickness (cm)	Weight (grams)
		F58	F29		4	PF	OQ	3	U	1	FM	X	1.4	.8	.1	.9
82	1N7E	F58	F50	93	1	BF	SQ	3	U	4	FM	X	1	1	.1	
		F58	F50		2	PF	TC	3	U	9	FP	S	.5	.6	<.1	.1
83	1N7E	F58	F29	93-100	1	PF	TC	3	B	4	FD	X	.7	.5	<.1	
		F58	F29		2	PF	TC	3	B	4	FP	S	.7	.5	<.1	
83	1N7E	F58	F29	93-100	3	BF	TC	3	U	4	FM	x	1	.5	.1	
		F58	F29		4	PF	SQ	3	U	3	FM	X	.7	.5	<.1	
		F58	F29		5	SH	SQ	3	U	0	X	X	.6	.4	.1	
		F58	F29		6	SH	SQ	3	U	0	X	X	.3	.3	<.1	.1
106	1N7E	F58	F53	93-100	1	PF	SQ	3	U	1	FM	X	.7	.6	<.1	<.1
121	1N7E	F58	F53	93-100	1	BF	UQ	3	U	7	FC	S	3.3	2.5	3	
					2	BF	UQ	3	U	4	FC	S	1.8	1.3	2	
					3	SH	UQ	3	U	0	X	X	.9	.3	<.1	
					4	BF	XQ	3	B	1	FC	S	.3	.3	<.1	
					5	BF	TC	3	U	4	FD	X	1.3	.7	1	
					6	SH	TC	3	U	0	X	X	.4	.3	<.1	
					7	SH	TC	3	U	0	X	X	.3	.2	<.1	
					8	SH	TC	3	U	0	X	X	.3	.2	<.1	

Table 4.2. Debitage from 42Un2331 (cont.)

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					9	BF	SQ	3	U	2	FP	S	1	.7	1	
					10	BF	SQ	3	U	1	FP	S	.2	.4	<.1	6.1
144	1N7E	F58	F52	88-90	1	BF	SQ	3	U	1	FP	S	1	.4	<.1	
					2	BF	SQ	3	U	1	FM	X	.7	.5	<.1	
					3	PF	SQ	3	U	1	FM	X	.4	.3	<.1	
					4	PF	SQ	3	U	1	FM	X	.4	.3	<.1	
					5	BF	SQ	3	U	1	FP	M	.4	.2	<.1	
					6	AD	SQ	3	U	0	X	X	.4	.1	<.1	
144	1N7E	F58	F52	88-90	7	BF	UQ	3	U	3	FM	X	1	.7	1	
					8	SH	UQ	3	U	0	X	X	.2	.3	<.1	
					9	BF	TC	3	U	2	FM	X	1.1	.9	<.1	
					10	BF	TC	3	U	3	FC	S	.7	.4	<.1	
					11	PF	TC	3	U	0	FM	X	.3	.3	<.1	
					12	PF	TC	3	U	0	FM	X	.4	.3	<.1	
					13	PF	UC	3	U	0	FC	S	.5	.5	<.1	1.1
154	1N7E	F58	F52	88-90	1	PF	TC	3	B	0	FD	X	.9	.4	<.1	
		F58	F52		2	PF	TC	3	U	0	FM	X	.5	.3	<.1	
		F58	F52		3	SH	TC	3	U	0	X	X	.3	.2	<.1	
		F58	F52		4	SH	TC	3	U	0	X	X	.3	.3	<.1	
		F58	F52		5	PF	SQ	3	U	1	FM	X	.3	.6	<.1	
		F58	F52		6	PF	SQ	3	U	1	FM	X	.9	.3	<.1	.5

Table 4.2. Debitage from 42Un2331 (cont.)

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Material color (prefix) and opacity (suffix) codes

Color Code		Color Code		Opacity Code	
B	black	R	red	t	translucent
D	dark grey	T	tan	o	opaque
G	grey	U	buff		
N	brown	X	unknown		
O	orange	W	white		
P	pink	Y	yellow		

Tool type (prefix) codes

Code		Code		Code	
B	biface	H	hammerstone	P	projectile point
C	chopper	J	core	R	preform
D	drill	K	pecking stone w/flaking	S	scraper
E	tested pebble	M	modified flake	U	uniface
F	utilized flake	N	knife	X	unknown
G	graver	O	tested cobble		

Tool Completeness (suffix) codes

Code	
b	tool base: terminal fragment, width exceeds length, shoulders missing in points
c	complete tool: may lack extreme tip or other minor part of perimeter
d	distal fragment: length exceeds width, or base missing, shoulders may be present on points
e	edge fragment: includes some portion of utilized edge only
f	non-classified fragment of tool
l	lateral fragment: portion representing left or right half of tool
m	medial fragment: tool fragment missing both proximal and distal ends, shoulders may be present on points
n	neck fragment: fragment from hafting area of tool, incomplete as to both base and shoulder areas
p	proximal fragment: length exceeds width, base and shoulder present on points
t	tip: tool tip (distal) fragment, width exceeds length

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Tool name (prefix) codes

Code		**Code**		**Code**	
C	Cottonwood	M	end (scrapers)	T	thumbnail (scrapers)
D	Desert	N	Northern	U	Uinta
E	Elko	P	Pinto	V	combination (scrapers)
H	Humbolt	R	Rose Spring	W	side (scraper)
K	McKean	S(1-4)	biface stage reduction	X	untyped

Tool detail (suffix) codes

Code		**Code**		**Code**	
c	corner-notch	o	lobed	v	concave base
e	eared	r	tri-notch	x	untyped or not applicable
l	lanceolate	s	side-notch	y	bifacial reduction (scrapers)
m	stemmed	t	triangle		
n	stemmed, indented base	u	unifacial reduction		

Tool type and completeness are identified by a two letter code. The prefix identifies the tool type and the suffix identifies the tool completeness. Utilized flakes have little to no retouch, and modified flakes have their shape modified to some extent.

Tool name and detail are qualitatively defined using letter codes. Tool name prefix codes denote named point types. Scraper codes are based on morphology (end scraper, side scraper).

Biface reduction stage (S1-S4) is also coded here. Detail codes (suffix) denote projectile point morphology or biface reduction stages (S) followed by a number from 1 (earliest stage) to 4 (finished). Biface reduction stages after McKibbin et al (1992: 21-22) are as follows:

S1: Incomplete thinning, shape irregular, edges highly sinuous. No secondary edge modification, cross-section thick and irregular.
S2: Thinner, more regular cross-section, reduced edge sinuosity, more symmetrical outline. No secondary edge modification.
S3: Cross-section thin and regular, shape symmetrical. Nearly all sinuosity lost and some retouch.
S4: "Finished" biface, thin symmetrical cross-section, lacks edge sinuosity, symmetrical and patterned outline. Prepared edges may have hafting modification.

Heat alteration is denoted by a one letter lowercase letter code. Heat alteration is coded as *y* (heat altered), *n* (no evidence of heat alteration), or *z* (the presence or absence of heat alteration could not be determined). Evidence of heat alteration includes potlids, heat fractures, and obvious changes in material color or luster.

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Length, width, and thickness are measured in centimeters. Dimensional data are recorded only where given parameters are complete. If a tool is considered essentially complete, a dimension may be entered with an asterisk denoting that the figure is an estimate. An entry of *z* for a parameter indicates that the dimension is missing. Measurements for an incomplete tool are given in the comments column.

Shoulder and notch angles are measured in degrees using the most complete and most acutely angled base and shoulder margin. Following Loosle (1988), distal shoulder angle is the angle of the distal shoulder to the long axis of the tool at the base. Notch opening angle is the included angle formed by the base margin and adjacent shoulder. Notch, neck, and base widths are measured in centimeters to two decimal places. The notch width is measured across the notch at the outer perimeter of the tool, using the most complete and most acutely angled notch. The neck width measures across the neck immediately below the shoulder. The base width is measured at the proximal end of the tool base. Base margin profile measurements (Beck 1998: 32) describe the base of the tool, and are written as a one letter code.

Base Margin Codes

Code		Code	
c	convex	n	notched
f	flat	r	radiused
i	indented	t	triangular/concave
l	lobed	v	concave

Tool profile is recorded as a single letter code. Tool profile codes are c (lenticular), p (plano-convex), and v (plano-concave). The latter is a nomenclature for occasionally strong curved dorsally flaked tools with a more or less flat ventral short axis. Weight is recorded in grams to one decimal place (0.0 g).

Analysis

Chipped stone tools were found in Structure 1, Structure 2, Knapping Station 1, and Excavation Area 3 (Table 4.3). The tools in the two structures were utilized flakes made from Sheep Creek quartzite with use wear on one to three sides. The extreme distal tip of a Tiger chert biface was found in Knapping Station 1. A utilized obsidian flake tool, a non-local material, was found in Excavation Area 3. The tool was sent to Geochemical Research Laboratory to identify its place of origin. Results indicate that the obsidian originated in Wild Horse Canyon, Utah, approximately 350 km from Deadman Lake (Hughes 2003; Appendix 2.2). Obsidian does not typically appear in the archaeological record on the Ashley National Forest until the middle of the Fremont period (Johnson and Loosle 2002:274), which would tentatively place occupation of this feature to around this time. Over half of the obsidian from a short-term Fremont camp at the Hogan Pass area in Sevier County also originated at Wild Horse Canyon outcrop, the most common raw material source from A.D.1000-1200 in that region (Metcalf et al. 1993:117).

Surface collections consist of one complete bifacially flaked tool (scraper or chopper), one broken bifacial flaked tool, and one complete Elko corner notched projectile point (Figure 4.1, *a-c*). All surface finds were found within the confines of the area demarcated “Location of Excavations” on Figure 3.3.

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FS#	Address	Feature (primary)	Depth (cm)	Material Name and Type	Material Color & Opacity	Tool Type & Completeness	Tool Name & Detail	Heat Treated	Length (cm)	Width (cm)	Thick (cm)	Base Lngth (cm)	Notch Wdth (cm)	Neck Wdth (cm)	Base Wdth (cm)	Base Profile	Tool Profile	Weight (grams)	Comments (include length / width / thickness on fragments)
Structure 1																			
162	5N6E	F01	57-70	SQ	To	Mc	Tx	n	3.1	2.0	0.1	1.3						1.3	Use wear on 1 side
Structure 2																			
89	0N2E	F12	20-26	SQ	To	Mc	Tx	n	2.8	2.1	0.2							2.1	Use wear on 3 sides
163	2N2E	F12	23-26	SQ	To	Mc	Tx	n	2.5	1.3	0.1							0.8	Use wear on 1 side
Knapping Station 1																			
159	50N49E	F08	32-38	TC	Bo	Bd	S1	n											.7(l)x1.3(w)x.6(t) see Appendix A2.2
Excavation Area 3																			
6	5N5E	F03	50-57	OB	Bt	Mc	Tx	n											1.5 x .94 x .25
Surface																			
152	Surface			SQ	Go	Sc	Vx	n	11	7	1.3					f	v	118.7	
153	Surface			SQ	Po	Bd	S3	n									p	21.5	8.5(l)x3.8(w)x.06 (t)
154	Surface			Oc	Wo	Pc	Ec	n	2.5	1.9	0.3	0.7	0.5	1.0	1.5	v	c	1.8	Chalcedony

Table 4.3. Chipped Stone Tools from 42Un2331

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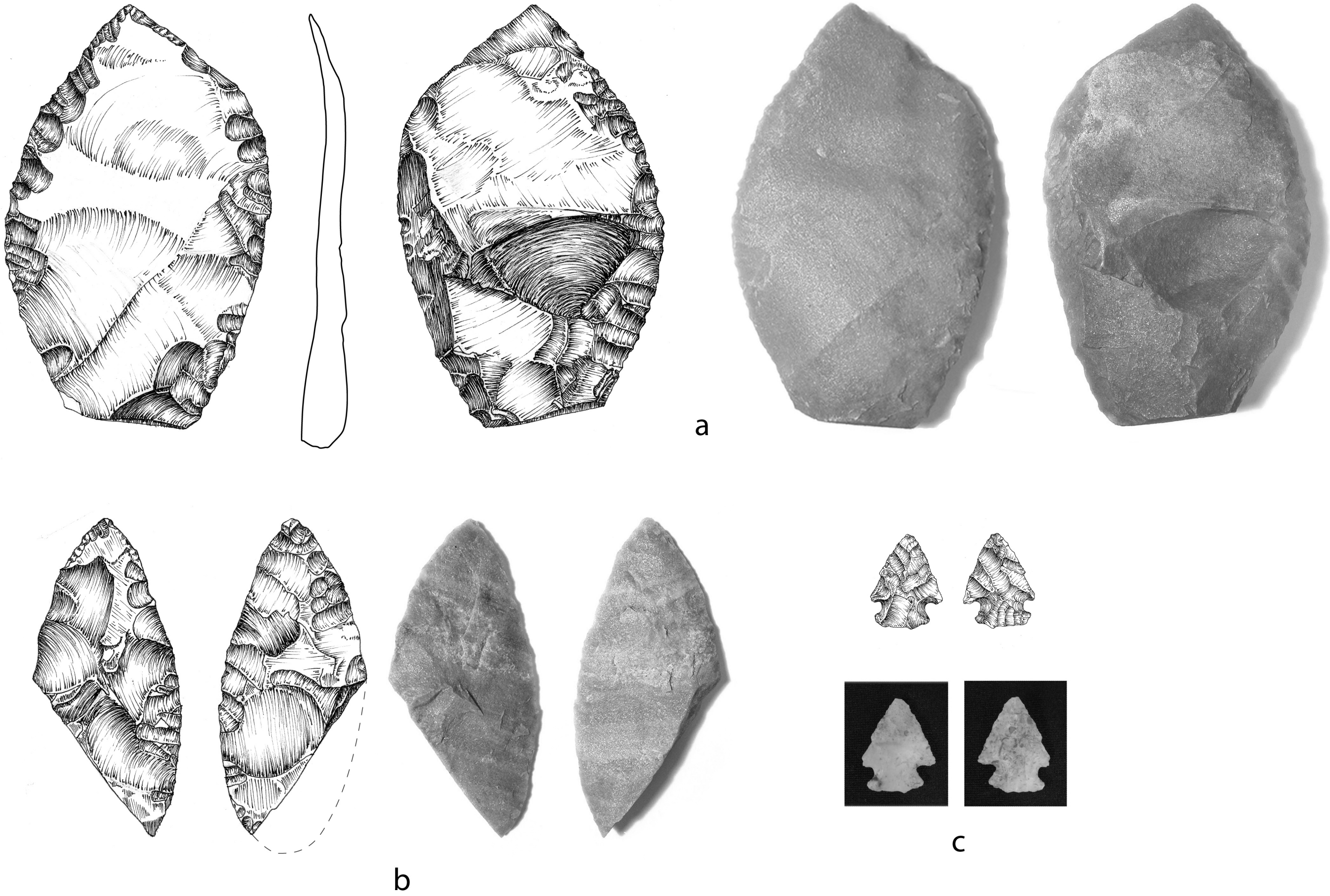

Figure 4.1. Stone tools found on the ground surface: (a) scraper? FS152, (b) biface FS 153, and (c) Elko style projectile point FS154. Scale: half full scale.

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Ceramics

Classification

All ceramic sherds found on the surface and during excavations were collected. Selected sherds were sent to David Hill (Hill 2003) for thin-sectioning and petrographic analysis of temper and paste. Results are reported in Appendix A2.1. The remaining sherds were analyzed by Michelle Knoll at Brigham Young University, following procedures described in Sutton and Arkush (1996) and Johnson (2002: Chapter 3).

Three categories used here represent the three main aspects of ceramics: form and function, technology, and style. *Form analysis* identifies different vessel shapes, usually from rim and shoulder sherds. Major vessel forms found in the New World are bowls, jars, scoops, plates, ladles, cups, mugs, and pitchers (Sutton and Arkush 1996:116). Forms are typically interpreted from sherds by calculating rim diameter and height in centimeters. Sherd type describes from which part of the vessel the sherd came from. If the sherd is a rim sherd, rim detail describes the profile of the artifact. Sherd thickness is measured at three points on each sherd to allow for thickness variation, and it is described as a thickness range in centimeters. Vessel function usually follows from vessel form and is typically based on ethnographic records.

Form Analysis Codes

Vessel Form Code	
J	Jar
B	Bowl
P	Plate
U	Unknown

Sherd Type Code	
B	Body
H	Handle
R	Rim
N	Neck

Rim Detail Code	
B	Beveled
F	Flat
P	Lipped
R	Rounded

Technology Analysis Codes

Temper/Inclusions Code	
B	Calcareous sandstone
C	Clay-cemented sandstone
D	Ceramic sherds
G	Igneous
K	Crystalline calcite
L	Limestone
N	None
P	Plant material
Q	Quartzite
S	Sand
T	Tuff

Construction code	
Md	Modeling
Co	Coiling
Mo	Molding
U	Unknown

Finishing Code	
Pa	Paddle and anvil
Sc	Scraped
U	Unfinished
Sm	Smoothed

Decorative Technique	
Ap	Applique
Im	Impressed
Ro	Roughened
In	Incised
St	Stamped
Po	Polished
Pa	Painted

Firing Atmosphere	
R	Reduced
O	Oxidized
U	Unknown

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Provenience					Form			Technological						Style	Sherd Size			
FS #	Address	Feature #	Depth (cmbd)	Vessel form	Sherd type	Rim detail	Estimated diamter (cm)	Paste color	Temper/inclusions	Construction technique	Finishing technique	Decorative technique	Firing atmosphere	Ware type	Sherd thickness	Sherd length	Sherd width	Notes
1.1	Surface			U	B			7.5YR 4/2	Qd	U	U	Im	R	Ib*	0.7	2.4	2	See Appendix 2.1
1.2				U	B			7.5YR 4/2		Co	Sc	Im	R	Ib	0.5	2.6	2.5	
1.3				U	B			7.5YR 3/1		U	U	U	R	Ib	0.4	1.3	0.8	
1.4				U	B			7.5YR 3/1		U	U	U	R	Ib	0.5	0.8	0.8	
1.5				B?	R	R	10	7.5YR 4/2		U	Sc	Im	R	Ib	0.4	2	2	
1.6				U	B			7.5YR 4/2		U	U	Im	R	Ib	0.8	1.5	1.1	
1.7				U	B			7.5YR 3/1		U	Sc	Im	R	Ib	0.4	1.3	1.2	
1.8				U	B			7.5YR 4/2		U	Sc	Im	R	Ib	0.6	1.6	1.3	
1.9				U	B			7.5YR 4/1	Q	U	Sc	Im	R	Ib	0.6	1.7	1.3	
1.10				U	B			7.5YR 4/1	Q	U	Sc		R	Ib	0.5	1.3	0.9	
1.11				U	B			7.5YR 4/1		U	U	?	R	Ib	0.5	0.9	1.2	
1.12				U	B			10YR 4/1		U	U	?	R	Ib	0.5	0.9	0.9	
2.1	Surface			U	B			?		U	Sc	Im	R	Ib	0.7	1.9	1.9	
2.2				U	B			?		U	Sc	?	R	Ib	0.6	1.4	1.5	
2.3				U	B			7.5YR 4/1		U	Sc	Im	R	Ib	0.5	1.6	1	
2.4	Surface			U	B			7.5YR 4/1		U	Sc	Im	R	Ib	0.5	1.3	1	

* Intermountain Brownware

Table 4.4. Ceramics from 42Un2331

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2.5				U	B			7.5YR 4/1		U	U	Im	R	Ib	0.5	1.5	0.7	
2.6				U	B			7.5YR 4/1		U	U	?	R	Ib	0.5	1	1	
2.7				U	B			7.5YR 4/1		U	U		R	Ib	0.4	1	0.7	
2.8				U	B			7.5YR 4/1		U	U	Im	R	Ib	0.5	1.6	0.8	
67.1	IN IE	F12	19-26	U	B			10YR 4/1	Qd	U	U	Im	R	Ib	0.5	2	1.8	See Appendix 2.1
67.2		F12		U	N			10YR 4/1		Co	Sm	Ro	R	Ib	0.4	2.4	1.8	
67.3		F12		U	B			10YR 4/1	Q	U	Sc	Im	R	Ib	0.6	1.5	1	
67.4		F12		U	B			10YR 4/1		U	Sc?	Im	R	Ib	0.6	1	1	
67.5	1N1E	F12	19-26	J	R	R	9	10YR 4/1		U	U	Ro	R	Ib	0.4	1.1	0.7	
67.6		F12		U	B			10YR 4/1		U	U	U	R	Ib	U	1	0.5	
73.1	IN IE	F12	26-31	U	B			7.5YR 3/1	p	U	Sm	Ro	R	Ib	0.6	1.6	1.2	
90.1	2N 1E	F44 in F12	18-23	U	B			7.5YR 3/1		U	Sc	Im	R	Ib	0.5	1.5	1.2	
90.2		F44 in F12		U	B			7.5YR 4/2		U	Sc	Im	R	Ib	0.4	1.5	1.5	
92.1	3N 1E	F44 in F12	17-23	U	B			7.5YR 4/2		U	U	U	R	U	0.4	0.7	0.7	
95.1	1N 1E	F12	26-31	U	B			?		U	U	U	R	Ib	0.3	0.9	0.6	
110.1	0N 0E	F44 in F12	13-17	U	B			7.5YR 4/2		Co	Sc	Im	R	Ib	0.6	1.7	1.4	

Table 4.4. Ceramics from 42Un2331 (cont.)

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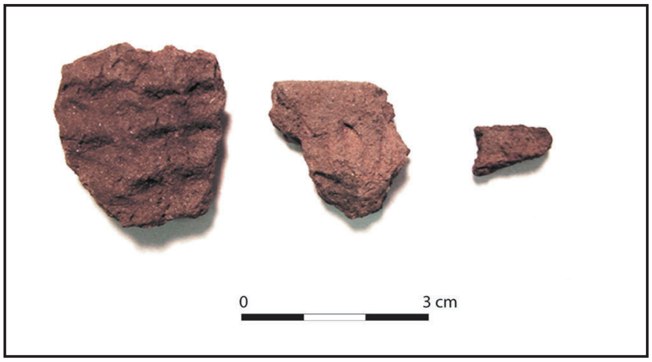

Figure 4.2. Intermountain Brownware ceramics. Full scale.

Technological analysis describes how vessels were constructed, finished, and fired. Core description includes paste color and temper. Paste refers to the clay substance excluding temper additives. It can provide information about processing techniques, firing techniques, and raw material content (Bennett 1974:24, 31). For example, a post-fired red color means that the clay contained iron, and that the vessel was fired in an oxidizing atmosphere. In contrast, a dark gray sample probably had a relatively high carbon content and was fired in a reducing atmosphere or was smudged during firing (Sutton and Arkush 1996:122). Paste color was determined using a Munsell color chart, though it is understood that this is still somewhat subjective. The fabric of the vessel includes both the paste and the temper (intentional) additives (Orton et al. 1993:70). Temper was often necessary to reduce the possibility of shrinkage and cracking during the firing process. The identification of tempers is important because it is believed that they are culturally diagnostic, both spatially and temporally (Sutton and Arkush 1996:103). Primary and secondary tempers listed here are ordered based on estimated quantities present, and they are listed as material type.

There are generally three methods for constructing ceramic vessels in the New World; modeling, coiling, and molding. The first two were the most common methods used. Finishing technique refers to the process of smoothing, texturing, or thinning the vessel, after its initial construction. The paddle and anvil technique was typically used to thin coil-built vessels, and scraping was often used to finish any of the three construction methods mentioned above. Scraping is the most common finishing technique in the Intermountain West, and to a lesser extent the Great Basin and the Colorado Plateau (Sutton and Arkush 1996:104-105). Decorative techniques identify any surface manipulation such as appliqué, impression, incision, painting, or punctation. The firing of aboriginal ceramics in North America is restricted to non-kiln (also known as open firing) conditions. An oxidizing atmosphere refers to an abundance of oxygen during the firing process, which yields colors in varying degrees of red, yellow, or buff. In contrast, a reducing atmosphere is characterized by a lack of oxygen resulting in colors in varying shades of grays. Sooting and smudging are caused by insufficient draft in a reducing atmosphere (Shepard 1980:216).

Style analysis is the classification of a ceramic assemblage based on wares and types established for a particular region. This type of ceramic analysis has been used to establish site chronology, interregional trade, population movements, and social organization. In general, New World ceramics are considered terra-cotta wares, defined as ceramics that are fired at a much lower temperature than earthenwares. A ware is defined as a pottery group that shares similar technology, paste, and surface treatment. Type, or style, is a subcategory of ware that describes surface color, treatment, and vessel function. Wares in North America are generally divided between plain wares, textured wares, and painted wares. Ware types are unique to a particular region and cultural affiliation.

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Analysis

All of the sherds are interpreted to have been affiliated with Numic speakers, and all were identified as Intermountain Brownware. In only 9.6 percent of the samples could the construction technique be identified, which was interpreted as coiling. The interiors of 45 percent of the sherds were scraped, two (6.4 percent) were smoothed (a smooth surface with an absence of scrape marks), and treatment of the remainder could not be determined. Most of the ceramic samples (54.8 percent) exhibit fingernail impressions, others (9.6 percent) appear to be roughened, and the remainder (38.7 percent) were too small to tell. All were likely fired with an open firing technique in a reducing atmosphere. Most of the sherds from Structure 2 were found on Level 1, with the exception of two (16.6 percent) that were found on Level 2.

Most of the samples were highly fragmented; only one specimen was quarter-sized, the rest were significantly smaller. Two rim sherds were found, one on the surface and one in association with Structure 2. Both rim sherds had rounded lips, but were too small to estimate rim diameters with any accuracy.

The petrographic analysis from a sherd (FS 1) found on the surface indicates a dark brown paste was used. The paste is partially comprised of 15 percent silt and brown biotite and 10 percent fine-grained quartz and alkali feldspar. Also present in the paste are two coarse-sized fragments of sandstone with brown clay cement. Hill (2003) believes that all of the inclusions in the paste were naturally present in the clay used to form the parent vessel. The paste of the sherd found in Structure 2 (FS 67) ranges from a very dark brown to opaque black color. About 30 percent of the paste is comprised of brown biotite, sub angular mineral grains (predominantly quartz) and a trace of alkali feldspar. A single medium sized grain of quartz arenite sandstone is also present in the paste. The analysis indicates (1) that the two sherds were from vessels that were made from slightly different ceramic resources or (2) there is local variation within the source of raw materials.

Miscellaneous Artifacts

All miscellaneous artifacts were analyzed by Michelle Knoll at Brigham Young University (Table 4.5). They include artifacts that do not fit into the established categories. With the exception of a piece of vitrified wood from Structure 1 and a piece of clear glass close to the ground surface in Structure 3 (possibly left from a nearby sheep herder's camp), the remaining artifacts were found in Structure 2. Artifacts from Structure 2 include a metal tinkler cone, a piece of wood with groove marks, and a melted globule of metal. The metal has not yet been identified.

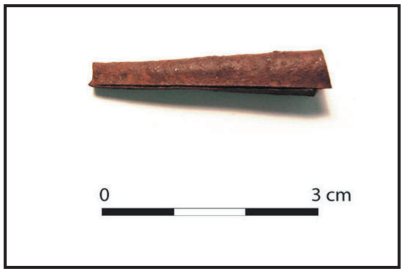

Figure 4.3. Metal tinkler cone.
Scale: full scale.

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FS #	Address	Feature (primary)	Feature (secondary)	Depth (cmbd)	Description	Material, texture, color	Weight (grams)	Comments
Structure 1								
115	5N10E	F01	F22	68-73	Vitrified Wood	wood	.1	
Structure 2								
146	1N2E	F12	F44	25-29	Wood with cutmarks	wood	.1	Root?
84	2N1E	F12	F44	18-23	Melted Metal	metal	18	Heavily corroded
70	1N1E	F12		19-26	Metal Bangle	tin?	.9	
Structure 3								
4	2N4E	F17		18-25	Clear Glass	glass	1.5	

Table 4.5. Miscellaneous Artifacts from 42Un2331

Zooarchaeological Remains

Classification

All faunal remains were collected during excavation and flotation. Designation of culturally deposited bone is largely based on evidence of burning, cut marks, or other cultural modification. The faunal assemblage for 42Un2331 was analyzed by Michelle Knoll at Brigham Young University. Identification of specimens was based on comparisons to reference collections held at Brigham Young University. Each field specimen is listed with its associated feature number(s), grid address, and depth. Attempts were made to identify all specimens to the family, genus, and if possible, species level. When genus cannot be determined, estimated size (i.e., small, medium, large) replaces family and phylum (i.e., mammal) replaces genus (follwing Ugan; see Johnson 2002: 56). Elements are defined using a three letter code. Due to the large number of possible codes, only the elements identified at 42Un2331 are listed below.

Size Range	Definition
micro mammal	species weighing <100 grams
small mammal	rabbit size
medium mammal	canid to caprine size
large mammal	antelope, bighorn sheep, deer size
very large mammal	elk to bison size or larger

Element Code	
LON	Long Bone
PHA	Phalanges
RAD	Radius
RIB	Rib
TIB	Tibia
TOO	Tooth
ZZZ	Unknown

When possible, the element's sidedness was identified with a single letter designation; R (right), L (left). Completeness was identified by a single letter code; L (less than half complete), H (half complete), and C (complete). Incomplete elements were further classified using a single letter code; D (distal), M (medial), and P (proximal) to describe from which end of the bone the element originated. The categories for burnt, butchered, gnaw marks, grinding marks, and weathered were recorded as counts. Weight was recorded in grams to one decimal place (0.0 g).

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FS #	Address	Feature (primary)	Feature (secondary)	Depth (cmbd)	Family	Genus	Species	Element	Side	Completeness	Proximity	Burnt	Butchering Marks	Gnaw Marks	Weathered	Total Quantity	Weight (grams)	Comments
Structure 1																		
13.1	5N5E	F1	F23	55-57	SMAL	MAMA		LON		L	M	7	1			7	0.1	
Structure 2																		
69.1	1N1E	F12		19-26	SMAL	MAMA		LON		L	M	2				2	<.1	
88.1	2N2E	F12	F44	23-26	SMAL	MAMA		TIB		L	P					1	<.1	
93.1	3N1E	F12	F44	17-23	SMAL	MAMA		ZZZ		L	M	1				1	0.1	
93.2	3N1E	F12	F44	17-23	UNID	MAMA		TOO		L	M	1				1		not definite
Structure 3																		
20.1	2N4E	F17		25-27	SMAL	MAMA		LON		L	M	1				1	0.1	
20.2	2N4E	F17		25-27	SMAL	MAMA		ZZZ		L	M	7				7	0.1	
20.3	2N4E	F17		25-27	SMAL	MAMA		PHA		H	D	1				1	<.1	
20.4	2N4E	F17		25-27	MICR	MAMA		RIB		L	D	1				1	<.1	
22.1	3N4E	F17	F41	25-30	SMAL	MAMA		PHA		H	D	1				1	<.1	
22.2	3N4E	F17	F41	25-30	MICR	MAMA		RAD		L	M	1				1	<.1	
22.3	3N4E	F17	F41	25-30	MICR	MAMA		PHA		H	M	1				1	<.1	Woodrat size
22.4	3N4E	F17	F41	25-30	UNID	MAMA		ZZZ		L	M	2				2	<.1	
22.5	3N4E	F17	F41	25-30	SMAL	MAMA		ZZZ		L	M	1				1	<.1	
Hearth 1																	<.1	
153.1	1N7E	F58	F52	88-90	UNID	MAMA		ZZZ		L	M	1				1	<.1	

Table 4.6. Faunal Remains from 42Un2331

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Quantifying Faunal Remains

Faunal remains are most commonly quantified using measures of abundance such as Number of Identifiable Specimens (NISP) and Minimum Number of Individuals (MNI). The NISP describes the total number of specimens (or elements) within an analytical unit, such as a level, a site, or some other arbitrary division that was identified to taxon (subspecies, species, genus, family, or higher) (Lyman 1994:38). Sutton and Arkush (1996:239) argue that while this provides a rough idea of the abundance of taxa, it often results in an overestimation of the number of specimens. For example, a bone that has been fractured in two will be recorded as two elements, when in fact it came from one. The MNI measures how many individuals are represented in an analytical unit, and is usually calculated using the most abundant sided element. However, using MNI as a measurement tool can be problematic. There is a possibility of overlap and an overestimation of the number of individuals present, especially if several elements are used (Sutton and Arkush 1996:240). On the other hand, if the criteria are limited to the most abundant sided element there is the possibility of underestimation of the number of individuals present because some elements (which were actually from different individuals) were excluded. Definitions of specimen and element must be clarified as well. Many zooarchaeologists (Grayson 1984:16; Shotwell 1955, 1958; Lyman 1994:39) define a specimen as "a bone, or tooth, or fragment thereof," while an element is, "a single complete bone or tooth in the skeleton of an animal."

Sutton and Arkush (1996:239-241) argue that a simple quantification does not always represent real economic importance of a species if the body weight is not considered. Factors such as differential preservation and cultural activities (such as kill, processing, and consumption sites) should also be considered. For example, Thomas and Mayer (1983) argue that at processing sites a "reverse utility strategy" is represented in the data when faunal elements of moderate and high utility are not represented in the site (they are carried out) while elements of low utility are highly represented (they are discarded). However, Lyman (1985) observed that many elements that rank high on utility rank low in density and vice versa. Because bones with lower densities deteriorate faster, he argues that the differences at the processing sites may have just as likely been the result of differential destruction, not bone transport. Concurring with this hypothesis, Grayson (1989:650) argues that bone destruction, not bone transport, was the cause of the faunal assemblage patterns in the White Mountains, California.

Analysis

In total, 29 specimens were recovered from all the cultural areas excavated (Table 4.6). Due to high fragmentation, none of the specimens could be identified to genus or species. Thus, all identification is limited to varying sizes of mammal. Twenty-two (75.9 percent) specimens were identified as small mammal, three (10.3 percent) were identified as micro mammal, and four (13.8 percent) could not be identified. Almost all (96.6 percent) of the bone specimens are burnt, and one small mammal specimen has butcher marks.

Structure 1 (cal A.D. 405) has seven bones specimens. All were found in the fill just above floor contact in 5N 5E, are less than half complete, are burnt, were identified as small mammal long bone based on the thickness and estimated diameter of the bone. Marmot (*Marmota flaviventris*) was observed near the site, and may be the mammal represented in the faunal assemblage. No bone was recovered from

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Knapping Station 1 or Excavation Area 3. Structure 2 (A.D. 1830-1890) yielded five bones, which were spread across 4 square meters. Four (80 percent) were identified as small mammal and one (20 percent) could not be identified to a size class. Structure 3 (cal A.D. 670) yielded the most bone of the six areas excavated. Sixteen pieces, concentrated in 2 square meters, were recovered from the fill just above the floor contact surface (F41) and from one level above the floor contact surface. Eleven specimens (68.7 percent) were identified as small mammal, three specimens (18.7 percent) were identified as micro mammal, and two specimens (12.6 percent) could not be identified to a size class. Hearth 1 (cal A.D. 665) contained one burnt mammal specimen that could not be identified to a size class. MNI counts were low; one small mammal from Structure1 and Structure 2, one small mammal and one micro mammal from Structure 3, and one animal of unidentified size from Hearth 1.

Archaeobotanical Remains

Methods

Pollen and soil samples were collected for archaeobotanical analysis. Approximately 80 percent of the macrofloral assemblage was floated on site, while the remainder was retained intact for laboratory flotation. If only one 1-gallon bag was collected from a square, that bag was sent to Paleo Research. Macrofloral samples that were manually floated on site were separated from the debris matrix by Michelle Knoll at Brigham Young University. Many of the analysis techniques followed Pearsall's (2000, Chapter 3) recommendations, with some minor adjustments for this particular project.

Dried flotation samples were transferred from their muslin pouches to hand screens and separated into size classes. The two screens used were U.S. Standard Sieve Series A.S.T.M. E11 sizes #16 (1.18 mm opening) and #30 (.6 mm opening). While Pearsall (2000:102) does not usually retain charcoal < 2 mm (because it does not significantly alter the total weight, and species identification is too difficult at less than 2 mm), most of the charcoal preserved at Deadman Lake was < 2 mm in size, and so the cut off point was set at >1.18 mm (or the largest screen size). All charcoal saved was weighed. The light and heavy fractions were carefully examined with the aid of a 16x Lupe magnifying glass. Flotation material was slowly passed under a lamp in very small quantities so that specimens could be easily identified and picked out of the debris. Charred and uncharred specimens were both separated and collected. The remaining debris was discarded. Many of the light fractions contained many rootlets and other modern organics.

Samples of *Cenoccum* sclerotia were also collected from some of the squares because they can be helpful in reconstructing prehistoric arboreal communities. Sclerotia are mycorrhizae associated with the fungi *Cenococcum graniforme*. They are like poppy-seed in size and shape, and blackish-brown in color. They exist in a symbiotic relationship with the roots of coniferous and deciduous species as well as willow, chokecherry, and linden. Most sclerotia found floating in flotation samples are likely to be dead, and thus might assist researchers in reconstructing past environments (McWeeney 1989). Based on the large amounts of sclerotia found in some of the flotation samples (470-2500/square meter in Structure 1 and Structure 3), it is possible that there were more trees in the immediate area than are present today. For example, Structure 1 is located in an open meadow, yet thousands of sclerotia were recovered in the flotation process.

Taxa were identified (when possible) and counted by Paleo Research Institute. In general, only charred seeds are considered to be ancient by paleoethnobotanists due to the quick decomposition of a seed under most environmental conditions, though it is also understood that not all charred seeds were due to human influence (Minnis 1981:147; Keepax 1977:227; Pearsall 2000). Charred and uncharred seeds were

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counted separately. While the uncharred seeds (found at varying depths below the modern ground surface) do not assist in interpreting the prehistoric component of the site, they may help to understand taphonomic processes that occur at sites, especially those at high altitudes. Pearsall (2000:135) notes that there are only a limited number of characteristics by which one can identify seeds recovered in flotation samples: size, shape, the nature and placement of the embryo and endosperm, abundance or lack of an endosperm, and seed coat. The latter is particularly important for uncharrred specimens and offers diagnostic characteristics such as color, texture, attachments, and scars. If the seed coat is lost there is a marked decrease in the ability to identify the taxa.

With the technological innovation of flotation, the recovery of botanical remains at archaeological sites has increased dramatically. However, Minnis (1981) argues that in order to take full advantage of this tool two aspects of macrobotanical analysis must be developed: (1) a better understanding of depositional and preservation processes and (2) appropriate quantitative means to analyze and interpret the assemblage.

Depositional Processes and Preservation

Minnis (1981:145) argues that depositional processes come in two forms. The first is known as *direct resource utilization* and is considered to be the most ubiquitous form of deposition. It is the result of collection, processing, and use/consumption of the plant resource. Charred specimens (which are preserved in the archaeological record) that reflect this form of deposition are likely the result of accidents in processing (burned in the hearth), the burning of debris, and the burning of stored materials. A plant's chance of being deposited in the archaeological record is also influenced by which part of the plant was consumed. Some scholars (Munson et al. 1971) argue that foods which have a dense inedible part (such as a maize cob) have a better chance of appearing in the archaeological record than plants which are dense but are eaten in their entirety (such as small seeds or maize kernels). These, in turn, will have a better chance of survival than non-dense foods with high water content (tubers and greens) that are eaten in their entirety.

Deposition in the form of *indirect resource utilization* occurs when seeds become incorporated into the archaeological record, not because the seed was used but because it was attached to a plant that was used. For example, seeds attached to roofing material or maize cupules in hearths (possibly the result of burning cobs for fuel) are only indirectly related to the use of maize for food. Another way that seeds may be deposited on a site is through seed rain. Seeds are produced in enormous quantities, and the greater the soil disturbance (such as the construction of a dwelling) the greater the production of seeds. Thus, it follows that there are generally more seeds produced near an agricultural field than a mature forest. In fact, archaeological studies on Denmark and Mexico demonstrate that there were approximately three modern seeds for every ancient seed recovered (Minnis 1981:144). Weedy annuals that grow after a site's abandonment are prolific in their seed production, and seed rain that fell at the site shortly after its abandonment can be preserved in the archaeobotanical record through accidental burning by natural causes (Minnis 1981: 145). Under these conditions a bias in the archaeobotanical assemblage would be present and could potentially skew the data if the site is not carefully excavated and analyzed.

Modern seeds also make their way into an archaeological site at depths that are seemingly unusual. Keepax (1977:225-226) suggests five ways that modern seeds can be vertically dispersed in the sediments and soils: plowing, root holes and drying cracks, downwashing in open textured sediments, earthworms, and other burrowing animals. There is evidence, through the large number of sclerotia, that there were more trees (and thus more tree roots) in direct association with some of the structures than is present today. This is especially true at Structure 1, Structure 3, and Excavation Area 3, which are currently located in an

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open meadow. The subsequent drawing back of the arboreal community had to have occurred long before the presence of *Claytonia*, which may only survive 40 years in the soil under normal conditions before disintegrating (following examples for *Chenopodium* and *Amaranthus* in Harrington 1972:177). Thus, it is unlikely that floralturbation caused the modern seeds to be deposited as they were. It is more probable that bioturbation accounts for the presence of several thousand modern Claytonia seeds only 2 cm above the floor of structures.

Differential preservation of plants will also bias the macrobotanical assemblage. One factor to be considered is the environment where the site is located. Arid and waterlogged contexts will preserve non-charred organic materials the best. Non-charred organic remains may also be better preserved in permanently frozen arctic or high alpine environments (King 1994:189), though this has not been proven as of yet. Other preservation factors to be considered are the physical structure of the plants, the plant parts collected and utilized by humans, storage, processing techniques, and method of discard (Popper 1988:54). Under normal environmental circumstances, the order of decay for a plant is (1) soluble parts, such as leaves; (2) proteins and starches, such as in roots and tubers; (3) cellulitic cell walls, such as is found in seeds; and (4) structural elements in the cells, such as silica. Thus, the most soluble elements disintegrate first, followed by those that are not readily soluble but are easily broken down by microorganisms or chemical agents, and finally those elements that contribute to the structure of the plant. The latter can last for hundreds or even thousands of years in the archaeobotanical record as sporopollenin (pollen) and silica (phytoliths) (Carbone and Keel 1985:5-6; King 1994:187-188). Therefore, plant parts collected by humans such as leaves, roots, tubers, corms, bulbs and flowers are much less likely to survive in the archaeological record as a macrobotanical sample than a seed or structural component (Hather 1993:vii; Minnis 1981:149). Processing techniques and location of consumption will also have an impact on what kinds of plants will be preserved. For example, plants that were cooked by parching (and thus stand a better chance of being accidentally charred) will be better represented in the archaeobotanical assemblage than plants that were boiled (Minnis 1981:149).

Quantifying Botanical Remains

Quantifying botanical remains is a particularly important step in any archaeological analysis. As with any attempt to quantify data, biases are present. Minnis (1981:149-150; see King 1994:187) argues that one major problem in ethnobotanical analysis is that some remains do not float, others break up when exposed to water, and some are particularly friable in the charred state (i.e., roots and tubers). To my knowledge no procedures exist to resolve the latter two, but the capture of the heavy fraction in a flotation sample should account for any remains that do not float. However, if the specimen is friable it could easily break up when it comes in contact with the gravel which did not float. This was a matter of great concern at the Deadman Lake project because of the theft of the hand sieve, which precluded our being able to separate the heavy and light fraction on many of the flotation samples. Problems in sampling size, methods of sampling, and human error during flotation will also introduce bias into the assemblage (Minnis 1981: 149-150; Pearsall 2000). The potential for post-occupation charred seed rain deposited on a site also has potential to bias the data. One last factor that adds to the difficulty of quantifying and interpreting botanical remains is the multiple uses of certain taxon. Unlike most animals (which were primarily captured for food) plants had many uses. King (1994:188, 196) notes many plants that were used for food also had medicinal qualities and thus makes it virtually impossible for paleoethnobotanists to reconstruct the prehistoric use of plants to that level of detail. To assume that all plants found on an archaeological site can be attributed to consumption is to be too simplistic. For example, bark (from several kinds of taxa) was used by Native

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Location	FS #	Address	Identification	Part	Charred		Uncharred		Weight/ Comments	# of liters floated
					W	F	W	F		
STRUCTURE 1	27	5N 5E	*Claytonia*	Seed			X	X		16.0 L
			Cyperaceae	Seed			1			on site
			Viola	Seed			4*			
			Cone scale-type remains or thorn bases			2				
			Sclerotia				450*	60*	Few	
			Charcoal			X			Few	
	28	5N 5E	*Picea*	Needle		1				
			Charred Tissue			7				
			Charcoal			X			1.80 g	
	39	5N 5E	Abies	Needle				1		4.6 L
			Carex	Seed			w			Paleo Research
			Claytonia	Seed			3	8		
			Moss					X	Few	
			Rootlets					X	Numerous	
			Sclerotia				X	X	Few	
			Charcoal			X			.71 g	
	14	5N 6E	Charred tissue- one with embedded seed			6			.09 g	16.0 L
										on site
	32	5N 6E	Claytonia	Seed				2		
			Charred tissue			X				
			Vitrified tissue			6				
			Sclerotia				425*	45*		
			cf. Bark			1				

Table 4.6. Botanical Remains from 42Un2331

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Location	**FS #**	**Address**	**Identification**	**Part**	**Charred**		**Uncharred**		**Weight/ Comments**	**# of liters floated**
					W	**F**	**W**	**F**		
			Charcoal			X			3.0 g	
	33	5N 6E	Claytonia	Seed						
			Carex	Seed		1				
	160	6N 6E	*Claytonia*	Seed			730+	X	Numerous	16.0 L
			Potentilla	Seed			X		Few	on site
			Viola	Seed			X		Few	
			Sclerotia					X	Few	
	161		Charcoal			X			Few	
	138	6N 6E	Conifer	Cone scale		1				5.0 L
			Bark	w		10				Paleo Research
			Vitrified Tissue			X			Few	
			Claytonia				30	36		
			Picea	Needle				2		
			Poaceae 1	Floret			1			
			Poaceae 2	Floret				1		
			Poaceae 3-Panicoid	Floret				4		
			Potentilla	Seed			1			
			Unidentified	Fruit				3		
			Moss > 2mm	Branch/ Leaf				31		
			Moss < 2mm	Branch/ Leaf			X	X	Few	
			Rootlets					X	Numerous	
			Sclerotia		X	X			Moderate	

Table 4.6. Botanical Remains from 42Un2331 (cont.)

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Location	**FS #**	**Address**	**Identification**	**Part**	**Charred**		**Uncharred**		**Weight/ Comments**	**# of liters floated**
					W	**F**	**W**	**F**		
			Charcoal			X			1.15 g	
			Picea	Wood				15	.8 g	
	161	6N 6E	Claytonia	Seed				2		
			Picea	Needle		1				
			Sclerotia					1		
			Charred Tissue			X				
			Vitrified Tissue			4				
			Charcoal			X			.84 g	
STRUCTURE 2	131	1N 2E	*Picea*	Needle		X			Moderate	4.0 L
			Carex	Seed			1			Paleo Research
			Claytonia	Seed			896*	772*		
			Picea	Cone scale				4		
			Picea	Needle			X	X		
			Potentilla	Seed			88*	32*		
			Modern grass				X	X		
			Roots					X	Moderate	
			Rootlets					X	Numerous	
			Sclerotia				X	X	Few	
			Charcoal			X			3.53 g	
			Wood					11	2.52 g	
	157	2N 1E	cf. Lamiaceae	Seed	1					4.0 L
			Unidentified R, *Ribes*-type	Seed	1					on site

Table 4.6. Botanical Remains from 42Un2331 (cont.)

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Location	FS #	Address	Identification	Part	Charred		Uncharred		Weight/ Comments	# of liters floated
					W	F	W	F		
			Carex	Seed			X		Few	
			Claytonia	Seed			651+			
			Phacelia	Seed			X		Few	
			Picea	Needle				X	Few	
			Picea	Seed			X		Few	
			Polygonum	Seed			1			
			Potentilla	Seed			X		Numerous	
			Ranunculus	Seed			X		Moderate	
			Viola	Seed			X		Few	
			Charcoal			X			Few	
STRUCTURE 3	41	2N 4E	Unidentified	Seed		3				4.0 L
			Vitrified Tissue > 1mm			35				Paleo Research
			Vitrified Tissue <1 mm			X			Moderate	
			Claytonia	Seed			2			
			Rootlets				X	X	Numerous	
			Sclerotia				X	X	Few	
			Charcoal			X			3.03 g	
			Bark			5			.13 g	
	24	2N 4E	Poaceae	Caryopsis	1					16.0 L
			Astragalus	Seed			1			
			Carex	Seed			1			
			Claytonia	Seed			1102	77		
			cf. Lamiaceae	Seed			1			

Table 4.6. Botanical Remains from 42Un2331 (cont.)

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Location	FS #	Address	Identification	Part	Charred		Uncharred		Weight/ Comments	# of liters floated
					W	F	W	F		
			Picea	Seed			1			
			Poaceae	Floret			2			
			Polygonum	Seed			1			
			Potentilla	Seed			19			
			Viola	Seed			2			
			Unidentified	Flower			1			
			Sclerotia				1	16		
	25	2N 4E	Unidentified Twig	Wood				1		
			Root/Corm/Tuber					70	Modern	
	26	2N 4E	Charcoal			X			1.48 g	
	29	3N 4E	Root/Corm/Tuber					1		16.0 L
			Charred Tissue			1				on site
			Vitrified Tissue			1				
			Charcoal			10			.23 g	
	30	3N 4E	*Picea*	Needle		1				
			Charred Tissue			2				
			Vitrified Tissue			9				
			Bark scale			1				
			Charcoal			X			4.73 g	
			Sclerotia				2			
	31	3N 4E	*Picea*	Needle		1				
			Claytonia	Seed			26	2		
			Potentilla	Seed			2			

Table 4.6. Botanical Remains from 42Un2331 (cont.)

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Location	FS #	Address	Identification	Part	Charred		Uncharred		Weight/ Comments	# of liters floated
					W	F	W	F		
			Piceae	Seed			1			
			Modern plant parts					2		
			Sclerotia					13		
			Charcoal			14				
	149	1N 4E	*Carex*	Seed			1			20.0 L
			Claytonia	Seed			754+			on site and machine flotation at BYU
			Picea	Needle				1		
			Picea	Seed			X		Few	
			Polygonum	Seed			1			
			Potentilla	Seed			X		Moderate	
			Viola	Seed			X		Few	
			Unidentified	Leaf				X		
			Unidentified	Flower			1			
			Sclerotia				1075*	975*		
	150	1N 4E	Charred Tissue			1				
			Charcoal			X			.20 g	
Hearth 1	80	1N 7E	cf. Bark			1			< .01 g	
From charcoal stain (F50), 88-90 cmbd	144	1N 7E	*Picea*	Needle		X		X	Few	5.0 L
			cf. PET fruity or charred meal with a seed fragment	Tissue		2				Paleo Research
			Vitrified tissue > 2mm			32				
			Vitrified tissue < 2mm			X			Few	
			Bark			X			Few	

Table 4.6. Botanical Remains from 42Un2331 (cont.)

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Location	FS #	Address	Identification	Part	Charred		Uncharred		Weight/ Comments	# of liters floated
					W	F	W	F		
			Claytonia	Seed			18	52		
			Cyperaceae	Seed			1			
			Poaceae	Floret				3		
			Poaceae- Panicoid	Floret				4		
			Viola adunca	Seed			4			
			Moss	Branch/ Leaf				X	Few	
			Rootlets					X	Numerous	
			Sclerotia				X	X	Numerous	
			Charcoal			X			2.32 g	
	152	1N 7E	Charred Tissue			16				8.0 L
			Charcoal			X			1.99 g	on site
	156	1N 7E	*Astragalus*	Seed			1			
			Claytonia	Seed			158	35		
			Poaceae	Seed				1		
			Polygonum	Floret				1		
			Potentilla	Seed			2			
			Trifolium	Seed			1			
			Viola	Seed			14			
			Unidentified	Fruit				1		
			Sclerotia				4	9		
			Charcoal			5				

Table 4.6. Botanical Remains from 42Un2331 (cont.)

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Location	FS #	Address	Identification	Part	Charred		Uncharred		Weight/ Comments	# of liters floated
					W	F	W	F		
From charcoal stain (F53), 93-100 cmbd	121	1N 7E	Cheno-am	Perisperm	2					5.5 L
			Lamiaceae-type	Seed	1					Paleo Research
			Picea	Needle		X		1	Few	
			PET starchy	Tissue		1				
			Vitrified tissue			X			Few	
			Bark > 2mm			9				
			Bark < 2mm			X				
			Claytonia	Seed			7	12		
			Viola adunca	Seed			1	1		
			Unidentified	Tuber/ Corm			1			
			Moss	Branch/ Leaf				X	Few	
			Rootlets					X	Numerous	
			Sclerotia				X	X	Numerous	
			Charcoal			X			4.7 g	

Table 4.6. Botanical Remains from 42Un2331 (cont.)

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Americans for food, medicine, and fuel. Despite these biases, a carefully crafted quantitative analysis of botanical remains is still an important step in understanding intra-site and inter-site assemblage patterns.

Quantitative methods are driven by research questions, and the more complex a research question is the more complex the quantitative measures must be in order to support it (Popper 1988:60). Pearsall (2000: 192) categorizes quantitative analysis of macrobotanical remains into two categories: *non-multivariate* and *multivariate* approaches. *Multivariate* statistics help the researcher find patterns in the data when the units of analysis have several variables (i.e., several botanical taxa in a coprolite sample). She offers three main reasons for using a multivariate approach: (1) to group or classify previously ungrouped data, (2) to determine the best way to distinguish among known groups of data, and (3) to reduce the number of variables needed to account for differences among ungrouped data (Pearsall 2000:218). Deadman Lake did not produce large amounts of botanical data, so the assemblage would not be able to stand up to the rigor of a multivariate statistical approach. A simpler analytical tool is the *non-multivariate* approach (Pearsall 2000:195-196). Under this approach, Popper (1988:54, 60-61) evaluates four methods of quantifying archaeobotanical data; absolute counts, ubiquity, ranking, and diversity. Absolute counts are the simplest but may reflect preservation and sampling errors and, if used alone, will probably not provide an adequate measurement. When considering any of the four quantitative methods mentioned above, Popper (1988:69-70) argues that we must consider the conditions they require in order to function properly. For example, ubiquity and ranking are less reliable when there are only a few samples in the data sets and diversity measures are useful for summarizing groups of data, but reveal nothing about individual taxon. Unfortunately, due to the small number of charred specimens identification and absolute counts are the only reasonable analyses that can have any bearing on this particular research question.

Analysis

Seven pollen samples and six macrobotanical samples separated by machine flotation were analyzed by Paleo Research Institute. Seeds recovered from on-site manual flotation, for Structure 1, Structure 2, Structure 3, and Hearth 1 were also sent to Paleo Research Institute for identification (see Appendix A3.2 and Appendix A3.3). One pollen control sample was collected from several points around the site in order to identify modern conditions. Most of the modern pollen consisted of local vegetation, although there were examples of plants whose growth limits are far from the site. For example, the presence of *Ephedra torreyana* (Mormon tea) and *Typha angustofolia* (cattails) are interesting because they only grow up to 2439 m and 2134 m, respectively, on the Uinta Mountains. The presence of Cheno-am pollen in the control sample may be from *Monolepis nuttalliana* (povertyweed), a member of the Chenopodiaceae family that grows up to 3170 m.

Structure 1

Soil samples analyzed by Paleo Research Institute from Structure 1 (cal A.D. 405) consisted of pollen and macrofloral samples from 5N 5E and 6N 6E as well as a pollen sample from 5N 6E. Most of the pollen remains were comprised of locally available vegetation, but there was no indication of processing of these plants. Several plants represented in the pollen assemblage for this feature were not local, such as: *Sarcobatus* (greasewood; grows up to 2134 m), *Ephedra*, *Typha angustofolia, Polygonum aviculare* (knotweed; grows up to 2652 m)*, Polygonum. sawatchense* (sawatch knotweed; grows up to 2591 m), *Sphaeralcea* (globemallow; grows up to 2195 m), and several non-local arboreal species. However,

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Polygonum douglasii (knotweed) does grow up to 3140 m in the Uinta Mountains. Plants such as Mormon tea, common knotweed, and scarlet globemallow have medicinal properties (Kershaw et al. 1998; Moore 1979). Various parts of the cattail were used for food, medicine, and weaving. Greasewood , Mormon tea, and typha (hearth; A.D. 1210) were also represented in the pollen analysis at Chepeta Lake (Johnson and Watkins 2002).

The presence of these plants at a site outside of their modern-day ranges suggests they may have been transported to the site from lower elevations. Of the local plant families present in the pollen samples from 5N 5E, 6N 6E, and 5N 6E, seven have species with food and/or medicinal qualities. Square 5N 6E exhibited a single pollen grain from the Lamiaceae (mint) family, which can grow up to 2500 m in the Uinta Mountains, and most are edible and/or have medicinal properties. It is possible that a species from this plant family was transported to the site. The presence of Brassicacea in two of the three pollen samples represents plants from the mustard family, many of which grow locally. At Chepeta Lake, a wash of a metate fragment in a context dated to A.D. 1210 revealed an elevated frequency of Brassicacea consistent with grinding seeds from this family. The pollen sample from the floor of 5N 5E contained a single starch with a centric hilum, typically produced by grass seeds, some roots, and seeds such as *Zea mays*. However, identification beyond it being a starchy substance that deteriorated on the floor of the structure was not possible. Also recovered was one piece of charred tissue with an embedded seed coat may represent a fruity tissue or a piece of burned ground meal (Puseman and Cummings 2003).

Structure 2

Two macrofloral samples were analyzed from Structure 2 (A.D. 1830-1950). Most charred remains were from local trees. One charred Lamiaceae seed and an unidentified charred *Ribes* seed (similar to a gooseberry or current) were also recovered from this structure in 2N 1E.

Structure 3

Pollen and macrofloral samples from 2N 4E and a pollen sample from 1N 4E from Structure 3 (cal A.D. 670) were analyzed as well. In addition to the identification of the expected pollen from the local arboreal vegetation, small quantities of pollen from the Geraniaceae family were found. Species such as *Geranaceae richardsonii* (white geranium) and *Geranium viscossomum* (wild geranium) both grow up to about 3200 m and have medicinal properties, but their presence is not enough to indicate processing here. Also present was pollen from *Opuntia erinacea* var. *utahensis* (pricklypear cactus). In the Uinta Mountains, this species was recorded from the juniper to the mountainbrush zones (1800-2200 m), strongly suggesting that the cactus fruit or pads (both can carry *Opuntia* pollen) were transported to the site. The macrofloral sample from 2N 4E contained three charred seed fragments that could not be identified, except that they were definitely not from Cheno-ams, grasses, members of the mustard family, nor members of the pink family.

Hearth 1

Pollen and macrofloral samples from the surface and 0-2cm below a thermal feature (F50) and a macrofloral sample from another thermal feature (F53) were analyzed from Hearth 1 (cal A.D. 665). The pollen record from the surface of F50 is very similar to that from Structure 1, and does not indicate economic activity. One small fragment of charred material was noted in the macrofloral sample. Two starches

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observed in the fragment are morphologically similar to many types of seeds. One of the starches exhibited "angularity," typical of starchy seeds such as *Zea mays*, but cannot be considered sufficient evidence for the presence of maize (Puseman and Cummings 2003:7). The macrofloral sample from F53 contained two charred Cheno-am perisperms, indicating that Cheno-ams were processed here. Charred Cheno-am seeds were also discovered at a prehistoric site in Colorado (3400 m, A.D. 130; Benedict 2000:174) along with groundstone fragments, suggesting that it was not unusual to transport seeds from this species to high altitudes. Also found was one charred Lamiaceae-type seed suggesting that a plant from the mint family was processed here. As was discussed in the pollen analysis for Structure 1, Lamiaceae plants do not grow locally, and therefore must have been transported to the site. One piece of charred PET starchy tissue was also present in the macrobotanical sample. The specimen was tested to identify the starch and found it typical of the generic forms produced by seeds and some roots and tubers, but is too generic to attribute to any one family of plants. However, the presence of tracheary elements may indicate that it is more likely from a root or tuber than a seed.

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Chapter 5
Material Culture: Discussion

The second research objective of this thesis is to identify cultural affiliation of the site, the site type, and season of occupation. Identifying who occupied the site, either by cultural affiliation or subsistence economy, is typically based upon diagnostic artifacts or reasoning from theoretical models. Site type can be inferred from feature types, artifact assemblages, amount of refuse, and investment in dwellings. The season of occupation can be determined from botanical or faunal remains, as well as reasonable expectations for that site's locality. For example, it is highly unlikely that the Deadman Lake site was occupied in the winter due to uninhabitable conditions at this time of year. A discussion of cultural and economic affiliation, site type, and season of occupation for Deadman Lake follows.

Cultural Affiliation
The Fremont Period Occupations

Two structures (Structure 1, A.D. 405 and Structure 3, A.D. 670) and a thermal feature (Hearth 1, A.D. 665) fall within the horticultural period of the Uinta Basin. It has been argued (Madsen and Simms 1998; Spangler 1995; cf. Loosle, personal communication 2003) that hunter-gatherers in the Uinta Basin may have lived contemporaneously with farmers. The task of distinguishing an ephemeral site left by farmers from one left by hunter-gatherers is a challenging one. The presence of artifacts diagnostic of farmers, such as maize or ceramics, can be used to affiliate a site with a horticultural group, but are not definitive (especially when there is the possibility of trade). Unfortunately, no artifacts traditionally associated with farmers were found in any of the features at Deadman Lake. Without these diagnostics it is impossible to determine on the artifact assemblages alone what economic group occupied Deadman Lake. However, based on the theoretical model established earlier in this thesis, if the features are logistical they may have been created by semi-sedentary farmers rather than full-time hunter-gatherers. To reiterate what was argued earlier (Chapter 2), the latter should have traveled as family groups to the timberline zone during the summer when plants and animals would have been at their productive peaks. The former should have traveled to the timberline as male hunting groups in the fall. This second scenario does not preclude the possibility that small groups or individuals were also procuring medicinal plants or participating in vision quests. It only infers that hunting is the most obvious proposal. At this time the only definitive statement that can be

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made regarding the earlier occupations is that Structure 1, Structure 3, and Hearth 1 were occupied during the Fremont period.

The Numic Occupation

The historic period structure (A.D. 1830-1950) is affiliated with the Numic occupation of the Uinta Basin. The Uintah-Ouray Reservation was established in 1861 and covered much of the Uinta Basin, some of the Uinta Mountains, and the Tavaputs Plateau (Lyman and Denver 1969:66; Smith 1992:xiii) by 1904. All sherds associated with Deadman Lake were positively typed as Intermountain Brownware, a Late Prehistoric ware. Based on the ceramic assemblage and the region's proximity to the Ute reservation the site was probably left by a local Ute group. The Utes made only limited amounts of pottery, being better known for their skills in basketry, and usually obtained their pottery from the Jicarilla Apache and the Pueblo Indians in New Mexico (Lyman and Denver 1969:126; Rockwell 1956:43;). However, Hill (2003) (Appendix A2.1) claims that the sources of the temper may be local, suggesting that these vessels were manufactured in the Uinta Basin region.

The metal artifacts from Structure 2 represent an interesting period in time when Native Americans were living in a post-contact world. The globule of melted metal, if melted intentionally, is curious because the occupants of this structure were still using bifacially flaked tools. Also found in this structure is a metal tinkler cone, which were traded for with European Americans as adornments. Tinkler cones were attached to hair, clothing, and other personal objects (Stone 1974:131). For example, Rockwell (1956:43-44) notes Ute men and women carried a beaded bag known as a "vanity bag." Following Daniels (1941), he describes it as "made of heavy leather with two stripes of blue beads on each side and a green stripe on the bottom. Small cone-like metal objects were attached to the bottom of the bag as well as on the buckskin flap which covered the opening. These caused the bag to jingle musically when being moved or carried." The tinkler cone found at Deadman Lake fits the description of brass and iron rolled tinklers found at Fort Union (on the border of Montana and North Dakota) from the early to mid 1800s (LeRoy and Hunt 1993). The rolled tinkler was manufactured from trapezoidal or triangular shaped sheet metal called blanks. The longitudinal edges were folded inward until the met to form a cone shape with openings on either end. If done well, there should be no overlapping on the edges. The tinkler was usually attached by way of a leather strip that was passed through the top opening and held with a knot on the inside of the cone (LeRoy and Hunt 1993:13).

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Site Type

Features and Material Culture

People living in temperate zones (e.g., collectors) should create *at least* two site types; residential sites and logistical sites. A residential site is simply defined here as an area where a family group lived. In addition to the presence of a habitation structure (or manipulation of a natural feature such as a rockshelter so that it can be used as a dwelling), artifacts that are usually representative of a Fremont period residential site are groundstone, ceramics, maize, and "women's" work tools. Three ephemeral brush structures were identified at the Deadman Lake site. These structures (and the non-structural features) contained very little refuse, suggesting that all of the occupations were short. Although groundstone was found on the surface in the general area, none was found in situ. Neither was there any evidence of intensive plant processing. Intermountain Brownware ceramics were only found in context with the historic period structure and on the ground surface. These site attributes would suggest that residential camps were not established at Deadman Lake during the Fremont periods, but perhaps (though unlikely) during the historic period. Thus, based on the artifact assemblages, temporary structures, and lack of residential debris the Fremont period occupations were likely temporary camps left by logistically-oriented male parties.

Lithic/Mobility Models

Site type can also be inferred using mobility/lithic models (Binford 1980; Kelly 1988; Kuhn 1994; Nelson 1991; Odell 1994, 1996; Parry and Kelly 1987). However, an analysis of the Deadman Lake lithic assemblage must be prefaced with a warning from Nelson. She (Nelson 1991:84-85) argues that focusing on site types in lithic analysis can be limiting for three reasons: (1) the possibility of variation within one economic strategy, (2) the relativistic nature of a local environment precludes using one model for all economic systems, and (3) site formation can be affected by taphonomic processes that can lead to misinterpretation of an assemblage.

Pecora's (2001) study at the Martin Justice site in Kentucky is a good example of the problems that can occur when one tries to classify a site based only on the lithic assemblage. Pecora (2001:176) argues that artifact patterning may actually be a result of different reduction junctures rather than a reflection of a settlement system. A reduction juncture represents the resumption of the manufacturing process after the transport of the material to a new location. The first juncture will include stages from the core to the finished point, while remains from the last juncture will be the result of tool maintenance only. Pecora offers two maxims that reflect how different junctures could affect lithic assemblage composition: (1) artifact quantity

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is not directly related to the intensity of the occupation, but instead is dependent on the point or juncture of manufacture, (2) artifact variability/diversity is dependent upon the point of juncture of manufacture. In other words, earlier junctures will have more lithic material available for more tool types (Pecora 2001: 177-178). A controlled experiment by Pecora shows that for each consecutive juncture, the proportion of debris for each objective piece decreases substantially so that Juncture I produces 15 times more debris than Juncture VI (Pecora 2001:180). At the Martin Justice site, the lithic assemblage is comprised of low quality, low diversity (in tools and material type), later reduction stages, and small artifact size (few artifacts were larger than .5 cm). Alone, the lithic assemblage would suggest a short-term, low intensity occupation when in fact this site is known to contain several residential bases occupied for varying lengths of time over several millennia. Thus, Pecora posits that the site is the location of late stage reduction junctures while the reduction of most of the core took place elsewhere.

Tool Diversity

There are several hypotheses that are being used to model types of human mobility; tool diversity and formality are two that will be discussed here. The diversity model argues that diversity in a tool assemblage should be greater at sites with higher degrees of sedentism than at sites representing more mobile peoples. Chatters (1987) and Shott (1986) have been the most forward proponents of this argument, which is based on the principle that highly mobile people will exploit a limited amount of resources in any given area for a relatively shorter period of time than more sedentary people. Specialized implements should be low while multifunctional tools should be high at sites left by more mobile people. In contrast, the lithic assemblage at residential camps should reflect a greater diversity of tool types representing a multitude of tasks (see Johnson 1996). Odell’s (1996:189, 210) study in the Illinois Valley tested several assumptions about lithic assemblages and decreased mobility over time. He found that the most diverse collections were in residential camps, and this phenomenon could not be argued as a function of chronology. In other words, sites created by later, more sedentary societies did not have more tool diversity than earlier ones. To test this hypothesis, Kuhn (1994; cf. Parry and Kelly 1987:298) used a maximum transport distance model to test for diversity in mobile toolkits and found that if only one object is carried, it should be a core. However, if “maximization of function per unit of mass” (Kuhn 1994:437) is the consideration he believes that cores should never be found in the portable toolkit when raw materials are locally available because it is more economical to reduce the core to a tool blank prior to transportation. In addition, Kuhn found that it would be more economical to carry several small specialized tools than one large multifunctional tool. Thus, he argues

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that a mobile toolkit will not *always* [my emphasis] be lacking in diversity, even though ethnographically this is typically the case (Shott 1986).

Tool Formality

The degree of tool formality or informality has also been used as an indicator of a people's degree of mobility (Sievert and Wise 2001:103). Formal tools are characterized as tools that are designed to be rejuvenated (multiuse) and redesigned for a variety of functions (mulitfunction), such as bifaces, formally prepared cores, drills, scrapers, and retouched flake tools (Andrefsky 1994:23; Parry and Kelly 1987:298). The ability of a biface to be used as a core as well as a tool makes it especially useful in a mobile toolkit. Untouched expedient flake tools, which are only suitable for one task if not altered and are simpler in shape and design, are characteristic of an informal tool (Andrefsky 1994:22; Parry and Kelly 1987:298). Material implications of an informal expedient technology should be few prepared cores, tools made from waste material, and a low investment in tool retouch or modification (Nelson 1991:82; Parry and Kelly 1987: 287).

The formality argument is built on the principle that stones are too heavy to carry around for long distances (Bamforth 1986). Thus, lithic technology is influenced by degree of a group's mobility and the group's ability to access raw materials. There are two opposing arguments to this model, both centered on accessibility to raw materials. Parry and Kelly (1987:300) assert that high residential mobility makes the procurement of raw material uncertain and so people practicing this strategy will likely create formal tools as a contingency against this possibility. In contrast, people who do not move far logistically or residentially only need to ensure that useable stone will be available near the location of a task, which precludes the need for formal tools. This argument assumes that sedentary populations are living within a reasonable distance from a raw material source, that they have stockpiled raw material at the residential camp, or that they are exchanging for raw materials (Clark, personal communication 2003; Johnson 1987; Koldehoff 1987; Parry and Kelly 1987). If residentially mobile people were using formal tools, their lithic assemblage should reflect more bifacial thinning flakes, resharpening flakes, a higher proportions of broken flakes and flake fragments, and recycled tools (Sievert and Wise 2001: 87; Whittaker and Kaldahl 2001: 53). Several studies (Parry and Kelly 1986:297; Odell: 1996:182) have in fact shown a decrease in bifacial tools and formally prepared cores as groups became more sedentary over time, though it was emphasized that the shift was not one of replacement by one technology over another but rather a shift in emphasis to more informal tools and amorphous cores. In other words, both formal and informal tools are present over time. Interestingly, while

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Parry and Kelly (1987) were able to correlate a reduction in bifacial tools with a reduction in bifacial thinning flakes among the Black Mesa Anasazi, Odell's (1996) results in the Illinois Valley did not concur. Parry and Kelly also note that this shift towards less formal tool technology was approximately contemporaneous with the introduction of the bow and arrow, ceramics, and the emphasis on maize as a major staple in the diet in the Southwest.

Others (Andrefsky 1994, 1991; Kelly 1988; Odell 1996) argue that tool technology (formal versus informal) is not necessarily reflective of levels of mobility, but instead is more dependent upon accessibility to raw material sources. They argue that a sedentary group that hunts logistically is just as likely to produce formal tools as is a residentially mobile group if access to an abundant and good quality lithic source is difficult. In contrast to what was argued earlier by Parry and Kelly, Odell (1996:11) believes that if more mobile people had constant access to lithic resources as they traveled they would not have a need for formal technology. It also stands to reason that if more sedentary people have infrequent access to raw materials, resulting in "resource stress," they would exhibit more care in the production of their tools, such as using formal technology and heat treating prior to tool reduction (see Johnson and Loosle 2002b: 269). In fact, a comparative study of short term occupation sites associated with mobile populations and long term sites assumed to be associated with sedentary populations in Pinyon Canyon, Colorado, did not show any differences with regard to formal or informal tools and cores (Andrefsky 1994:27; also see Odell 1996:211). However, there was a high percentage of local material used over non-local materials in both site types. Thus, Andrefsky argues that direct association between mobility and tool formality cannot be inferred without equal consideration of how mobility aids or prevents access to good quality and abundant raw materials (see also Bamforth 1986; Kelly 1988:719).

Mobile Toolkits at Timberline

The upper montane zones have unique characteristics that may have influenced the mobile toolkit design for both residentially and logistically mobile people. Three strategies for technological organization (or design) argued by Nelson (1991:62-65) are applicable to this discussion: curation, expediency, and opportunistic behavior. Curation is a strategy of caring for tools, cores, and toolkits by preparation, transport to a location, reshaping, and caching. It anticipates the need for materials and tools at a location. An expedient strategy depends on planned stockpiling of materials, or anticipates that there will be materials available at the destination or along the way. It is also reliant on the availability of time to procure non-

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stockpiled materials. Unlike curation and expedient strategies, which are planned, an opportunistic strategy is a response to an *unanticipated* availability of material.

I suggest that the lack of good quality raw materials at high altitudes, and the effort needed to access the timberline zone, would require both the residentially and logistically mobile hunter to carry a portable toolkit consisting of, at minimum, a formal bifacially flaked tool/core. Kelly (1988:720-721) believes that this was the situation at Alta Toquima. Because there is no easily knapped stone on Mount Jefferson, he argues that people "geared up" before traveling to the mountain by preparing bifaces that could be used as cores as well as long-life tools. In fact, many of the bifaces and projectile points recovered at Alta Toquima were resharpened and reused thoroughly. Transportable toolkits must be lightweight with a few items that are maintainable, versatile, and resistant to breakage (Nelson 1991:73). Ideal lithic materials for transportable tool kits are cryptocrystalline quartz (such as chalcedony, chert, jasper, flint, and agate) and glasses (obsidian) because they are easily shaped, can be reshaped with minimal waste, and provide sharp edges (Goodyear 1989). Bifaces are repeatedly cited as ideal tools for a portable toolkit because of their flexibility, maintainability, and their high ratio of edge to weight ratio (Nelson 1991:74). Most scholars (Binford 1979; Kelly 1988:723; Nelson 1991:79, 84; Wilke 2002) agree that if a transportable toolkit is being used at a site the archaeological record should reflect a high proportion of retouch flakes, bifacial thinning flakes, and flakes with utilized edges (cf. Kelly 1988:723). Simply put, the material record should reflect what Pecora (2001) has identified as a Junction V or Junction VI, rather than a Junction I (which would include the entire reduction process from core to finished product).

I suspect both residentially mobile hunter-gatherers and logistically mobile horticulturalists carried portable toolkits to the timberline ecotone because they are light, maintainable, and mulitfunctional. If this is true, then perhaps it is the anticipated access to raw materials that would create a difference in lithic technologies between the two mobility strategies. As is the case on Mount Jefferson, good quality raw material sources on the crest of the Uintas are sparse; raw materials available in this area are Uinta quartzite and some chalcedony. If a residentially mobile strategy means that the occupants expect to be away from any known source of raw material for a given length of time, the lithic assemblage might reflect three attributes: a higher percentage of cryptocrystalline quartz or obsidian (Goodyear 1989), heat treating to facilitate the shaping process with the least amount of waste (Odell 1996), and a higher percentage of well used tools (Kelly 1988) or utilized flakes. The first attribute assumes that the two predominant material choices in the region (Tiger chert and Sheep Creek quartzite) are available in equal numbers. In contrast, a logistical hunter in the Uinta Mountains who knows that he will be returning to the residential base reasonably soon may be

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less frugal with the resources in his toolkit. This assumes that a raw material source will be encountered on the return trip or within a reasonable distance from the residential base. Assuming again that both material types are available in equal numbers, attributes of a lithic assemblage at a timberline logistical site should be as follows: material could be Tiger chert or Sheep Creek quartzite (no preference for materials that can be heat treated), there should be less evidence of heat treatment if chert was used, and there should be a higher percentage of single use flakes or waste flakes.

Mobile Toolkits at Deadman Lake

In general, the lithic assemblages for the different occupations represent a curated strategy with a formal tool (most flakes were the product of bifacial reduction or maintenance), a high percentage of broken flakes, and no core reduction (Clark 2003, personal communication). This implies low tool diversity, small artifact size (median flake length is less than 1 cm), and late reduction stages. In addition, the assemblages were small in quantity; the smallest assemblage (Structure 1) contained 10 flakes and the largest (Structure 2) contained 56 flakes.

Structure 2, affiliated with the regional Numic occupation, was dominated by broken Tiger chert pressure flakes (76 percent), of which 11 percent were heat treated. This structure also contained two utilized flake tools. The high percent of Tiger chert, some heat treating, and the two utilized flake tools would suggest that the occupants did not expect to return to a raw material source in the very near future. However, Tiger chert use increased during the Fremont period (Loosle, personal communication 2003), and thus the high representation of chert in the assemblage may only be a factor of time, rather than indicative of a residential mobility strategy.

Structure 1, Structure 3, and Hearth 1 are of the greatest interest here because they represent a pre-contact and pre-equestrian lifestyle, which is more applicable to current hunting and gathering models. The lithic assemblage from Structure 1 (Late Archaic/Early Fremont) is 100 percent Sheep Creek quartzite, exhibits no heat treatment, and contains one utilized flake tool. Structure 3 and Hearth 1, both of the Uinta Fremont period, are comprised of almost equal proportions of Tiger chert and Sheep Creek quartzite. In addition, 36 percent and 25 percent of the chert, respectively, of the artifacts in both areas were heat treated. However, Hearth 1 is a thermal feature, and thus a strategic heat treatment cannot be inferred. There were no tools found in either area. Based on the low diversity in tool types, small number of flakes, high proportions of late stage reduction flakes, the lack of preference for chert, and the presence of only one utilized flake (Structure 1), it is probable that Structure 1, Structure 3, and Hearth 1 are logistical sites. The only attribute

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that was unusually high for a model of logistical mobility in the timberline zones was the percent of chert that was heat treated. If non-strategic burning (e.g., discard into a campfire or a post-occupation wildfire) could be ruled out, this would mean that attempts were still made to make chert as productive as possible.

Seasonality

Seasonality of a site is typically determined from faunal or botanical assemblages. Because no juvenile bone was found that could indicate a spring occupation, the remainder of this discussion will focus on the botanical remains. A model was developed earlier arguing for dissimilar use of the mountains between full time hunter-gatherers and part-time farmers. One half of the argument suggests that the growing season of maize prevented farmer groups from moving their residences until after the fall harvest. The remainder of the argument was built upon the premise that maize met certain nutritional needs such that geophytes (at their peak from May until September in the Uinta Mountains) were no longer a necessary source of carbohydrates for farmer groups. Therefore, groups of farmers could relocate residential camps after the harvest to mid-elevations for the procurement of other important plants, such as *Chenopodium* seeds. In the fall, *Chenopodium* seeds are at their prime at mid-elevations up to 2900 m. Fall is also the time that ungulates begin to move down slope to the Low Benches and Intermediate Benches. Residential camps located in these locales during this season would offer the best opportunity for hunters and gatherers alike.

Charred Cheno-am perisperms were found in Hearth 1, strongly suggesting a fall occupation at this feature. Other plants recovered in the botanical assemblage that imply a fall occupation are the charred *Ribes* (possibly gooseberry or currant) and Lamiaceae (mint) seeds (Puseman, personal communication 2003). The charred mint seeds found in Hearth 1 and Structure 2, as well as the mint pollen from Structure 1, indicate that this culinary and medicinal plant was transported to the timberline zone from 2500 m or lower. Ribes grow up to 3350 m and were likely procured locally by the occupants of Structure 2. Finally, starch samples from Structure 1 and Hearth 1 may represent the presence of *Zea mays*, though this cannot be stated definitively. If they are, in fact, maize they would also represent a fall occupation in the alpine zone.

Conclusion

In conclusion, all of the Fremont occupations excavated indicate a logistical strategy based on site features, amount of refuse, lack of artifacts associated with “women’s work,” and the lithic assemblage attributes. Structure 1, Structure 3, Hearth 1, and possibly Excavation Area 3 also fall within the Late

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Archaic/Early Formative to Uinta Fremont periods, suggesting that Fremont-period timberline sites tend to be logistical in nature. Charred *Chenopodium* and Lamiaceae seeds recovered from Hearth 1 argue for a late summer to fall occupation. This is in agreement with Loosle (2002b:22-23) who posits, based on current ANF data, that the seasonally mobile Fremont farmers repeatedly exploited mid-elevation sites in the fall.

The historic Numic period brush structure lacked extensive refuse deposits and groundstone but did contain 32 Intermountain Brownware sherds. Despite the presence of a large slab metate a few meters from Structure 2, there was no indication of intensive plant processing activity in this structure. Thus, it is unclear if women were present at this dwelling (usually indicative of a residence) or if the ceramics were transported here by an individual or small group for medicinal, ritualistic, or other purposes (logistical). Another culturally diagnostic artifact is the metal tinkler cone, which was typically worn by both men and women. Charred Lamiaceae and *Ribes* seeds from Structure 2 suggest a late summer to fall occupation.

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Chapter 6

Modeling a Settlement System

Because most (if not all) of the Deadman Lake occupations are, as argued, logistical sites then it follows that the affiliated residential camps must be located elsewhere. While most scholars who study the Uinta Basin (Talbot and Richens 1996, 1999; Spangler 2000; Loosle and Johnson 2002:286) speculate that high altitude land use in the Uinta Mountains, as it is with other montane systems, was restricted to the summer and early fall, few scholars have been able to offer a more specific hypothesis. Loosle and Johnson (2002:286-287) have initiated a conversation by arguing that Fremont farmers would have traveled to mid-elevation sites to collect Cheno-ams (and there is evidence of this on the north foothills of the Uinta Mountains) for lowland bases, but a lack of sufficient data in the alpine zones has prevented this idea from extending into a settlement-subsistence model that includes the upper montane region.

I suggest that an "up-down" (sensu Benedict 1992) mobility system between the timberline ecotone and mid-elevation residential camps occurred in the eastern Uinta Mountains. Residential camps associated with timberline sites should be located at mid-elevations in order to facilitate the procurement of important economic plants and allow easier access to upper elevations. In this chapter a maximum transport model that originates from Deadman Lake will be tested for compatibility with central place foraging models. In other words, the model will attempt to verify if a calculated maximum transport distance (determined by energy expended versus calories returned) will reach the expected location for a residential base (inferred by central place foraging). If the distance extends to the *Chenopodium* zone then the appropriateness of using a maximum transport model has been illustrated. If the distance does not reach the maximum extent of *Chenopodium* on the eastern Uinta Mountains it suggests that maximum transport models may not be appropriate for use at high altitude sites. In other words, immeasurable currencies, such as prestige or the desire for fatty meat, may have had a greater influence on distance traveled than current transport models allow.

Formative Peoples in the Utah Mountains

The lack of Fremont period residential sites in the mountains is not an exceptional phenomenon. In fact, there are no known residential camps over 2280 m in Utah during this period. Surveys on the Wasatch Plateau (McDonald 2000:131) at elevations ranging from 2591-3201 m mostly recorded lithic scatters and

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lithic source workshops from Paleoindian to Protohistoric times. Five sites could potentially be classified as Formative Period (2000-600 B.P.) based on the artifacts recorded; a ground stone ball, two Rose Spring corner notched points, and Fremont ceramics at two sites. Equally as important is what was absent from highland sites; groundstone (except for one), variability in tool types, and substantial site features. McDonald suggests that while the upper montane areas were used by Fremont period people (possibly horticulturists) it was likely limited to logistical hunting forays at times when larger groups fissured, probably during the summer and early fall.

A metate fragment found at Chepeta Lake at 3183 m in a hearth dates to AD 1210. This would place the metate in the Late Agricultural Period. Because of the lack of structures, Johnson and Watkins (2002:227) argue that the Chepeta Lake site was a logistically organized group of men and women who were there to exploit plant resources (there were several metates found on the surface). Whether or not these occupations are representative of full time hunter-gatherers or farmers is difficult to determine due to the lack of diagnostics. The presence of women at this site implies that a residential camp was located within a day's walk from the processing site. In other words, because foot travel between the crest of the Uinta Mountains and the lowlands is not feasible in one day the residential camp should have been situated in the mid elevations to upper elevations.

Despite the lack of Fremont period residential sites at the upper elevations, there is evidence of sites left by Fremont farmers at mid-elevations in Utah. In Sevier County, a Fremont period village (Round Spring) at 2278 m was excavated in the Fish Lake National Forest (Metcalf et al. 1993). It is believed to be a year-round residential site in the pinyon-juniper zone. Excavations revealed 10 formal pithouse structures with clay-rimmed hearths. Three time periods were represented, but the most intense occupation was during the Fremont period, with the heaviest use from A.D. 900-1100. A large faunal assemblage (mostly rabbit, although small artiodactyl was well represented), abundant macrofloral remains, groundstone, cultigens (maize, squash, and possibly sunflower), ceramics (including some trade sherds), and a variety of worked tools and other miscellaneous objects were uncovered. The *Chenopodium* remains (90 percent of the entire macrobotanical assemblage) overwhelmed the cultigens. This, in addition to a lithic industry geared toward hunting suggests to Metcalf et al. that despite evidence of horticulture, the primary subsistence activity at the Round Spring site was geared towards locally focused hunting and gathering. Several short term camps and a Fremont period residential base (2451 m) were found in the area as well.

Mickey's Place and Moon Ridge (Janetski 1999) are two sites located at the north end of Fish Lake at an approximate elevation of 2700 m. Mickey's Place, a single occupation Fremont-period site, contained

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the remains of a wickiup structure, groundstone, plain gray ceramics, maize, a midden area, and outside activity areas. The site was occupied multiple times from A.D. 700-1100, though the majority of use was during the earlier period. Moon Ridge is a multicomponent ridge-top site that contains both Numic and late Fremont artifacts and features. The Fremont period occupation (Structure 3 in Area 3), which contained numerous ceramic sherds, dated to the A.D. 1300s.

The Summit Springs rockshelter (2500 m) is located on the northeastern slope of the Uinta Mountains (Johnson and Loosle 2002c). One midden and four hearths from this site date to the Formative period. Macrofloral remains include charred Cheno-am and charred *Corypahantha* (ball or pincushion cactus) seeds, suggesting a late summer or fall occupation. Johnson and Loosle (2002c:98) argue that this site was a temporary hunting camp established mainly for the procurement and transport of large game to larger farming bases along the Green River. The presence of high quality Uinta Gray ceramics (135 sherds), groundstone (at least 24 metates and 23 manos), 15 types of chipped stone tools, over 1600 large mammal bone fragments, and *Zea mays* pollen and starch on a metate strongly suggests that this rockshelter may have been a temporary residential base. It was from this locus that logistical tasks were carried out.

Hunting at Timberline

It is argued that most of the occupations at Deadman Lake, with the possible exception of the Numic period structure, are logistical field camps. An understandable assumption would be that men traveled to this zone to hunt ungulates. However, the faunal assemblage did not produce the kind of data necessary to argue for the presence of hunters. The lack of large mammal bone in any of the structures, if the sample can be considered a good representation of the artifact population, argues unequivocally that no butchering of large animals took place there. Three behavioral scenarios are suggested to explain the lack of large mammal. The first is that there were no large mammals encountered or killed.

A second possibility is that ungulates were not the main target. A scenario proposed by Grayson (1991) for the White Mountains has relevance for this discussion. In the White Mountain village faunal assemblage, marmots (79.4 percent) and mountain sheep (9.7 percent) together comprise 89.1 percent of the total taxa that could be identified to the genus level. Based only on counts, marmots dominate the archaeological record in both the previllage and village assemblages. However, Grayson (1991:500) argues that while there is heavier emphasis on mountain sheep in the previllage assemblages the marmots are heavily overrepresented in the village occupations. Marmots are good source of fat-laden meat, especially just before hibernation in the fall (Armitage et al. 1976; Barash 1989:26). In fact, they are a better source of

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fat than ungulates during the fall rut (Driver 1990:14). Grayson (1991:505) believes that in years of expected low producing pinyon crops, alpine villages (post 600 AD) in the White Mountains were utilized more intensively for the procurement of marmots. While he does not discount the likelihood that other resources were hunted and gathered, he does not believe that these other resources would have been a focal point of activity. Grayson speculates that this was the situation at the Alta Toquima village as well.

A third scenario is that logistically oriented hunters transported the game elsewhere, either whole or butchered. There is ethnographic evidence (Kelly 1964) that the Southern Paiute transported deer from the montane areas to residential camps elsewhere. There is no evidence of butchering at any of the feature areas excavated, although this does not mean that it did not occur somewhere close by. Cassells (2000:211) notes that skeletal remains are usually not found in high altitude contexts on the Colorado Front Range. He believes that this is because mountain sheep, the presumed target, are small enough to transport off the mountain whole. If a group of logistical hunters in the Uinta Mountains were able to procure a mountain sheep they may have transported the entire animal back to a residential camp. This is one explanation for why there was no large mammal bone in the faunal assemblage, but begs the question where did they go?

Some scholars (Spangler 1995; Talbot and Richens: 1999) suggest that horticulturists would have kept the residential bases in the lowlands for the procurement of local plants. However, as Loosle (2002) has demonstrated, some Uinta Fremont sites, which are heavily biased toward the collection of Cheno-ams, have been recorded in the Intermediate to Mountain Benches (2000-2700 m). By testing a maximum transport distance model from Deadman Lake, this thesis will attempt to identify how far a resource-laden individual should be willing to travel from the timberline ecotone. A calculation specific to three routes originating from Deadman Lake will establish the maximum distance before an individual begins to operate at a caloric loss. The fit of the model will be determined based on the ability of the maximum transport distance to fall within a range that accounts for both men’s and women’s economic strategies. In other words, the residential base should be located where women can procure resources within one day’s journey, but also close enough to Deadman Lake so that the energy expended to return to the base with large game will not exceed the caloric benefits gained from the resource. If the maximum transport distance from Deadman Lake does not reach the maximum range for women’s economic activities, then it is suggested that measuring transport costs based on calories alone is not an appropriate for alpine land use.

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Predicting Central Places

Current Models

Locational analysis is one method used to predict settlement locations. However, Limp (1983: 22) argues that the majority of archaeological locational analyses have been "Thuenian" in nature (Thunen 1875). In studies such as these (also known as "catchment" analysis), Limp argues that the settlement's location is already known. Concentric circles of a constant preselected radius are projected from the locus and the relative amounts of resources are evaluated based on density estimates. While this approach is able to answer some types of settlement location questions, it is "retrodictive" in that it requires that the site location already be known (Limp 1983:22). Rather than predicting locations, it determines what resources may have been the impetus for site selection. Limp also takes issue with the use of evenly distributed concentric circles because it likely does not reflect natural conditions.

In general, models that deal with the transportation of resources assume that the resources are not consumed where they are captured, but transported to a residential base where they are eaten, stored, or distributed (Szuter and Bayham 1989: 88). Maximum transport models typically account for the cost of production, processing time, and transport costs. Based on travel speed and distance measurements, Limp (1983:24) sets the maximum distance at which one would reasonably travel in one day at 10 km from a camp. For a resource that has already been processed, that distance is increased to 18 km. While variability must be accounted for each locational setting, ethnographic records (Densmore 1927; Lee 1968; for discussion see Kelly 1995:131-146) roughly confirm Limp's estimates.

Jones and Madsen's (1989) maximum transport distance model for the Great Basin is perhaps more widely recognized. Also built upon optimal foraging models, their maximum transport distance model argues that the decision to transport a resource extralocally is directly related to the amount of the resource available locally. In other words, a locally available resource will decrease the need to transport the same resource from outside the area. The *net maximum transport quantity* (nMTQ) is the maximum amount of a resource that can be transported, and is calculated by subtracting the cost to fill a basket (hours and caloric cost) from the calories gained from the resource (includes weight of resource in a set basket size). *Maximum transport distance* (MTD) is the maximum distance that the nMTQ should be carried, and is calculated by dividing the net maximum transport quantity by the transport cost. The maximum transport distance is the point at which the energy expended collecting and transporting the resource equals the amount of energy gained. To go any further would result in a loss. Assumptions made in the Jones-Madsen model are an average grade of 3 percent, a walking rate of 3 km/ hr, and a terrain coefficient of 1.5 (heavy brush). They

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also assume that unburdened walking cost is 100 calories / km and the energy cost to carry 1 kg of resource is 1.25 calories / km.

Most criticisms of the Jones-Madsen model (Brannan 1992; Rhode 1990) have focused on the unrealistic results that occur. Transport distances such as 812 km for pinyon nuts or 664 km for bulrush seeds is far beyond what any ethnographic account has recorded. Brannan (1992:56) argues that the Jones-Madsen model has four shortcomings that should be accounted for: (1) it holds gradient and terrain constant, (2) it incorrectly assess the relationship between weight carried and the caloric cost of transporting that weight, (3) it fails to take travel to the resource into account, and (4) it does not provide symbolic equations independent of specific numerical values. Brannan's model utilizes the nMTQ, but also considers round trip costs (with and without a weight variable), various gradients, various terrain types, and an increase in caloric cost with increase in weight and different gradients. Brannan's model does not calculate maximum transport distance, but instead computes the final net caloric value that a resource holds after it has been transported to the place of consumption (presumably the residential base).

A more recent model by Madsen, Scott, and Loosle (2000:21) argues that the return rate of a resource from a distant location must be greater or equal to the return rate of local resources in order for it to "pull" hunters to procure game extralocally. By listing the average return rates of selected lowland resources (flora and fauna) in the Great Basin, and comparing the return rate of transporting 25 kg of deer or sheep 10, 20, and 30 km, they illustrate the impact distance can have on the viability of transporting meat. At 10 km from a lowland residential base, the average return rate of the deer/sheep is still well above most lowland resources. At 20 km it is somewhat in the middle, and at 30 km the energy gained from the deer/sheep has fallen below all local fauna, though it still remains above most local plants. Calculations of differential transport costs from the canyon mouths at both the north and south slopes of the Uinta Mountains have led them to suggest that most of the sites surveyed in the Fox Lake Basin (which are within close proximity to Deadman Lake) were created by logistical hunters traveling from the north (Madsen et al. 2000: 23).

A Maximum Transport Distance Model for Deadman Lake

The final part of this thesis, is concerned with predicting where residential bases (or central places) should be located based two interrelated factors: (1) how far a hunter should be willing to transport a resource back to a residential base from Deadman Lake and (2) the elevational extent of economic plant species on the Uinta Mountains. The latter should determine where women were willing to settle based on their own subsistence tasks. None of the models presented thus far have fit exactly to the needs of this

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research question, especially to account for terrain as varied as the Uinta Mountains. The first half of this model combines the positive attributes of the Jones-Madsen model (1989) and the Brannan model (1992) to determine how far a hunter will transport large game, but is independent of the resource return rate at the residential camp. The second half of the model will be a reiteration of Rhode's (1990) model to see if the MTD (or male economic sphere) reaches the Chenopodium zone (or the female economic sphere). Chenopodium was chosen because it is ubiquitous in macrobotanical assemblages at mid-elevation Fremont sites.

This model retains the Jones-Madsen concept of maximum transport distance (MTD) but uses Brannan's model for transport costs (TC) so that variability in terrain type, terrain grades, and round trip costs can be considered. Once calculated, the model will be tested to see if any Fremont period sites exist within the MTD. Maximum transport distance is calculated here as,

$$MTD = ARR/TC$$

where,

MTD= maximum transport distance (Jones and Madsen 1989)
ARR= average return rate of a resource (Madsen et al. 2000)
TC= transport cost
t= terrain coefficient (Brannan 1992; Figure 6.1, Table 2)
K= calories expended walking to resource (Brannan 1992; Figure 6.1, Table 1)
L= calories expended walking from resource (Brannan 1992; Figure 6.1, Table 1)
x= weight of resource being transported
y= percent increase based on gradient (Brannan 1992; Figure 6.1, Table 3)
w= percent increase in caloric cost ($x \div 10 \cdot y$)
f= frequency of occurrence

ARR is used in lieu of nMTQ from the Jones-Madsen model. Exact terrain conditions for every kilometer traveled were unknown, so an average terrain coefficient (t) of 1.2 was assumed as an average condition somewhere between heavy brush and alpine tundra. The weight of the sheep/deer (x) was estimated at 45 kg of meat and hide (about 40 percent of the average weight of a mountain sheep). The hide was included because of ethnographic accounts, which record the Southern Paiute butchering the animal, piling the flesh on the hide, tying the four legs together, and transporting the entire package on their backs. If the deer was too heavy to carry at once, the hind quarters and hide were taken first and the remainder was suspended in a tree until the hunter could return for it (Kelly 1964:49). The calories expended walking to and from the hunting locale (K,L) do not account for any weight in addition to body weight.

In order to calculate an *average* caloric cost per kilometer for each gradient (needed for the Jones-

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Caloric Cost per Kilometer of Walking at a Rate of 3 Kilometers per Hour at Various Gradients

Percent Grade	Log_{10}H	Cal/Km
-40	0.6452	88.4
-35	0.5838	76.8
-30	0.5615	72.6
-25	0.5389	69.2
-20	0.4771	60.0
-15	0.2976	39.6
-10	0.2635	36.6
-5	0.2986	39.8
0	0.4030	50.6
5	0.5766	75.4
10	0.7606	115.2
15	0.8459	140.2
20	0.9279	169.4
25	1.0060	202.8
30	1.0790	239.8
35	1.1480	281.2
40	1.2110	325.2

Source: Formulas Given by McDonald (1961)

Table 1 (from Brannan 1992)

Estimated Increase in Caloric Cost (Percent) with 10-Kilogram Increase in Weight Carried at Various Gradients

Percent Grade	Percent Increase in Caloric Cost (y)
-40	8.00
-35	8.00
-30	8.00
-25	8.00
-20	8.00
-15	8.00
-10	8.00
-5	8.00
0	8.00
5	9.75
10	11.50
15	15.00
20	18.50
25	22.00
30	25.50
35	28.50
40	31.50

Source: McDonald (1961)
Note: Estimates assume a walking rate of 3 km per hour and a male subject of average size. Because the influence of weight on caloric cost at negative gradients is unknown, 8% is an estimate only.

Table 3 (from Brannan 1992)

Coefficients for Cost of Travel on Different Types of Terrain

Terrain Type	Coefficient
Paved Road	1.0
Dirt Road	1.1
Light Brush	1.2
Heavy Brush	1.5
Swampy Bog	1.8
Loose Sand	2.1

Sources: Soule and Goldman (1972); McArdle, Katch, and Katch (1984)
Table 2 (from Brannan 1992)

Figure 6.1. Formulea for calculating transport costs

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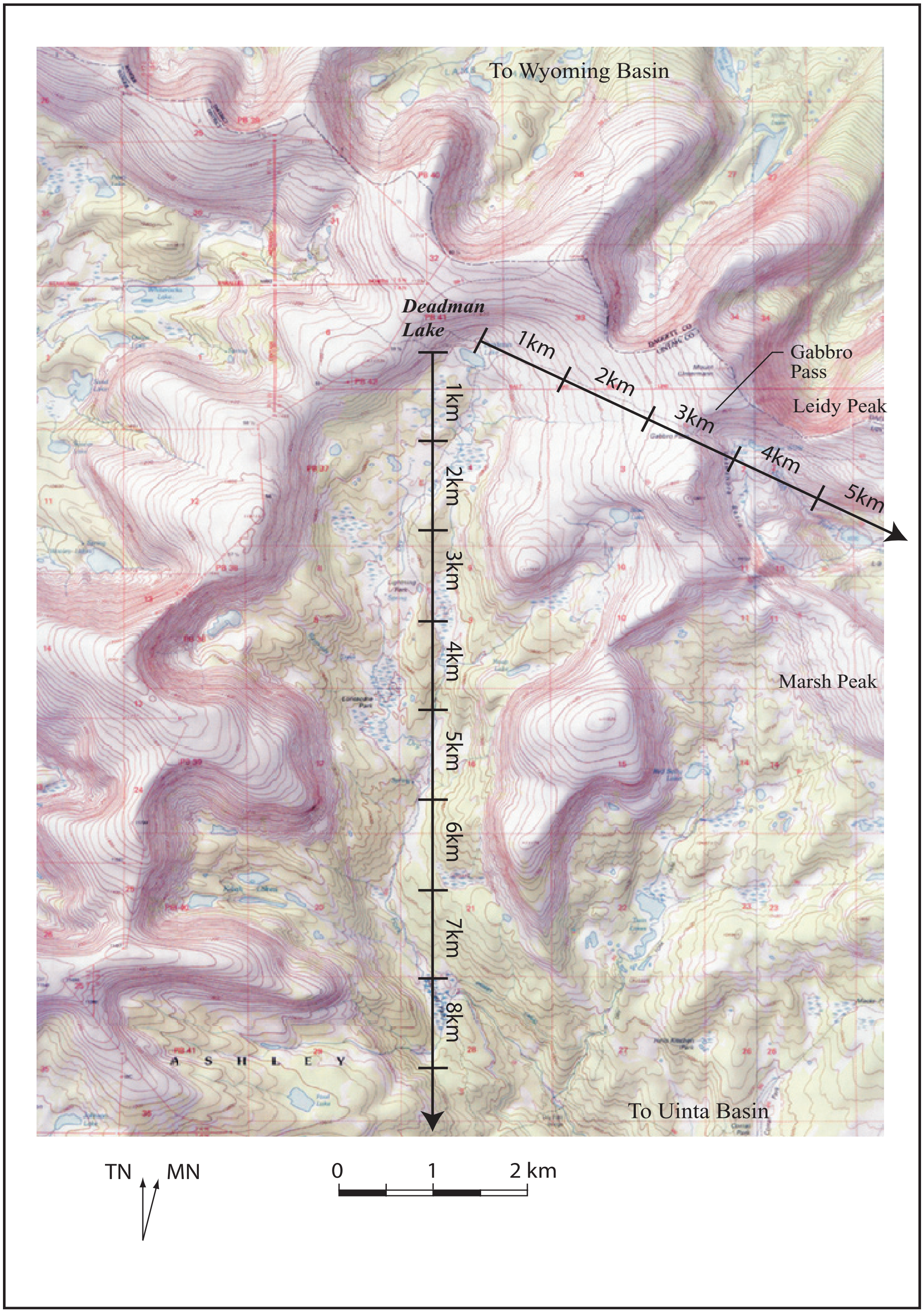

Figure 6.2. Southeastern, southern, and northeastern routes from Deadman Lake. Gradients were calculated for each kilometer.

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From DML traveling southeast				**From DML traveling south**			
Km	Elevation (m)	Gradient	Direction	Km	Elevation (m)	Gradient	Direction
1	3350-3450	10%	up	1	3350-3275	7.5%	dn
2	3450-3525	7.5%	up	2	3275-3250	2.5%	dn
3	3525-3500	2.5%	dn	3	3250-3225	2.5%	dn
4	3500-3350	15%	dn	4	3225-3150	7.5%	dn
5	3350-3300	5%	dn	5	3150-3150	0.0%	
6	3300-3250	5%	dn	6	3150-3100	5.0%	dn
7	3250-3225	2.5%	dn	7	3100-3100	0.0%	
8	3225-3200	2.5%	dn	8	3100-3150	5.0%	up
9	3200-3175	2.5%	dn	9	3150-3150	0.0%	
10	3175-3150	2.5%	dn	10	3150-3125	2.5%	dn
11	3150-3125	2.5%	dn	11	3125-3025	10.0%	dn
12	3125-3100	2.5%	dn	12	3025-3050	2.5%	up
13	3100-3075	2.5%	dn	13	3050-3000	5.0%	dn
14	3075-3100	2.5%	up	14	3000-2950	5.0%	dn
15	3100-3100	0%		15	2950-2900	5.0%	dn
16	3100-3050	5%	dn	16	2900-2600	30.0%	dn
17	3050-3000	5%	dn	17	2600-2750	15.0%	up
18	3000-3075	7.5%	up	18	2750-2650	10.0%	dn
19	3075-3050	2.5%	dn	19	2650-2600	5.0%	dn
20	3050-2950	10%	dn	20	2600-2550	15.0%	dn

Table 6.1. Gradients from Deadman Lake on Southeastern and Southern Routes

Madsen model), three straight lines were drawn from Deadman Lake, one southeast, one northeast, and one due south (Figure 6.2). Each line was divided into kilometers, and gradients were calculated for each kilometer traveled on that line for 20 kilometers (Table 6.1). Twenty kilometers was chosen because it is the distance suggested by the Madsen-Scott-Loosle model to be the point at which deer/mountain sheep transported from the alpine zone are ranked in the middle of a lowland resource list. At 30 km the deer/mountain sheep would rank lower than most lowland plant resources.

Transport costs (sensu Brannan 1992) were calculated as the total cost to travel to the alpine zone plus the total cost to return to the residential base with the resource.

$$\mathrm{TC} = \overset{\text{(to resource)}}{\Sigma\,(tK)f} \quad + \quad \overset{\text{(from resource- laden)}}{\Sigma\,(\,t[(wL) + L]\,)f}$$

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The energy cost for each kilometer to the site was added together and divided by 20 (the number of kilometers) to obtain the average expenditure of enegy. The same was done for travel from Deadman Lake. These numbers were then added together for the final transport cost. The transport cost was then divided by the ARR to calculate the MTD for that route.

Maximum Transport Distance Results

The result for a 20 km trip on the southeastern route is an average of 79.7 calories/km to travel to the resource and an average of 2,518.98 calories/km. to return to the residential base laden with 45 kg. It should be remembered that these numbers are specific to this particular route. Added together, the total transport cost is 2,599 calories expended. The average return rate for mountain sheep/deer (24,771 when consumed where captured; Madsen et al. 2000:22) was divided by the TC (2,599) for a MTD of 9.5 km. Additional calculations resulted in a MTD of 9.4 km for the northeastern route and a MTD of 11.6 km for the southern route.

Residential Camps on the Slopes of the Uinta Mountains

As defined here, residential sites left by Fremont farmers should contain a shelter, ceramics, maize, storage pits, and/or groundstone. If residential sites are found within the calculated MTDs, this study has shown that calculating a maximum transport distance from a timberline site is one possible way to model settlement-subsistence strategies in the high country. This model would be especially fruitful for understanding "up-down" mobility systems. If residential sites cannot be located, or if they are located well outside the MTD, it may be that MTD is not an appropriate method for calculating transport costs from timberline ecotones. In other words, it is possible that the energy expended to access and return from the upper montane areas would be greater than the caloric returns gained from the resource. However, this does not mean that hunters did not use the timberline, it only suggests that currencies other than caloric return were important enough to encourage people to travel farther than current models allow.

A search query was entered into an ANF Geographical Information System (GIS) database in order to locate all sites with groundstone and/or ceramics within a 20 km radius of Deadman Lake. Concentric circles at 10 km and 20 km radiating from Deadman Lake were drawn, and all relevant sites within these distances were plotted. Although there were many sites recorded along these routes (mostly lithic scatters), there were no ceramic nor groundstone sites within the MTDs (Figure 6.3). The southern route has been

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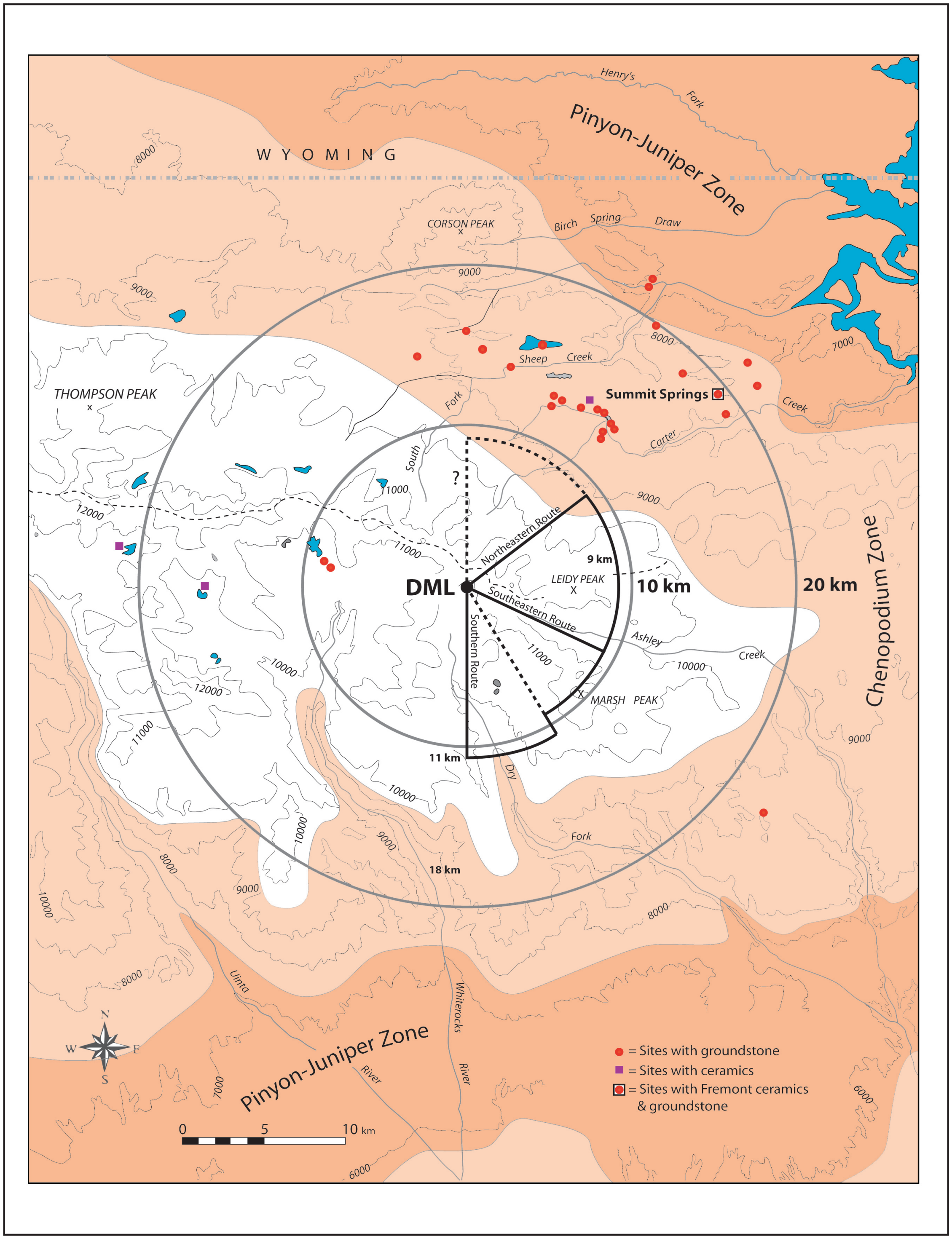

Figure 6.3. Map of eastern Uinta Mountains showing sites with groundstone and/or Fremont ceramics, vegetation zones, and maximum transport distance from Deadman Lake.

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surveyed by ANF archaeologists, and thus it is likely that the lack of groundstone/ceramic sites along this route accurately represents reality. However the southeastern route has not been extensively surveyed. Therefore, future surveys may encounter ceramic or groundstone sites within this region. Four sites with Uinta Gray ceramics and 26 sites with groundstone were plotted on the map to the north and west of the site. Summit Springs (42Da545) rockshelter is the only site that can thus far be interpreted as a residential site. Excavations revealed Fremont ceramics, groundstone, storage pits, extensive faunal remains, and maize. Summit Springs is just barely within the 20 km range but well outside the MTD calculated in this thesis. Madsen et al (2000) argue that at 20 km of the alpine zone, 25 kg of deer or mountain sheep meat transported to a residential site on the north slope will still be higher ranked than most locally available vegetation. However, it is unclear if the Madsen-Scott-Loosle model accounted for variations in land gradients. In addition, the model presented here was calculated with 45 kg, thus lessening the distance one could travel efficiently.

Problems with assumptions made in the model may be influencing the results. For example, reducing the weight of the resource would increase the travel distance. Or, the model could be grossly underestimating how much a prehistoric hunter could carry. In other words, modern-day experiments may not be accurately reflecting the ability of prehistoric peoples to carry heavy loads and travel long distances at a lower expenditure of energy than ourselves. Also, the model does not include immeasurable currencies, such as prestige, that certainly influenced behavior and could extend the MTD well beyond what efficiency models allow.

Because women's tasks usually dictate where a residential camp is located (and when it should be relocated) a central place foraging model that measures mobility from the crest of the Uinta Mountains to the foothills must test for fitness with models that predict residential locations. In other words, a maximum transport distance is unrealistic if the maximum distance does not reach the minimum distance for a residential base. To reiterate what was stated earlier, Rhode (1990:417) argues that the profitability of a distance of a resource must be considered with the profitability of resources available locally, and that it is, "never profitable to transport distant resources that rank lower in return rate than local resources. A group may sometimes be better off residing in a resource patch with a relatively low return rate and using other resource patches with higher return rates on a logistical basis." Assuming that *Chenopodium* ranked lower than ungulates, it is expected that a residential camp at mid-elevations would not be located beyond this plant's maximum elevation. The *Chenopodium* zone for the eastern Uinta Mountains has been demarcated here at the maximum range of the genus, specifically the species *Chenopodium atrovirens*, which grows up

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to 2896 m. However, residential camps could feasibly be located much lower in elevation. The MTD range on the southeastern and southern routes does not extend to the *Chenopodium* zone. A portion of the MTD range on the northeastern route does. If the *Chenopodium* zone accurately reflects the maximum elevation for women's economic tasks, and by default the residential base, then transporting 45 kg of meat from Deadman Lake to this zone along the former two routes would not be efficient (based on the principal tenets of optimal foraging theory).

Even if future surveys locate residential sites on the southeastern route, it is likely that they will be in the *Chenopodium* zone. This would mean that men would have had to travel farther than the MTD allows for maximum efficiency. This is not to say that transporting game from the timberline was not done, only that the men would have operated at a caloric loss. Thus, currencies other than calories would have to have been the impetus for traveling that far. The northern route, on the other hand, is more promising. While the MTD barely reached the Cheno-am zone, it is clear that the north slope was a preferred region for settlement in the foothills. This suggests that currencies, such as fatty meat or prestige, may have had enough importance to push hunters to travel beyond their efficiency levels. Thus, the extent of the MTD into the Cheno-am zone and the clustering of sites on the north slope would argue, as was suggested by Madsen et al., that most logistical hunting at the crest of the Uinta Mountains originated from the north slope.

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Chapter 7

Conclusions

High elevation archaeological sites provide a unique insight into prehistoric human behavior that is still not well understood. The montane biotic system is a compression of resources in a short period of time, which required procurers of wild flora and fauna to schedule their movements to coordinate with the most optimal period. However, not all collectors of wilds resources were able to utilize the high country in the same manner. Full-time hunter-gatherers are usually semi-nomadic, which allows them to make residential moves into the alpine zone during periods of optimal resource abundance. Male horticulturists, as has been recorded in several ethnographies, are generally tethered to their fields from late spring until the fall. Thus, their window of opportunity for long distance travel is significantly shortened. This would not determine *if* they would use the alpine zone, but instead *when* they would use it. Rather than practicing a residential mobility strategy, as has been argued for the Colorado Rocky Mountains and the western Great Basin ranges, part-time farmers would have been more apt to establish residency at mid-elevations. This would allow them to reach the alpine zone logistically but also facilitated the collection of important plant resources close to a residential camp. As it was for farmer-hunters in the early 20th century, mid-elevation residential camps were likely established within 30-40 km of the summer residence where the major store of corn was cached. In addition, farmers with stores of maize should have transported at least some of their cache to the mid-elevations, decreasing the risk associated with moving a residential camp.

It has also been argued that the nutritional needs of full-time hunter-gatherers and farmers were different in that farmers acquired carbohydrates (necessary in a lean meat diet) from maize while hunter-gatherers would receive these important nutrients through the consumption of geophyte plants, such as roots and tubers, and pine nuts. Because no archaeological evidence thus far has pointed to the prehistoric use of pine nuts on the ANF, it is proposed that full-time hunter-gatherers acquired their carbohydrates from geophytes. Trade between different economic groups was also possible, but likely not enough to preclude the collection of wild carbohydrate-rich plants. During the climax of the alpine growing season, May to August, tubers can be found from 2134 m to the alpine ecotone. Since women were traditionally the procurers of geophytes, it stands to reason that full-time hunting and gathering parties in the alpine zone would have included family groups in the summer.

The six excavated areas at Deadman Lake illustrate a use of the high country that is different than what has been recorded in Colorado and the western Great Basin. Some of the features at Deadman Lake

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validate at least part of the hypothesis stated at the beginning of this thesis: farmer-hunters would occupy the alpine zone logistically in the fall. All three of the Fremont period features (Structure 1, Structure 3, Hearth 1, and possibly Excavation Area 3) are logistical sites. The historic Numic site recorded at Deadman Lake may have been a residential camp, but the small amount refuse and lack of evidence for intensive plant processing argues for a short occupation. Structure 2 (A.D. 1850) and Hearth 1 (A.D. 665) contained plant remains that would have been available in the late summer to fall. Structure 1 (A.D. 405) and Structure 3 (A.D. 670) contain plant remains that were transported from lower elevations, but the season cannot be defined unequivocally.

Because the Fremont period sites are logistical, it stands to reason that the residential camp must be located elsewhere. Simply put, central place foraging models are efficiency models that compare caloric expenditure to caloric gain. A maximum transport distance model (MTD) was applied to the Deadman Lake site to determine how far a male hunter could travel before he would be operating at a caloric loss. However, it was also argued that this model is irrelevant without also understanding where a residential camp should be located based on women's economic tasks, established here at the Chenopodium zone. Thus, the maximum extent of the male logistical zone must reach the female logistical zone, or the efficiency model is invalidated. Two of the routes projecting from Deadman Lake did not reach the Chenopodium zone, while the third (the northeast route) barely extended into the uppermost reaches. For this reason it is argued that efficiency models may not be the most appropriate models to use for studying prehistoric logistical mobility between alpine and mid-elevation sites. In other words, other currencies (such as prestige associated with large game) must be considered important mechanisms for travel beyond that which is physically efficient.

Sites plotted within a 20 km radius of Deadman Lake revealed another interesting trend. While there is some bias because of a lack of extensive survey on the eastern slopes of the Uinta Mountains, the current map shows an agglomeration of ceramic and groundstone sites on the north slope within close proximity of the Green River. Many sites excavated on the north slope have been argued (Loosle 2002b: 22-23) as fall occupations by Fremont farmers. Summit Springs was clearly occupied by Fremont farmers who were also hunting mountain sheep, elk, and deer. In fact, 77 percent of the total faunal assemblage represents the hunting of bighorn sheep (Johnson and Loosle 2002a: 96). The overall assemblage also suggests that the entire carcass was being processed at the site. The adjacent grassy slopes, rocky escarpments, and canyons make the Summit Springs site good bighorn sheep habitat. In fact, bighorn sheep that were reintroduced to the Uinta Mountains have been observed at 2500 m on the north slope during the summer. However, the botanical assemblage from Summit Springs argues for a fall occupation and, as it was argued earlier,

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mountain sheep and deer should have preferred the south slopes to the north slopes in the fall and winter. Therefore, the presence of mountain sheep and deer bone at Summit Springs questions if (1) mountain sheep will tolerate living on the north slope in the fall and winter, thus implying that they were procured locally, or (2) hunters were transporting the entire animal from the upper mountains or other slopes. The southeast slope should be more conducive to a local procurement of mountain sheep traveling down slope in the fall. Thus, I suspect that more survey and excavation on the southeast slope of the Uinta Mountains will reveal Fremont period residential sites similar to Summit Springs.

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Appendix 1

Record of Excavation

Appendix A1.1 Features

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Feature Position			Grid Location	Description	Feature Position			Grid Location	Description
	in	in				in	in		
F1				Structure 1	F29	F58		1N 7E	General fill outside structure
F2				Area 2	F30	F3		5N 5E	Test pit from 2001
F3				Excavation Area 3	F31	F3		5N 5E	Charcoal stains, Level 1
F4				Area 4	F32	F3		5N 5E	Charcoal stains, Level 2
F5				Area 5	F33	F3		5N 5E	Charcoal stains, Level 3
F6				Area 6	F34	F3		5N 5E	Charcoal stains, Level 4
F7				Area 7	F35	F3		50N 49E	Charcoal stain, Level 1
F8				Knapping Station 1	F36	F8		50N 49E	Charcoal stain, Level 2
F9				Area 9	F37	F8		50N 50E	Charcoal stain, Level 3
F10				Area 10	F38	F8		50N 51E	Charcoal stain, Level 4
F11				Area 11	F39	F8		49N 51E	Charcoal stains
F12				Structure 2	F40	F17		1N4E-3N4E	Orange contact level
F13				Area 13	F41	F17		1N4E-3N4E	Floor
F14				Area 14	F42	F17		1N 4E	Charcoal stain
F15				Area 15	F43	F12		1N 4E	Charcoal stain
F16				Area 16	F44	F12			Arc of stains on floor
F17				Structure 3	F45	F12			Postmolds
F20	F1		5N 5NE	Charcoal stain	F50	F58		1N 7E	Charcoal stain at 88cmbd
F21	F1		5N 5NE	Floor	F51	F50	F58	1N 7E	Surface of F50
F22	F1			General fill	F52	F51	F58	1N 7E	0-2 cm below F51
F23	F21	F1		Fill above floor	F53	F58		1N 7E	Charcoal stain at 92cmbd
F24	F21	F1	5N 6E	Charcoal stain (posthole?)	F54	F1		6N 6E	Charcoal stains at floor
F25	F21	F1	5N 6E	Charcoal stain	F55	F1		6N 6E	Charred wood
F26	F1		5N6E-5N7E	Charcoal lens on north wall	F56	F58		1N 7E	Charred wood
F27	F1		5N 7E	Charcoal stain	F57	F41	F17	3N 4E	Charcoal stains
F28	F1		5N 7E	Charcoal stain	F58			1N 7E	Hearth 1

Table A1.1. List of Features from 42Un2331

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Appendix A1.2 On-site Flotation from 42Un2331

Date	Flotation #	Provenience	Depth	Volume	Observations
7/23/02	1	1N4E/ F17	20-23	1 gal	Soil was heavily clumped with roots
	2	1N4E/ F17	20-23	1 gal	Soil was heavily clumped with roots
7/24/02	3	1N4E/ F17	20-23	1 gal	prescreened 1/16” screen
	4	1N4E/ F17	20-23	1 gal	prescreened 1/16” screen
	5	3N4E/F41 in F17	25-30	1 gal	bag missing
7/25/02	6	5N5E/ F23 in F1	55-57	1 gal	not prescreened, a lot of gravel
	7	5N5E/ F23 in F1	55-57	1 gal	not prescreened, a lot of gravel
	8	5N5E/ F23 in F1	55-57	1 gal	not prescreened, a lot of gravel
	9	2N4E/ F17	25-27	1 gal	prescreened 1/16” screen
	10	2N4E/F17	25-27	1 gal	prescreened 1/16” screen
	11	5N6E/ F23 in F1	72-75	1 gal	prescreened 1/16” screen
	12	5N6E/ F23 in F1	72-75	1 gal	prescreened 1/16” screen
	13	3N4E, F41 in F17	25-30	1 gal	prescreened 1/16” screen
	14	3N4E, F41 in F17	25-30	1 gal	prescreened 1/16” screen
	15	3N4E, F41 in F17	25-30	1 gal	prescreened 1/16” screen
	16	3N4E, F41 in F17	25-30	1 gal	prescreened 1/16” screen
	17	5N5E/ F23 in F1	55-57	1 gal	not prescreened, a lot of gravel
8/13/02	18	2N4E/ F17	25-27	1 gal	prescreened 1/16” screen
8/14/02	19	5N6E/ F23 in F1	72-75	1 gal	prescreened 1/16” screen
	20	5N8E/F23 in F1	77-79	1 gal	prescreened 1/16” screen
	21	5N8E/F23 in F1	77-79	1 gal	prescreened 1/16” screen
	22	5N8E/F23 in F1	77-79	1 gal	prescreened 1/16” screen
	23	5N6E/ F23 in F1	72-75	1 gal	prescreened 1/16” screen
	24	5N8E/F23 in F1	77-79	1 gal	prescreened 1/16” screen
	25	5N9E/F23 in F1	77-79	1 gal	prescreened 1/16” screen
	26	5N9E/F23 in F1	77-79	1 gal	prescreened 1/16” screen
	27	5N9E/F23 in F1	77-79	1 gal	prescreened 1/16” screen
	28	5N9E/F23 in F1	77-79	1 gal	prescreened 1/16” screen
8/15/02	29	51N50E/F8	40-43	1 gal	prescreened 1/16” screen
	30	51N50E/F8	40-43	1 gal	prescreened 1/16” screen
	31	51N50E/F8	40-43	1 gal	prescreened 1/16” screen
	32	51N50E/F8	40-43	1 gal	prescreened 1/16” screen

Table A1.2. Manual Flotation Record for 42Un2331 (List does not include samples floated by Paleo Research)

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Date	Flotation #	Provenience	Depth	Volume	Observations
	33	50N50E/F8	40-43	1 gal	prescreened 1/16” screen
	34	50N50E/F8	40-43	1 gal	prescreened 1/16” screen
	35	50N50E/F8	40-43	1 gal	prescreened 1/16” screen
	36	50N50E/F8	40-43	1 gal	prescreened 1/16” screen
	37	1N7E/F52 in F58	88-90	1 gal	prescreened 1/16” screen
	38	1N7E/F52 in F58	88-90	1 gal	prescreened 1/16” screen
	39	2E1N/F44 in F12	21-23	1 gal	prescreened 1/16” screen
	40	2N1E/F44 in F12	21-27	1 gal	prescreened 1/16” screen
	41	2N4E/F17	25-27	1 gal	prescreened 1/16” screen
	42	2N2E/F44 in F12	24-26	1 gal	prescreened 1/16” screen
	43	6N6E/F23 in F1	63-66	1 gal	prescreened 1/16” screen
	44	6N6E/F23 in F1	63-66	1 gal	prescreened 1/16” screen
	45	6N6E/F23 in F1	63-66	1 gal	prescreened 1/16” screen
	46	6N6E/F23 in F1	63-66	1 gal	prescreened 1/16” screen
11/20/02	47	3N4E/F40 in F17	25-30	1 gal	FS37/ Machine Flotation*
	48	51N50E/F8	38-42	1 gal	FS139/Machine Flotation
	49	50N50E/F8	41-43	1 gal	FS140/Machine Flotation
	50	2N4E/F40 in F17	27-33	1 gal	FS43/Machine Flotation
	51	2N4E/F17	25-27	1 gal	FS10/Machine Flotation
	52	?/F40 in F17	33-37	1 gal	FS42/Machine Flotation
	53	1N4E/F17	20-23	1 gal	FS9/Machine Flotation
	54	5N9E/F23 in F1	77-79	1 gal	FS134/Machine Flotation
	55	5N8E/F23 in F1	77-79	1 gal	FS120/Machine Flotation
	56	5N7E/F26 in F1	75-78	1 gal	FS38/Machine Flotation
	57	5N7E/F26 in F1	75-78	1 gal	FS40/Machine Flotation

* All machine floation not sent to Paleo Research was performed at Brigham Young University. Flotation samples sent to Paleo Research are not included in this list.

Table A1.2. Manual Flotation Record for 42Un2331(cont.).

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Appendix 2
Material Culture

Appendix 2.1 Petrographic Analysis for 42Un2331

PETROGRAPHIC ANALYSIS OF SELECTED CERAMICS AND ONE FIGURINE FRAGMENT FROM THE ASHLEY NATIONAL FOREST, NORTHEASTERN UTAH

David V. Hill

INTRODUCTION

A sample of sixteen ceramic sherds and one figurine fragment were submitted for petrogrphic analysis. The ceramic sample represent examples of prehistoric Fremont and historic Numic potters recovered from the Ashley National Forest. The sherds and figurine fragment were examined to identify the potential sources of raw materials that could possibly have been used to construct the vessel. This project will also substantively contribute to the existing database of petrographic analyses of ceramics from northeastern Utah.

METHODOLOGY

The sample of sixteen sherds attributable to Fremont and Numic ceramic industries, and a fragment of a Fremont style figurine were submitted for petrographic analysis by Clay Johnson an archaeologist with the Ashley National Forest. The ceramics and figurine fragment were analyzed by the author using a Nikon Optiphot-2 petrographic microscope. Analysis was conducted by examining the eighteen thin-sections and generating a brief description for each of the samples. The ceramic samples were then compared with one another to examine the number of potential sources of pottery present in the sample. The sizes of the inclusions present in the paste are described in terms of the Wentworth Scale, a standard method of characterizing particle sizes in sedimentology. The particle sizes were derived from measuring a series of ten grains using a graduated reticle built into one of the microscopes optics. The percentages of inclusions observed in the ceramic paste of the ceramic samples were estimated using comparative charts (Matthew et al. 1991; Terry and Chilingar 1955). Given the diversity of the inclusions that are present in ceramics, the comparative method for assessing the amount and size of materials found in ceramics has been found as useful for archaeological ceramic petrography as point counting (Mason 1995). Ideally, petrographic analysis should be conducted in conjunction with chemical analysis of ceramic pastes using techniques such as ICP-MS or INAA and the recovery and comparative study of potential raw materials used for pottery making.

ANALYSIS OF THE CERAMIC SAMPLE

FS 1-Site 42Un2331

The paste of this sherd is dark brown in color. About 15% of the paste contains silt to fine sized books of brown biotite. Also present in the paste are about 10% rounded fine-sized grains of quartz and untwinned alkali feldspar. Quartz accounts for about 75% of the rounded grains, with the untwinned alkali feldspars making up the rest of the rounded grains.

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Two very coarse-sized fragments of a well sorted sub-mature sandstone with brown clay cement are also present. Given the size of the isolated rounded grains of quartz and alkali feldspar present in the ceramic paste, it is likely that these grains were derived from the sandstone present. It is thus likely that all of the inclusions observed in the paste of the current sample were naturally present in the clay used in forming the parent vessel.

FS 67-Site 42Un2331

The paste of this sherd ranges from a very dark brown to an opaque black color. The paste contains about 3% very fine brown biotite. The paste also contains rounded to sub-angular isolated mineral grains, predominately quartz. A trace amount of untwinned alkali feldspar is also present. These mineral grains account for about 30% of the ceramic paste.

A single medium sized grain of very fine grained well sorted quartz arenite sandstone is also present in the paste of this sherd.

DISCUSSION OF THE PETROGRAPHIC SAMPLE

Sample 134.1 from Site 42Da1005 is characterized by a silty paste with few sandy inclusions and displaying fragments of original soil structure, indicating poor clay preparation. Fine to medium sized angular voids are all that is left from where the original temper particles have leached. Leaching of temper particles in Fremont ceramics has been reported previously through petrographic analysis from 42Da791 (Hill 2002). What was originally contained within these angular voids is currently unknown.

Sample 1 from Site 42Un2331 was constructed using a clay that contained a sub-mature clay cemented sandstone. The coarse sized sandstone fragments are missing from Sample 67 from this same site. The feldspars display a slightly greater degree of weathering in Sample 67 than in Sample 1 indicating that these two sherds represent vessels that were made using slightly different ceramic resources or is indicative of the local variation within the source of the raw materials. The sources of the variation in the pastes of these sherds cannot be address, without sampling and analysis of local ceramic resources. Regardless, of the source of the sandstone, these two sherds from 42Un2331 indicate a potential new local variation of Unita Grayware.

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Appendix 2.2 Obsidian Analysis for 42Un2331

Geochemical Research Laboratory Letter Report 2003-5

January 18, 2003

Mr. Clay Johnson
Archaeological Technician
Ashley National Forest
355 North Vernal Avenue
Vernal, Utah 84078

Dear Clay:

The table below present x-ray fluorescence (xrf) data generated from the analysis of seven obsidian artifacts from seven different archaeological sites/localities within the Ashley National Forest, Utah. This research was conducted pursuant to your letter request of January 8, 2003.

Laboratory analysis conditions, artifact-to-source (geochemical type) attribution procedures, measurement resolution limits for each element, and literature references applicable to these samples follow those I reported last year for obsidian from 42Da545 and 45Da791 (Hughes 2000).

Trace and Selected Minor Element Concentrations

Cat. Number	Zn	Ga	Rb	Sr	Y	Zr	Nb	Ba	Ti	Mn	$Fe_2O_3^T$	Obsidian Source (Chemical Type)
42Da390, FS# X3	45 ±6	14 ±3	119 ±4	69 ±3	29 ±3	86 ±4	11 ±3	1660 ±15	nm	nm	nm	Malad, Idaho
42Da963, FS# X2	45 ±7	20 ±3	113 ±4	66 ±3	27 ±3	81 ±4	9 ±3	1614 ±18	nm	nm	nm	Malad, Idaho
42Da1253, FS# X1	50 ±7	12 ±3	118 ±4	70 ±3	27 ±3	82 ±4	12 ±3	1573 ±20	nm	nm	nm	Malad, Idaho
42Dc1424, FS# 110	55 ±7	14 ±4	262 ±5	11 ±3	53 ±3	97 ±4	27 ±3	0 ±12	456 ±17	473 ±12	.95 ±.10	Black Rock area, Utah
42Un2331, FS # 6	44 ±7	18 ±3	182 ±5	37 ±3	19 ±3	103 ±4	21 ±3	151 ±14	nm	nm	nm	Wild Horse Cnyn., Utah
Red Canyon, FS# X4	55 ±7	17 ±4	287 ±5	9 ±3	56 ±4	100 ±4	31 ±3	0 ±15	404 ±17	440 ±12	.91 ±.10	Black Rock area, Utah
Round Park 4, FS# X5	44 ±5	13 ±3	113 ±4	64 ±3	27 ±3	83 ±4	12 ±3	1596 ±14	nm	nm	nm	Malad, Idaho

Values in parts per million (ppm) or, for total iron, weight percent (%) composition; ± = expression of x-ray counting uncertainty and regression fitting error at 300 and 600 (*) seconds livetime. nm= not measured.

Of seven specimens analyzed, xrf data indicate that four have the same trace element profile as obsidian of the Malad, Idaho, chemical type, two others conform to the Black Rock area, Utah, chemical signature, while one specimen has the same trace element fingerprint as Wild Horse Canyon (Mineral Mountains), Utah, volcanic glass.

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I hope this information will help in your analysis of these site materials. Please contact me at my laboratory ([650] 851-1410; e-mail: rehughes@silcon.com) if I can be of further assistance.

Sincerely,
Richard Hughes
Richard E. Hughes, Ph.D.
Director, Geochemical Research Laboratory

encl.

REFERENCE

Hughes, Richard E.
2000 X-Ray Fluorescence Analysis of Artifacts from Two Archaeological Sites (42DA545 and 42DA791) on the North Slope of the Uinta Mountains, Northeastern Utah. Geochemical Research Laboratory Letter Report 2000-53 submitted to Clay Johnson, Ashley National Forest, June 26, 2000.

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Appendix 3
Botanical Analysis

Appendix A3.1 Uinta Mountain Timberline Flora
Plants that grow at 10,000ft and higher in the Ashley National Forest

f = food
m = medicinal
i= ideological (hunting luck, ceremonies, etc.)

Family	Scientific Name	Common Name	Range
Apiaceae	*Angelica roseana* (m,f)	Angelica	10-11,700
	Oreoxis alpine	Oreoxis	10-10,800
	Osmorhiza depauperata (m)	Sweetroot	10,600
	Achillea millefolium (m)	Yarrow	6-11,000
Asteraceae	*Agoseris dasycephala* (m?)	Mountain dandelion	10,600-11,000
	Antennaria alpina (m)	Pussytoes	10,200-11,500
	Antennaria umbrinella (m)	Pussytoes	11,000
	Arnica cordifolia (m)	Arnica	7,200-11,000
	Arnica latifolia (m)	Arnica	9,500-11,100
	Arnica longfolia (m)	Arnica	10,800-11,000
	Arnica rydbergii (m)	Arnica	10-11,000
	Artemesia norvegica	Mountain Sagewort	11,000
	Artemesia scopulorum	Prairie Sagewort	10,500-13,000
	Aster engelmannii	Aster	8,200-10,600
	Chaenactis alpina (m)	Dusty-maiden;False Yarrow	11,200-11,600
	Cirsium eatonii (*)	Thistle	10,600-11,000
	Cirsium murdockii	Thistle	9,800-11,400
	Erigeron acris	Fleabane; Daisy	11,400
	Erigeron caespitosus	Fleabane; Daisy	8,600-13,000
	Erigeron compositus	Fleabane; Daisy	7,800-13,000
	Erigeron leiomerus	Fleabane; Daisy	9,200-12,000
	Haplopappus clementis	Goldenweed	9-10,700
	Hieracium gracile	Hawkweed	10-11,000
	Senecio atratus	Groundsel	9,600-10,600
	Senecio crassulus	Groundsel	9,700-10,600
	Senecio fremontii	Groundsel	9,950-13,000
	Senecio integerrimus	Groundsel	7,200-11,000
	Senecio multilobatus	Groundsel	5,700-11,200
	Senecio sphaerocephalus	Groundsel	7,600-10,500
	Senecio streptanthifolius (m)	Groundsel	7,600-11,200
	Senecio triangularis	Groundsel	7,600-11,000
	Solidago mulitradiata (m)	Goldenrod	8,600-11,600
	Solidago parryi	Goldenrod	8,500-11,600
	Taraxacum lyratum (f,m)	Dandelion	10,600-13,000
	Townsendia montana	Townsendia	10-10,200

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Berberidaceae	*Betula glandulosa*	Dwarf Birch	9-11,000
Boraginaceae	*Mertensia fusiformis*	Bluebells	6-10,650
Brassicaceae	*Arabis drummondii*	Rockcress	7,600-11,000
	Descurainia richardsonii	Tansymustard	7-10,500
	Draba cana	Whitlow-grass; Draba	10,600-12,000
	Draba crassa	Whitlow-grass; Draba	12,450
	Draba crassifolia	Whitlow-grass;Draba	9,600-11,500
	Draba rectifructa	Whitlow-grass;Draba	7-10,500
	Draba ventosa	Whitlow-grass;Draba	10,900
	Erysimum asperum (m)	Wallflower	5-11,300
	Lesquerella utahensis	Bladderpod	8,400-10,800
	Rorippa curvipes (*)	Cress;Yellowcress	8-11,000
	Smelowskia calycina	Smelowskia	9,700-13,000
	Thlaspi montanum	Pennycress;Stinkweed	7,300-12,500
Callitrichaceae	*Callitriche palustris*	Water starwort	7,100-10,500
Campanulaceae	*Campanula rotundifolia* (i)	Bellflower;Harebell	7,500-11,500
Caprifoliaceae	*Sambucus racemosa* (f,m)	Black Elderberry	8-10,500
Caryophyllaceae	*Arenaria congesta*	Sandwort	7-11,500
	Arenaria filiorum	Sandwort	10,500-11,000
	Arenaria nuttallii	Sandwort	11,300
	Lychnis drummondii	Campion	7,200-11,200
	Sagina saginoides	Pearlwort	8,100-13,000
	Silene menziesii	Campion;Wild Pink;Silene	7-10,400
	Stellaria calycantha (f)	Starwort;Chickweed	7,300-10,300
	Stellaria jamesiana (f)	Starwort;Chickweed	6,800-10,600
	Stellaria longpipes (f)	Starwort;Chickweed	7-11,400
	Stellaria umbellata (f)	Starwort;Chickweed	9-11,400
Celastraceae	*Pachistima myrsinites* (m)	Mountain Boxwood	7-10,400
Chenopodiaceae	*Monolepis nuttalliana*	Monolepis;Povertyweed	5-10,400
Cornaceae	*Sedum rhodanthum*	Rosecrown	9,700-11,800
Cupressaceae	*Juniperus communis* (m,i)	Juniper	7-11,000
Cyperaceae	*Carex albonigra*	Sedge	11,000
	Carex aquatilis	Sedge	7-12,000
	Carex erecta	Sedge	7,500-12,700
	Carex bipartita	Sedge	12-12,700
	Carex breweri	Sedge	11-12,100
	Carex dioica	Sedge	8,200-10,400
	Carex illota	Sedge	9,500-11,500
	Carex lenticularis	Sedge	7-11,000
	Carex leporinella	Sedge	9-10,200
	Carex microptera	Sedge	7,200-11,200
	Carex misandra	Sedge	11,500-12,800
	Carex muricata	Sedge	8,100-10,400
	Carex nigricans	Sedge	9-11,100
	Carex nova	Sedge	9,160-12,100
	Carex pauperula	Sedge	9-10,400
	Carex praeceptorum	Sedge	10,600-11,200
	Carex pyrenaica	Sedge	12-12,100
	Carex saxatilis	Sedge	9-12,500
	Carex scirpodea	Sedge	10,300-13,000
	Carex stenophylla	Sedge	7-10,720

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	Carex straminiformis	Sedge	9-10,300
	Eleocharis acicularis	Spikerush	7,185-10,500
	Eleocharis palustris (f)	Spikerush	up to 10,500
	Eleocharis pauciflora	Spikerush	6,840-11,100
Elaeagnaceae	*Shepherdia canadensis* (f)	Buffaloberry	8,200-10,600
Ericaceae	*Ledum glandulosum* (m)	Trapper’s Tea	7,400-11,000
	Vaccinium caespitosum (f,m)	bberry,hberry,blberry,wberry	10,500-12,000
Fabaceae	*Lupinus rubricaulis*	Lupine	7-11,100
	Oxytropis deflexa	Sainfoin; Locoweed	9,240-11,300
	Oxytropis parryi	Sainfoin; Locoweed	10,200-11,300
	Trifolium dasyphyllum	Whiproot Clover	11-12,000
	Trifolium parryi	Whiproot Clover	9-12,000
Gentianaceae	*Frasera speciosa* (i,m)	Green Gentian	7,500-10,500
	Gentiana algida (m)	Gentian	10,200-13,000
	Gentiana calycosa (m)	Gentian	10-11,500
	Gentiana prostrata (m)	Gentian	9-11,600
	Gentianella amarella	Moench;Gentian	7,320-11,500
	Gentianella heterosepala	Moench;Gentian	7,400-10,650
Geraniaceae	*Geranium richardsonii* (m)	White Geranium	7,200-10,600
	Geranium viscosissimum (m)	Wild Geranium	7,200-10,400
Isoetaceae	*Isoetes bolanderi*	Quillwort	conifer/timberline
Junceceae	*Juncus castaneus*	Rush;Wiregrass	alpine
	Juncus drummondii	Rush;Wiregrass	9-11,400
	Juncus ensifolius	Rush;Wiregrass	7-10,500
	Juncus hallii	Rush;Wiregrass	9,700-11,000
	Juncus longistylis	Rush;Wiregrass	5,300-11,000
	Juncus mertensianus	Rush;Wiregrass	8-11,400
	Juncus parryi	Rush;Wiregrass	9,800-11,000
	Juncus triglumus	Rush;Wiregrass	9,200-12,500
	Luzula campestris	Woodrush	8-11,000
	Luzula parviflora	Woodrush	7,500-11,400
	Luzula spicata	Woodrush	10,400-12,500
Liliaceae	*Allium brandegei* (f)	Onion	7-10,600
	Allium brevistylum (f)	Onion	7,500-11,000
	Erythronium grandiflorum (f)	Dogtooth-violet	7,800-10,600
	Lloydia serotina	Alplily	11-12,500
	Smilacina stellata (f,m)	Solomon-plume	4,700-10,500
	Streptopus amplexifolius (f)	Twisted Stalk	7,300-10,600
	Veratrum californicum (*)	False Hellebore;Skunk Cabbage	7,500-11,000
Linaceae	*Linum kingii*	Flax	7,900-10,800
Nymphaeaceae	*Nuphar polysepalum* (f)	Cow-lily;Yellow Water-lily	9-11,000
Onagraceae	*Epilobium alpinum*	Willow-weed	10-11,340
	Epliobium angustifolium	Willow-weed	8-11,500
	Gayophytum racemosum	Groundsmoke	6-10,300
Papaveraceae	*Papaver radicatum*	Poppy	above 12,000
Pinaceae	*Pinus contorta* (f,m)	Lodgepole pine	8-10,500
	Picea engelmannii (m)	Engelman spruce	9-11,000
Plantaginaceae	*Plantago tweedyi* (*,m)	Plantain	above 8,000
Poaceae	*Agropyron scribneri* (f)	Wheatgrass	ridges/ timberline
	Agrostis humilis	Bentgrass;Redtop	9,700-11,500
	Agrostis scabra	Bentgrass;Redtop	6,100-10,800

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	Agrostis thurberiana	Bentgrass;Redtop	10-11,000
	Agrostis variabilis	Bentgrass;Redtop	9,750-11,500
	Alopecurus aequalis	Water Foxtail	7-10,500
	Alopecurus alpinus	Alpine Foxtail	7,600-10,600
	Calamagrostis canadensis	Reedgrass	7,400-11,000
	Calamagrostis purpurascens	Reedgrass	9-11,700
	Calamagrostis scopulorum	Reedgrass	7,500-10,800
	Calamagrostis stricta	Reedgrass	5,500-10,500
	Deschampsia cespitosa	Tufted Hairgrass	7-12,500
	Glyceria striata	Mannagrass	7-10,500
	Helictotrichon mortonianum	Perrenial Oatgrass	11-12,000
	Hordeum brachyantherum	Barley	6,500-10,500
	Melica bulbosa	Oniongrass	7,700-10,500
	Muhlenbergia filiformis	Muhlygrass;Muhly	7,500-10,500
	Phleum alpinum	Mountain Timothy	7,500-11,500
	Poa alpina	Bluegrass	10-13,000
	Poa arctica	Bluegrass	10-13,000
	Poa glauca	Bluegrass	8- timberline +
	Poa lettermanii	Bluegrass	above 12,000
	Puccinellia pauciflora	Alkaligrass	up to 10,500
	Stipa lettermanii	Needlegrass	8-11,500
Polemoniaceae	*Phlox pulvinata*	Sweet William	9-11,200
	Polemonium pulcherimum	Jacobs Ladder	9-11,100
	Polemonium viscosum	Jacobs Ladder	10,200-12,700
Polygonaceae	*Erigonum umballatum porteri* (m)	Wild Buckwheat	8,200-11,500
	Polygonum bistortoides (f,m)	American Bistort	7,500-11,500
	Polygonum douglasii (m)	Knotweed;Smartweed;Ladysthumb	7,500-10,300
	Polygonum vivparum (f,m)	Alpine bistort	8,100-11,900
	Rumex salicifolius	Dock;Sorrel	7,500-11,000
Polypodiaceae	*Asplenium viride*	Spleenwort	10,200-10,500
	Cryptogramma crispa (m)	Rockbrake	9,500-timberline
	Woodsia scopulina	Woodsia	10,800-11,600
Portulacaceae	*Claytonia megarrhiza* (f)	Springbeauty	timberline+
	Lewisia pygmaea (f)	Bitteroot;Lewisia	7,500-alpine
	Lewesia triphylla	Bitteroot;Lewisia	10,600
Primulaceae	*Androsace septentrionalis* (i)	Rock-jasmine	7-12,500
	Dodecatheon alpinum	Shootingstar	7,200-11,500
	Primula parryi	Primrose	timberline +
Pyrolaceae	*Pyrola secunda* (m)	Shinleaf;Wintergreen	7,300-11,000
Ranunculaceae	*Anemone multifida* (m)	Anemone;Windflower	7,300-11,200
	Aquilegia coerulea (m)	Columbine	7,500-11,700
	Delphinium nuttallianum (m,i)	Nelson’s Larkspur	4,900-10,400
	Delphinium occidentale (m,i?)	Larkspur	8-10,500
	Ranunculus eschscholtzii	Buttercup;Crowfoot	10,200-11,100
	Ranunculus inamoenus	Buttercup;Crowfoot	7,500-11,200
	Thalictrum sparsiflorum	Meadowrue	7,400-11,000
	Trollius laxus	Globeflower	9-10,800
Rosaceae	*Dryas octopetala*	Dryad;Mountain-avens	11,400-13
	Fragaria vesca (f,m)	Strawberry	7-10,500
	Fragaria virginiana (f,m)	Strawberry	7,500-10,800
	Potentilla diversifolia (*)	Cinquefoil;Five-finger	9,350-11,500

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	Potentilla fruticosa	Cinquefoil;Five-finger	7-10,500
	Potentilla gracilis pulcherrima	Cinquefoil;Five-finger	7,400-11,000
	Potentilla hippiana	Cinquefoil;Five-finger	7,400-10,600
	Potentilla ovina decurrens	Cinquefoil;Five-finger	8,100-12,000
	Potentilla ovina ovina	Cinquefoil;Five-finger	8,530-11,100
	Potentilla rubricaulis	Cinquefoil;Five-finger	10,500-11,200
	Sibbaldia procumbens	Sibbaldia	9-12,000
Rubiaceae	*Galium bifolium*	Bedstraw;Cleavers	6,800-10,600
	Galium trifidum (m)	Bedstraw;Cleavers	6-11,000
Ruppiaceae	*Salix glauca* (m)	Willow	9,100-12,000
	Salix planifolia (m?)	Willow	9,500-12,000
	Salix reticulata (m?)	Willow	10,500-13,000
	Salix wolfii (m?)	Willow	9-10,100
Saxifragaceae	*Mitella pentandra*	Miterwort	7,800-10,800
	Ribes cereum (f,m)	Current;Gooseberry	6,500-11,000
	Ribes inerme	Current;Gooseberry	7-11,000
	Saxifraga cespitosa (m)	Saxifrage	timberline-13,000
	Saxifraga debilis (m?)	Saxifrage	10-13,000
	Saxifraga flagellaris (m?)	Saxifrage	13,700
	Saxifraga odontoloma (m?)	Saxifrage	7,500-11,000
	Saxifraga rhomboidea (m?)	Saxifrage	7,500-12,000
Scrophulariaceae	*Besseya wyomingensis* (i)	Alpine Kittentails	11,000
	Castilleja applegatei	Indian Paintbrush	9,200-11,700
	Castilleja miniata	Indian Paintbrush	10-11,300
	Castilleja rhexifolia	Indian Paintbrush	10-11,300
	Castilleja sulphurea	Indian Paintbrush	8,800-11,500
	Mimulus lewisii	Monkeyflower	8-11,700
	Mimulus primuloides	Monkeyflower	11,000
	Ortocarpus tolmei	Owl-clover	6-10,200
	Pedicularis bracteosa	Lousewort	8,200-11,100
	Pedicularis groenlandica	Lousewort	7,800-12,500
	Pedicularis parryi	Lousewort	10,500-12,500
	Pedicularis racemosa	Lousewort	9-10,600
	Penstemon whippleanus (m)	Beardtongue	8,600-11,000
	Scrophularia lanceolata (m)	Figwort	7-10,400
	Synthyris pinnatifida	Kittentails	8,900-10,800
	Veronica serpyllifolia (f,m)	Speedwell,Brooklime	7,500-11,000
	Veronica wormskjoldii (f,m)	Speedwell;Brooklime	8,100-11,200
Selaginellaceae	*Selaginella densa*	Spikemoss	8-12 ,000
Sparganiaceae	*Sparganium angustifolium*	Bur Reed	8,700-10,500
Valerianaceae	*Valeriana acutiloba* (f,m)	Valerian	6,800-10,900
Violaceae	*Viola adunca*	Violet	7-timberline

* The roots of young *Cirsium hookerianum* (Hooker's Thistle) were eaten (sometimes raw, sometimes baked). The Flathead tribe enjoyed them so much they imposed a taboo to prevent people from picking too many (Kershaw, MacKinnon, and Pojar 1998: 226). It is not known if the same can be said for the species found in the Uinta Mountains. *Rorippa palustris* (Marsh Yellowcress) was eaten raw or cooked (ibid: 142). *Veratrun viride* (Indian Helleborne; Green False-Hellebore) is extremely poisonous but was highly respected as a powerful medicine. People from east of the Rocky Mountains would travel great distances to trade for this root. The California False-hellebore is assumed to have the same properties (ibid:

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100). *Plantago major* (Common Plantain) is edible and is rich in vitamins A, C, and K. The seeds can be ground into meal or flour (ibid: 260). It is unclear if the species *Plantago tweedyi* is also edible. Potentilla (cinquefoil) plants are effective at stopping bleeding and dysentery (ibid: 150), inflammation, fevers, and ulcers (Moore 1979: 134), but it is not clear if this applies to all species or just certain ones.

Sources:

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Appendix A3.2 Botanical Analysis for Samples Retrieved by Machine Flotation at Paleo Research Institute

POLLEN AND MACROFLORAL ANALYSIS AT DEADMAN LAKE (SITE 42UN2331), ASHLEY NATIONAL FOREST, UTAH

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Part A

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INTRODUCTION

Samples from site 42UN2331 in Ashley National Forest, northeastern Utah, were examined for pollen and/or macrofloral remains. This site is a high elevation site overlooking Deadman Lake in the Uinta Mountains and appears to represent early Fremont, mid-Fremont, and Ute occupation of the area. Pollen and macrofloral analysis is used to provide information concerning plant resources utilized by the various occupants of this site.

METHODS

Pollen

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 300 pollen grains at a magnification of 5 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. A plus (+) on the pollen diagram indicates that the pollen type was observed outside the regular count while scanning the remainder of the microscope slide. Pollen diagrams are produced using Tilia,

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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.

Macrofloral

The macrofloral samples were floated using a modification of the procedures outlined by Matthews (1979). Each sample was added to approximately 3 gallons of water, then stirred until a strong vortex formed. The floating material (light fraction) was poured through a 150 micron mesh sieve. Additional water was added and the process repeated until all floating material was removed from the sample (a minimum of 5 times). The material which remained in the bottom (heavy fraction) was poured through a 0.5 mm mesh screen. The floated portions were allowed to dry.

The light fractions were weighed, then passed through a series of graduated screens (US Standard Sieves with 2 mm, 1 mm, 0.5 mm and 0.25 mm openings) to separate charcoal debris and to initially sort the remains. The contents of each screen then were examined. Charcoal pieces larger than 2 mm, 1 mm, or 0.5 mm in diameter were separated from the rest of the light fraction and the total charcoal weighed. A representative sample of these charcoal pieces was broken to expose a fresh cross-section and examined under a binocular microscope at a magnification of 70x. The weights of each charcoal type within the representative sample also were recorded. The material which remained in the 2 mm, 1 mm, 0.5 mm, and 0.25 mm sieves was scanned under a binocular stereo microscope at a magnification of 10x, with some identifications requiring magnifications of up to 70x. The material which passed through the 0.25 mm screen was not examined. The heavy fractions were scanned at a magnification of 2x for the presence of botanic remains. Remains from the light and heavy fractions were recorded as charred and/or uncharred, whole and/or fragments. The term "seed" is used to represent seeds, achenes, caryopses, and other disseminules. Macrofloral remains are identified using manuals (Martin and Barkley 1973; Musil 1978; Schopmeyer 1974) and by comparison with modern and archaeological references.

Samples from archaeological sites commonly contain both charred and uncharred remains. Many ethnobotanists use the basic rule that unless there is a specific reason to believe otherwise, only charred remains will be considered prehistoric (Minnis 1981:147). Minnis (1981: 147) states that it is "improbable that many prehistoric seeds survive uncharred through common archaeological time spans." Few seeds live longer than a century, and most live for a much shorter period of time (Harrington 1972; Justice and Bass 1978; Quick 1961). It is presumed that once seeds have died, decomposing organisms act to decay the seeds. Sites in caves, water-logged areas, and in very arid areas, however, may contain uncharred prehistoric remains. Interpretation of uncharred seeds to represent presence in the prehistoric record is considered on a sample-by-sample basis. Extraordinary conditions for preservation are required.

ETHNOBOTANIC REVIEW

It is a commonly accepted practice in archaeological studies to reference ethnological

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(historic) plant uses as indicators of possible or even probable plant uses in prehistoric times. It gives evidence of the exploitation, in historic times, of numerous plants, both by broad categories, such as greens, seeds, roots, and tubers, etc. and by specific example, i.e., seeds parched and ground into meal which was formed into cakes and fried in grease. Repetitive evidence of the exploitation of resources indicates a widespread utilization and strengthens the possibility that the same or similar resources were used in prehistoric times. Ethnographic sources do document that with some plants the historic use was developed and carried from the past. A plant with medicinal qualities very likely was discovered in prehistoric times and the usage persisted into historic times. There is, however, likely to have been a loss of knowledge concerning the utilization of plant resources as cultures moved from subsistence to agricultural economies and/or were introduced to European foods during the historic period. The ethnobotanic literature serves only as a guide indicating that the potential for utilization existed in prehistoric times--not as conclusive evidence that the resources were used. Pollen and macrofloral remains, when compared with the material culture (artifacts and features) recovered by the archaeologists, become indicators of use. Pollen and macrofloral analyses identified remains of plants that might have been important food items for the various occupants of this site. These plants will be discussed in the following paragraphs in order to provide an ethnobotanic background for discussing the remains.

Native Plants

Cheno-ams

Cheno-ams are a group of plants that include *Amaranthus* (pigweed) and members of the Chenopodiaceae (goosefoot) family, such as *Atriplex* (saltbush), *Chenopodium* (goosefoot), *Cycloloma atriplicifolium* (winged pigweed), *Monolepis* (povertyweed, patata), *Sarcobatus* (greasewood), and *Suaeda* (seepweed). These plants are weedy annuals or perennials, often growing in disturbed areas such as cultivated fields and site vicinities. Plants were exploited for both their greens and seeds, which are very nutritious. Young shoots and stems can be eaten fresh or cooked as greens, either alone or with other foods. The greens are most tender in the spring when young but can be used at any time. The small seeds can be eaten raw, but most often they were ground into a meal and used to make a variety of mushes and cakes. The seeds usually are noted to have been parched prior to grinding. Cheno-am seeds are noted to have been important resources for Fremont groups (Madsen 1989). The red fleshy fruit clusters of *Chenopodium capitatum* (strawberry blite) and *Monolepis* roots were eaten raw or cooked. The ashes of *Atriplex canescens* (four-wing saltbush) make a good substitute for baking powder, while a black dye can be obtained by soaking *Suaeda* stems and leaves in water for many hours. Various parts of the Cheno-am plants are noted to have been gathered from early spring (greens) through the fall (seeds) (Harrington 1964:55-62, 69-71, 80-82, 234-236; Harrington 1972:68-71, 82-84; Kirk 1975:56-63; Sweet 1976:48; Tilford 1997:14-15, 88-89).

Lamiaceae (Mint Family)

The Lamiaceae (mint) family is characterized by square stems and the hair-like oil glands on the surfaces of leaves and stems that are often used as flavorings. Members of this family were utilized as potherbs, seasonings, flours, and medicines. A tea made from dried or fresh

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Mentha (wild mint) leaves often is used to relieve stomach pain and to treat intestinal disorders. It also can be used as a colic remedy for infants. The active ingredient is menthol, which acts as a carminative and digestive system antispasmodic (Moore 1990:57, 66, 81; Tilford 1997:60). *Monarda* (beebalm, wild oregano) is used as a cough and sore throat remedy, for stomach pain, and to induce sweating. The young leaves and leaf buds also can be used as a seasoning or a potherb (Moore 1990:61; Tilford 1997:18). *Salvia* (sage) is a valued medicine for epilepsy. A leaf tea can be used to treat coughs, colds, fevers, sore throats, stomach gas, and worms. Crushed leaves are used as an antiseptic and to relieve skin wounds and cuts. Sage oil can be rubbed on the skin to keep mosquitos and gnats away (Hedrick 1972; Heinerman 1983:54-55; Kirk 1975:84; Krochmal and Krochmal 1978:198; Medsger 1966). *Stachys* (hedge nettle) has edible leaves and flowers, and "it is used for sore throats, urethritis, cystitis, joint inflammations, and migraine headaches" (Tilford 1997:72).

Charcoal

Charcoal recovered from archaeological samples most often represents use of that type of wood as fuel; however, several trees and shrubs had utilitarian and medicinal uses as well. The presence of charcoal indicates that the trees and shrubs represented were present at the time of occupation. If these resources were present and collected as fuel, it also is possible that they were exploited for other purposes as well. The following paragraphs discuss plants represented only by charcoal in the macrofloral record.

Abies (Fir)

Abies (fir) needles are rich in vitamin C, and a needle tea can be used to treat colds. The pitch can be applied to cuts, boils, and sores. Firs make good Christmas trees, holding the needles even when dry. A. concolor (white fir) and A. lasiocarpa (subalpine fir) are native trees of Utah that are noted to be major components of the conifer forest (Albee et al. 1988:402-403; Petrides and Petrides 1992:46; Robinson 1979:64).

***Picea* (Spruce)**

The inner bark (cambium) of *Picea* (spruce) was eaten fresh or dried and ground into a flour. Spruce needles contain vitamin C, and a needle tea was used to treat colds. Spruce sap was used as a salve for cuts and wounds. Paiute groups used *P. engelmanii* (Engelmann=s spruce) boughs on the floor for sweat houses and for camping beds. Spruce needles fall off quickly upon drying (Moerman 1998:398; Petrides and Petrides 1992:41; Robinson 1979:146).

DISCUSSION

Site 42UN2331 is located on a knoll overlooking Deadman Lake, which is at the head of Dry Fork Basin on the south slope of the Uinta Mountains in northeast Utah. This site is situated at tree line at an elevation of about 11,000 feet in the Hudsonian life zone/Alpine life zone transition.

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Dominant tree cover is spruce (*Picea*) with some sub-alpine fir (*Abies lasiocarpa*) (Loosle 2002:4). A variety of forbs and grasses also are found at 10,000 feet and higher, with bistort (*Polygonum*), spring beauty (*Claytonia*), gentian (*Gentiana*), and others noted at the site (Michelle Knoll, personal communication, 2002).

Pollen and macrofloral samples were collected from three areas believed to represent an early Fremont structure, a mid-Fremont structure, and a Ute brush structure, as well as from a possible work area outside one of the structures. In addition, a Apinch@ pollen sample was recovered from across the site surface to serve as a control for samples from the archaeological features (Table 1).

Pollen control sample 47 is dominated by *Pinus* pollen (Figure 1, Table 2), reflecting local pines. In addition, a moderate quantity of *Picea* pollen was noted, representing local spruce. *Abies* pollen was present in a small quantity, representing local fir. Small quantities of *Juniperus* and *Quercus* pollen also were noted, representing juniper and oak growing in the region. *Artemisia* pollen was most abundant among pollen representing the understory. This reflects the presence of sagebrush. Small quantities of Low-spine and High-spine Asteraceae pollen in these samples represents the presence of various members of the sunflower family. Recovery of a small quantity of Caryophyllaceae pollen, accompanied by aggregates, in this sample indicates that members of the pink family grew in the local understory. Cheno-am pollen was noted in a small quantity, representing the presence of at least one member of the Chenopodiaceae family or genus *Amaranthus* in the area. Upslope winds could account for pollen transport if no Cheno-ams are noted to grow in the immediate vicinity. A small quantity of *Sarcobatus* pollen also was observed in this sample, reflecting at least regional presence of greasewood. Recovery of a small quantity of *Claytonia* pollen represents local spring beauty. Recovery of a small quantity of *Ephedra torreyana*-type pollen in this sample is probably the result of wind transport, since *Ephedra* pollen travels well and far on the wind. *Eriogonum* pollen was noted in a small quantity, indicating that wild buckwheat also was present in the local vegetation. Poaceae pollen was noted in a moderate quantity, representing the presence of grasses locally. *Polygonum bistortoides*-type was noted in a slightly elevated frequency and accompanied by aggregates, reflection local bistort in the vegetation. Recovery of a small quantity of *Polygonum sawatchense*-type pollen reflects the presence of yet another species of *Polygonum*. *Ranunculus* pollen was observed in this sample, indicating the presence of buttercup in the local vegetation. Rosaceae pollen was noted as both plain and striate grains, indicating the presence of at least two members of the rose family. The striate pollen might represent *Potentilla*. Recovery of *Typha angustifolia*-type pollen indicates the presence of cattails within a mile or two of the area tested.

Feature 1 is a depression believed to be a probable structure. Five large, flat stones were placed in the center of the depression, and large branches within and near the depression are thought to be the possible remains of a superstructure. Charcoal from the depression yielded a conventional radiocarbon age of 1660 40 BP, with a two sigma calibrated age range of A.D. 265-290 and A.D. 325-445 (Beta-170460), suggesting an early Fremont occupation. Pollen samples 45, 60, and 126 were examined from the floor contact (Feature 21) in three different units. The pollen record from these samples is fairly similar, as expected, since they represent the floor within the same structure. Pollen representing local and regional trees is similar, with all three

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samples containing *Juniperus*, *Picea*, and *Pinus* pollen. In addition, sample 126 exhibited a small quantity of *Pseudotsuga* pollen and sample 45 exhibited this pollen in the scan, while samples 60 and 126 contained small quantities of *Quercus* pollen. Only sample 126 exhibited *Salix* pollen, representing local presence of willow. Minor fluctuations, such as these, are expected in the pollen record, since it is a sample of the pollen present in each sample. *Artemisia* pollen is present in all three samples, as are Low-spine and High-spine Asteraceae pollen. Caryophyllaceae, Cheno-am, *Sarcobatus*, Cyperaceae, *Ephedra*, *Eriogonum*, Poaceae, *Polygonum bistortoides*-type, and *Typha angustifolia*-type pollen also are present in all three samples, which is typical if these pollen types represent local vegetation. In addition, recovery of Brassicaceae pollen in two of the three floor samples probably is the result of presence of members of the mustard family in the local vegetation. Geraniaceae and *Sphaeralcea* pollen are present in two samples, while *Polygonum aviculare*-type and *P. sawatchense*-type pollen are each present in one sample. Onagraceae pollen was observed in all three samples while scanning them. It is likely that all of these pollen also represent local vegetation in the geranium family, globemallow, and at least two types of knotweed. *Erodium cicutarium*-type pollen was noted in samples 45 and 60, reflecting relatively modern intrusion of pollen into these locations. *Erodium cicutarium* (storksbill) is an introduced annual that grows in disturbed areas between 800 and 2460 m (Albee et al. 1988:320). Recovery of this pollen in these samples is surprising, both from the standpoint of apparent contamination of the samples and also with respect to the fact that reported distribution of this plant does not extend to 11,000 feet, where the site is located. Recovery of single pollen grains of Fabaceae and Lamiaceae pollen in samples 126 and 60, respectively, probably also represents the presence of a member of the legume and mint families in the local vegetation, although processing a member of the mint family certainly cannot be ruled out. The pollen record does not appear to represent any particular economic activity within this structure. All pollen samples were scanned in an effort to find *Zea mays* pollen, if it was present. None was observed in these three samples. Sample 45 did, however, contain a single starch with a centric hilum. These starches are produced by grass seeds and some other seeds, including maize seeds. In addition, this type of starch is observed in some roots. Although this type of starch is not considered to be diagnostic for maize, certainly it could have been produced by maize. At present, its presence is merely interpreted to indicate that a starchy substance deteriorated on this part of the floor.

Macrofloral samples 39 and 138 were taken from the floor fill (Feature 23) found 0-3 cm above the floor contact in Feature 1. Sample 39 from Unit 5N 5E yielded pieces of *Abies*, *Picea*, *Picea* root, and conifer charcoal, as well as charcoal too vitrified for identification (Table 3, Table 4). Vitrified material has a shiny, glassy appearance due to fusion by heat. The charcoal record suggests that local spruce and fir wood were burned as fuel and/or used as building materials for the structure. An uncharred *Abies* needle fragment, uncharred *Claytonia* and *Carex* seeds, uncharred moss, and numerous uncharred rootlets represent modern plants. The sample also contained 30 small lithic flakes and a few sclerotia.

Sclerotia are small, black, solid or hollow balls that range from 0.5 to 4 mm in size. They are the resting structures of mycorrhizae fungi, such as *Cenococcum graniforme*, that have a mutualistic relationship with tree roots. Many trees are noted to depend heavily on mycorrhizae and might not be successful without them. “The mycelial strands of these fungi grow into the roots and take some of the sugary compounds produced by the tree during photosynthesis. However, mycorrhizal fungi benefit the tree because they take in minerals from the soil, which are then

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used by the tree" (Kricher and Morrison 1988:285). Sclerotia appear to be ubiquitous and are found with a variety of coniferous and deciduous trees including *Abies* (fir), *Juniperus communis* (common juniper), *Larix* (larch), *Picea* (spruce), *Pinus* (pine), *Pseudotsuga* (Douglas-fir), *Alnus* (alder), *Betula* (birch), *Populus* (poplar, cottonwood, aspen), *Quercus* (oak), and *Salix* (willow). These forms originally were identified by Dr. Kristiina Vogt, Professor of Ecology in the School of Forestry and Environmental Studies at Yale University (McWeeney 1989:229-130; Trappe 1962).

Sample 138 from Unit 6N 6E contained charred and partially charred pieces of *Abies* and *Picea* charcoal, reflecting use of local fir and spruce as fuel woods and/or construction materials. One small charred conifer cone scale might reflect discard of a conifer cone after obtaining the seeds or possibly use of conifer cones as fuel. A few pieces of charred, vitrified tissue might represent charcoal or other plant tissue too vitrified for identification. Other charred remains include *Picea* root charcoal and charred bark fragments. Several types of uncharred plant remains and numerous insect chitin fragments reflect subsurface disturbance from insect activity and introduction of modern material.

Feature 58 in Unit 1N 7E was originally believed to be an outside work area associated with Feature 1; however, a conventional radiocarbon age of 1360 70 BP (Beta-170461) suggests a mid-Fremont occupation. Pollen sample 127 and macrofloral sample 144 were collected from a charcoal stain at a depth of 88 cmbd in this area. Pollen sample 127 represents fill from the surface of the stain (Feature 51) and yielded a pollen record very similar to that from Feature 1. This sample exhibited pollen reflecting similar trees noted in pollen samples examined from Feature 1. In addition, *Abies* pollen was noted in this sample. Much of the non-arboreal pollen record in sample 127 also was very similar to that in samples from Feature 1. Differences in recovery of pollen that occurred as 1% or less of the record are expected and not interpreted to be significant. All pollen types observed in sample 127 also were recorded in samples from Feature 1. Therefore, there is no evidence of economic activity in sample 127 that might identify economic activity in this area. A small quantity of *Erodium cicutarium*-type pollen was noted in this sample, indicating intrusion of relatively modern pollen.

Macrofloral sample 144 was taken from fill 0-2 cm below the surface of the charcoal stain (Feature 53). This sample contained a few charred *Picea* needle fragments. Spruce needles might have been utilized as tinder or as a medicinal resource, or the needles might have been adhering to spruce branches burned as fuel. Pieces of *Abies* and *Picea* charcoal suggest use of fir and spruce as fuel woods. One small fragment of charred material was recovered that appears to represent charred meal with a small seed coat fragment imbedded in it. A portion of this material was digested with Schulze solution to recover any starches present that would aid in identification of this material. Schulze solution is a mixture of strong nitric acid (75%) and potassium (or sodium) chlorate. Microscope slides were made with glycerine for examination with a binocular microscope and cross-polar illumination at a magnification of 500x. Two starches were observed in this sample that have morphological characteristics similar to those of many seeds -- that is, they have centric hila and exhibit an AX@ under cross-polar illumination. Although these characteristics are typical of starches produced by grass seeds, they are not necessarily diagnostic of starches produced by grass seeds. One of the starches exhibited angularity, which is typical of very starchy seeds, such as Zea mays. Unfortunately, this single starch is not sufficient evidence to interpret the presence of the

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cultigen Zea mays. Additional evidence should be sought. Given the presence of these starches in this sample, this would have been a good provenience to sample for pollen. Recovery of Zea mays pollen is expected to accompany the presence of ground maize meal and is unequivocal evidence for the presence of maize. The sample also yielded charred bark fragments, pieces of charred and vitrified tissue, *Picea* root charcoal, vitrified conifer charcoal, uncharred modern plant remains, numerous sclerotia, 14 lithic flakes, and 19 insect chitin fragments.

Macrofloral sample 121 was recovered from fill in an area of charcoal stains at a depth of 93 cmbd (Feature 53) in Feature 58. Two charred Cheno-am perisperm were present, suggesting that Cheno-am seeds were processed. Cheno-am perisperm represents seeds that have lost their diagnostic outer seed coat. One charred Lamiaceae-type seed might reflect use of a member of the mint family. Charred bark fragments, charred vitrified tissue, and one charred piece of possible PET starchy tissue also were present. The possible PET starchy tissue fragment consisted of parenchymous tissue exhibiting a slight curvature. The tissue was digested with Schulze solution to recover starches to aid in identification. This sample yielded a single centric starch that is typical of the generic forms produced by numerous seeds, including grass seeds and some roots/tubers. There was no angularity to this starch. This form of starch is entirely too generic to interpret as representing any particular family of plants. A few tracheary elements also were present, which are typical of roots and tubers. *Picea* charcoal and partially charred wood dominated the charcoal record in sample 121, with a few pieces of *Abies* charcoal, a charred *Picea* root fragment, and a piece of unidentifiable vitrified root charcoal also present. Non-floral remains include 10 small lithic flakes and several insect chitin fragments.

Feature 17 is a possible structure dating to the mid-Fremont. A conventional radiocarbon age of 1350 40 BP was returned for charcoal from this feature, with a two sigma calibrated age range of A.D. 635-720 and A.D. 745-760 (Beta-170459). Pollen samples 64 and 65 were examined from areas of floor contact (Feature 41) in Units 2N 4E and 1N 4E. Macrofloral sample 41 also was recovered from floor contact in Unit 2N 4E. The pollen record for this feature yielded more *Picea* pollen than was noted in samples from other features at this site. In addition, quantities of *Artemisia* and High-spine Asteraceae pollen were depressed. Small quantities of Geraniaceae pollen and *Opuntia* pollen fragments were noted in this sample. *Opuntia erinacea* (grizzlybear pricklypear) is noted to grow up to an elevation of 2790 m (Albee et al. 1988:188), which is still lower than the elevation of this site. It is possible that prickly pear cactus fruit or even pads might have been transported to this site. Either has the potential to transport *Opuntia* pollen. Other pollen types remained similar to those observed in other samples examined from this site. This is the only sample that exhibited Onagraceae pollen, reflecting the presence of a member of the evening primrose family growing as part of the local understory vegetation. Once again, pollen recovered from this feature appears to represent plants growing in the vicinity of this site, rather than representing plants that probably were processed in this specific location. *Erodium cicutarium*-type pollen was observed while scanning this sample, indicating relatively recent pollen intrusion into this sample or location.

Macrofloral sample 41 contained three charred unidentified seed fragments that might represent seed processing activities in this structure. These seed fragments appear to represent a small seed. Although these seed fragments are unidentified, it is possible to determine that they

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do not represent Cheno-ams, grasses (Poaceae), members of the mustard family (Brassicaceae), or members of the pink family (Caryophyllaceae). A moderate amount of charred vitrified tissue might reflect charcoal or other plant tissue. Two uncharred *Claytonia* seeds and numerous uncharred rootlets represent modern plants. The charcoal record consists of *Abies*, *Picea*, *Picea* root, conifer charcoal not further identified to genus, vitrified conifer charcoal, charcoal too vitrified for identification, and charred bark fragments. The sample also yielded a possible lithic flake, insect chitin fragments, and a few sclerotia.

Feature 12 is a Numic feature that yielded metal bangles, Intermountain grayware, and a radiocarbon age of A.D. 1830-1890. It is believed to represent a Ute brush structure. Macrofloral sample 131 was recovered from an arc of stains (probable postholes) in the floor contact zone in the southern half of the feature. A few charred *Picea* needle fragments were noted in this sample, as well as *Abies* charcoal; *Picea* charcoal; uncharred *Picea* wood; charred, partially charred, and uncharred *Picea* root wood; and charred *Picea* root bark fragments. Several types of uncharred modern plant remains were present, including a *Carex* seed, numerous *Claytonia* seeds, four *Picea* cone scale fragments, numerous *Picea* needle fragments, several *Potentilla* seeds, roots, rootlets, grasses, and other modern plant parts. A few sclerotia and numerous insect chitin fragments complete the record.

SUMMARY AND CONCLUSIONS

Pollen and macrofloral analyses at 42UN2331 yielded few remains indicative of plant processing activities, but no remains indicative of Fremont occupation. The pollen record was scanned in search of evidence of *Zea mays* (maize), but none was found. Although evidence for Lamiaceae (mint family) pollen was noted in Feature 1, processing could not be documented through the pollen record. The pollen record indicates that local and regional vegetation was not significantly different that than of today during the Fremont occupation. Minor differences in the presence or elevational distribution of some plants is expected through time. Identifying these differences was not part of the research design supported by samples examined for this project. Recording this type of difference would require intensive stratigraphic sampling, so it is not addressed here.

The macrofloral record from Feature 1 (early Fremont) and Feature 12 (Numic) did not contain charred remains to indicate processing of plant foods in these structures. Macrofloral samples from the two charcoal stains in Feature 58 that are believed to represent possible hearths suggest that plant foods were processed in this area. Recovery of charred Cheno-am and Lamiaceae-type seeds suggests use of Cheno-ams and a member of the mint family. Recovery of starches in charred meal indicates that starchy seeds probably were ground into meal. Presence of starch in one of the floor samples from Feature 1 suggests the possibility that starchy foods were prepared in that area. Recovery of a starch when examining a charred PET starchy tissue fragment supports an interpretation that this remain represents a root or tuber. Three small charred seed fragments in Feature 17 might represent seed processing activities in this possible structure. The charcoal record was dominated by *Abies* and *Picea*, indicating that local fir and spruce wood

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were burned as fuel. Recovery of several vitrified charcoal fragments might indicate that some of the wood was burned green, since presence of sap when wood burns at a high temperature tends to produce a vitrified appearance. Recovery of charred spruce root wood in each of the macrofloral samples suggests the possibility that past forest fires in the area burned spruce roots, which grow close to the ground surface.

TABLE 1
PROVENIENCE DATA FOR SAMPLES FROM SITE 42UN2331, DEADMAN LAKE

Sample No.	Area	Feature No.	Depth (cmbd)	Provenience/ Description	Analysis
47	1			Modern control sample; pinch across site surface	Pollen
45	1	F21 in F1	57	5N 5E; Floor contact from a probable structure; early Fremont	Pollen
39	1	F23 in F1	55-57	5N 5E; Fill from 0-3 cm above the floor contact; early Fremont	Macro
60	1	F21 in F1	75	5N 6E; Floor contact from a probable structure; early Fremont	Pollen
126	1	F21 in F1	66	6N 6E; Floor contact from a probable structure; early Fremont	Pollen
138	1	F23 in F1	65-66	6N 6E; Fill from 0-3 cm above the floor contact; early Fremont	Macro
127	1	F51 in F58	92	1N 7E; Fill from the surface of a charcoal stain at 88 cmbd (possible hearth) in a possible work area outside the probable structure; mid-Fremont	Pollen
144	1	F52 in F58	88-90	1N 7E; Fill from 0-2 cm below the surface of the charcoal stain at 88 cmbd (possible hearth) in the possible work area outside the probable structure	Macro
121	1	F53 in F58	93-100	1N 7E; Fill from an area of charcoal stains at 93 cmbd in the possible work area outside the probable structure	Macro
64	17	F41 in F17	33	2N 4E; Floor contact from a possible structure; mid-Fremont	Pollen
41	17	F41 in F17	32-37	2N 4E; Floor contact from a possible structure; mid-Fremont	Macro
65	17	F41 in F17	33	1N 4E; Floor contact from a possible structure; mid-Fremont	Pollen
131	12	F44 in F12	21-23	1N 2E; Fill from an arc of stains (probable postholes) in the floor contact zone of a probable Ute brush structure	Macro

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TABLE 2
POLLEN TYPES OBSERVED IN SAMPLES FROM SITE 42UN2331, DEADMAN LAKE

Scientific Name	Common Name
ARBOREAL POLLEN:	
Juniperus	Juniper
Pinaceae:	Pine family
Abies	Fir
Picea	Spruce
Pinus	Pine
Pseudotsuga	Douglas-fir
Quercus	Oak
Salix	Willow
NON-ARBOREAL POLLEN:	
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
Campanula	Bell flower
Caryophyllaceae	Pink family
Cheno-am:	Includes amaranth and pigweed family
Sarcobatus	Greasewood
Claytonia	Spring beauty
Cyperaceae	Sedge family
Ephedra nevadensis-type	Mormon tea
Ephedra torreyena-type	Mormon tea
Eriogonum	Wild buckwheat
Erodium cicutarium-type	Heron-bill, introduced
Fabaceae	Bean or Legume family

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Geraniaceae	Geranium family
Lamiaceae	Mint family
Nyctaginaceae	Four o=clock family
Onagraceae	Evening primrose family
Opuntia	Prickly pear cactus
Poaceae	Grass family
Polemonium	Phlox
Polygonaceae:	Knotweed/Smartweed family
Polygonum aviculare-type	Knotweed
Polygonum bistortoides-type	Western bistort
Polygonum sawatchense	Sawatch knotweed
Ranunculus	Buttercup
Rosaceae	Rose family
Sphaeralcea	Globe mallow
Typha angustifolia-type	Cattail
Indeterminate	Too badly deteriorated to identify
STARCHES:	
Starch with Hilum	
SPORES:	
Lycopodium scalloped	Clubmoss
Monolete	Fern
Selaginella densa	Little clubmoss
Trilete	Fern

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TABLE 3
MACROFLORAL REMAINS FROM SITE 42UN2331, DEADMAN LAKE

Sample			Charred		Uncharred		Weights/ Comments
No.	Identification	Part	W	F	W	F	
39	Liters Floated						4.60 L
F. 23	Light Fraction Weight						62.03 g
in	FLORAL REMAINS:						
F. 1	*Abies*	Needle				1	
	Carex	Seed			1		
	Claytonia	Seed			3	8	
	Moss					X	Few
	Rootlets					X	Numerous
	Sclerotia				X	X	Few
	CHARCOAL/WOOD:						
	Total charcoal ≥ 2 mm						0.53 g
	Conifer	Charcoal		9			0.07 g
	Conifer - vitrified	Charcoal		1			<0.01 g
	Abies	Charcoal		5			0.08 g
	Picea	Charcoal		5			0.01 g
	Picea root	Charcoal		4			0.01 g
	Unidentifiable - vitrified	Charcoal		2			<0.01 g
	NON-FLORAL REMAINS:						
	Flake					30	
	Rock/Gravel					X	Numerous
	Sand					X	Numerous
138	Liters Floated						5.00 L
F52 in F1	Light Fraction Weight						193.26 g
	FLORAL REMAINS:						

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	Conifer	Cone scale		1			<0.01 g
	Bark ≥ 2mm			10			0.04 g
	Vitrified tissue			X			Few
	Claytonia	Seed			30	36	
	Picea	Needle				2	
	Poaceae 1	Floret			1		
	Poaceae 2	Floret				1	
	Poaceae 3 - Panicoid	Floret				4	
	Potentilla	Seed			1		
	Unidentified	Fruit				3	
	Moss ≥ 2mm	Branch/ Leaf				31	
	Moss < 2mm	Branch/ Leaf			X	X	Few
	Rootlets					X	Numerous
	Sclerotia		X	X			Moderate
	CHARCOAL/WOOD:						
	Total charcoal ≥ 2 mm						0.84 g
	Abies	Charcoal		7			0.05 g
	Abies	Charcoal		5pc			0.16 g
	Picea	Charcoal		10			0.04 g
	Picea	Charcoal		6pc			0.06 g
	Picea root	Charcoal		2			<0.01 g
	Total wood ≥ 2mm						1.05 g
	Picea	Wood				15	0.80 g
	NON-FLORAL REMAINS:						
	Insect	Chitin				240*	
	Rock/Gravel					X	Numerous
144	Liters Floated						5.00 L
F52 in F58	Light Fraction Weight						117.16 g
	FLORAL REMAINS:						

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	Picea	Needle		X		X	Few
	cf. PET fruity or charred meal with a seed fragment	Tissue		2			0.01 g
	Vitrified tissue ≥ 2mm			32			0.07 g
	Vitrified tissue < 2mm			X			Few
	Bark			X			Few
	Claytonia	Seed			18	52	
	Cyperaceae	Seed			1		
	Poaceae	Floret				3	
	Poaceae - Panicoid	Floret				4	
	Viola adunca	Seed			4		
	Moss	Branch/ Leaf				X	Few
	Rootlets					X	Numerous
	Sclerotia				X	X	Numerous
	CHARCOAL/WOOD:						
	Total charcoal ≥ 2 mm						1.91 g
	Conifer - vitrified	Charcoal		6			0.07 g
	Abies	Charcoal		10			0.13 g
	Picea	Charcoal		14			0.14 g
	Picea - root	Charcoal		5			0.07 g
	NON-FLORAL REMAINS:						
	Flake					14	
	Insect	Chitin				19	
	Rock/Gravel					X	Moderate
	Sand					X	Moderate
121	Liters Floated						5.50 L
F. 53	Light Fraction Weight						81.11 g
in	FLORAL REMAINS:						
F. 58	Cheno-am	Perisperm	2				
	Lamiaceae-type	Seed	1				

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	Picea	Needle		X		1	Few
	PET starchy	Tissue		1			<0.01 g
	Vitrified tissue			X			Few
	Bark ≥ 2mm			9			0.03 g
	Bark < 2mm			X			Few
	Claytonia	Seed			7	12	
	Viola adunca	Seed			1	1	
	Unidentified	Tuber/ Corm			1		
	Moss	Branch/ Leaf				X	Few
	Rootlets					X	Numerous
	Sclerotia				X	X	Numerous
	CHARCOAL/WOOD:						
	Total charcoal ≥ 2 mm						4.04 g
	Abies	Charcoal		4			0.06 g
	Picea	Charcoal		17			0.34 g
	Picea	Charcoal		7pc			0.22 g
	Picea root	Charcoal		1			0.03 g
	Unidentified root - vitrified	Charcoal		1			0.01 g
	NON-FLORAL REMAINS:						
	Flake					10	
	Insect	Chitin				27	
	Rock/Gravel			X		X	Moderate
	Sand					X	Moderate
41	Liters Floated						4.00 L
F. 41 in F. 17	Light Fraction Weight						51.00 g
	FLORAL REMAINS:						
	Unidentified	Seed		3			
	Vitrified tissue ≥ 1mm			35			0.17 g
	Vitrified tissue < 1mm			X			Moderate

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	Claytonia	Seed			2		
	Rootlets				X	X	Numerous
	Sclerotia				X	X	Few
	CHARCOAL/WOOD:						
	Total charcoal ≥ 2 mm						2.37 g
	Conifer	Charcoal		10			0.07 g
	Conifer - vitrified	Charcoal		3			0.07 g
	Abies	Charcoal		5			0.05 g
	Picea	Charcoal		10			0.24 g
	Picea root	Charcoal		7			0.09 g
	Unidentifiable - vitrified	Charcoal		9			0.01 g
	Bark			5			0.13 g
	NON-FLORAL REMAINS:						
	cf. Flake					1	
	Insect	Chitin				20	
	Rock/Gravel					X	Moderate
	Sand					X	Moderate
131	Liters Floated						4.00 L
F. 44	Light Fraction Weight						222.04 g
in	FLORAL REMAINS:						
F. 12	*Picea*	Needle		X			Moderate
	Carex	Seed			1		
	Claytonia	Seed			896*	772*	
	Picea	Cone scale				4	
	Picea	Needle			X	X	Numerous
	Potentilla	Seed			88*	32*	
	Modern grass and other plant parts				X	X	Moderate
	Roots					X	Moderate
	Rootlets					X	Numerous

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	Sclerotia				X	X	Few
	CHARCOAL/WOOD:						
	Total charcoal ≥ 2 mm						1.88 g
	Abies	Charcoal		2			0.01 g
	Picea	Charcoal		4			0.04 g
	Picea root	Charcoal		21			1.31 g
	Picea root	Charcoal		1pc			0.01 g
	Picea root bark ≥ 4mm	Charcoal		14pc			0.28 g
	Picea root bark < 4mm	Charcoal		Xpc			Moderate
	Total wood ≥ 4mm						1.77 g
	Picea	Wood				10	0.45 g
	Picea root	Wood				1	0.30 g
	NON-FLORAL REMAINS:						
	Insect	Chitin			186*		
	Rock/Gravel					X	Few
	Sand					X	Few

W = Whole
F = Fragment
X = Presence noted in sample
g = grams
pc = Partially charred

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* = Estimated frequency

TABLE 4
INDEX OF MACROFLORAL REMAINS RECOVERED FROM SITE 42UN2331, DEADMAN LAKE

Scientific Name	Common Name
FLORAL REMAINS:	
Abies	Fir
Cheno-am	Includes goosefoot and amaranth families
Claytonia	Spring beauty
Cyperaceae	Sedge family
Carex	Sedge
Lamiaceae	Mint family
Poaceae	Grass family
Potentilla	Cinquefoil
Viola adunca	Violet
PET fruity tissue	Fruity epitheloid tissues; resemble sugar-laden fruit or berry tissue without the seeds, or succulent plant tissue such as cactus pads
Sclerotia	Resting structures of mycorrhizae fungi
Vitrified tissue	Charred tissue with a shiny, glassy appearance due to fusion by heat. This tissue might represent charcoal or other plant tissue too vitrified for identification
CHARCOAL/WOOD:	
Conifer	Cone-bearing, gymnospermous trees and shrubs, mostly evergreens, including the pine, spruce, fir, juniper, cedar, yew, and cypress
Abies	Fir
Picea	Spruce

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Appendix A3.3 Macrobotanical Analysis for Samples Retrieved by On-site Manual Flotation and Identified at Paleo Research Institute

POLLEN AND MACROFLORAL ANALYSIS AT DEADMAN LAKE (SITE 42UN2331), ASHLEY NATIONAL FOREST, UTAH

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Paleo Research Institute Technical Report 02-93

Part B

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TABLE 1
PROVENIENCE DATA FOR ADDITIONAL BOTANIC SAMPLES FROM SITE 42UN2331, DEADMAN LAKE

FS No.	Unit No.	Feature No.	Description
27	5N 5E	F1	Seeds
28	5N 5E	F1	Charcoal
14	5N 6E	F1	Botanical
32	5N 6E	F1	Charcoal
33	5N 6E	F1	Seeds
160	6N 6E	F1	Seeds
161	6N 6E	F1	Charcoal
80	1N 7E	F58	Botanical
152	1N 7E	F58	Charcoal
156	1N 7E	F58	Seeds
24	2N 4E	F17	Seeds
25	2N 4E	F17	Botanical
26	2N 4E	F17	Charcoal
29	3N 4E	F17	Botanical
30	3N 4E	F17	Charcoal
31	3N 4E	F17	Seeds
149	1N 4E	F17	Seeds
150	1N 4E	F17	Charcoal
157	2N 1E	F12	Seeds

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TABLE 2

MACROFLORAL REMAINS IN ADDITIONAL BOTANIC SAMPLES FROM SITE 42UN2331

Sample			Charred		Uncharred		Weights/
No.	Identification	Part	W	F	W	F	Comments
27	FLORAL REMAINS:						
F1	*Claytonia*	Seed			X	X	
5N 5E	Cyperaceae	Seed			1		
	Viola	Seed			4*		
	Cone scale-type remains or thorn bases			2			
	Sclerotia				X	X	Few
	Charcoal			X			Few
	NON-FLORAL REMAINS:						
	Insect	Chitin				1	
28	FLORAL REMAINS:						
F1	*Picea*	Needle		1			
5N 5E	Charred tissue			7			0.02 g
	Charcoal			X			1.80 g
14	FLORAL REMAINS:						
F1 5N 6E	Charred tissue–One piece appears to have an embedded seed coat (good candidate for PET analysis)			6			0.09 g
32	FLORAL REMAINS:						
F1	*Claytonia*	Seed				2	
5N 6E	Charred tissue			X			0.20 g
	Vitrified tissue			6			0.03 g
	cf. Bark			1			0.01 g
	Charcoal			X			3.00 g
	NON-FLORAL REMAINS:						
	Insect	Chitin				1	
33	FLORAL REMAINS:						

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F1	*Claytonia* (Michelle pulled)	Seed			195		
5N 6E	*Claytonia*	Seed			X		Numerous
	Carex	Seed			1		
160	FLORAL REMAINS:						
F1	*Claytonia* (Michelle pulled)	Seed			730		
6N 6E	*Claytonia*	Seed			X	X	Numerous
	Potentilla	Seed			X		Few
	Viola	Seed			X		Few
	Sclerotia					X	Few
	Charcoal			X			Few
	NON-FLORAL REMAINS:						
	Insect	Chitin				X	Few
	Pebble					X	Few
161	FLORAL REMAINS:						
F1	*Claytonia*	Seed				2	
6N 6E	*Picea*	Needle		1			<0.01 g
	Sclerotia					1	
	Charred tissue			X			0.01 g
	Vitrified tissue			4			0.02 g
	Charcoal			X			0.84 g
	NON-FLORAL REMAINS:						
	Insect	Chitin				2	
	Pebble/Sand					X	Few
80	FLORAL REMAINS:						
F58 1N 7E	cf. Bark			1			<0.01 g
152	FLORAL REMAINS:						
F58	Charred tissue			16			0.09 g
1N 7E	Charcoal			X			1.99 g
156	FLORAL REMAINS:						

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F58 1N 7E	*Astragalus*	Seed			1		
	Claytonia (Michelle pulled)	Seed			94		
	Claytonia	Seed			64	35	
	Poaceae	Floret				1	
	Polygonum	Seed				1	
	Potentilla	Seed			2		
	Trifolium	Seed			1		
	Viola	Seed			14		
	Unidentified	Fruit				1	
	Sclerotia				4	9	
	Charcoal			5			
	NON-FLORAL REMAINS:						
	Insect	Chitin				1	
24	FLORAL REMAINS:						
F17 2N 4E	Poaceae		1				
	Astragalus	Seed			1		
	Carex	Seed			1		
	Claytonia (Michelle pulled)	Seed			738		
	Claytonia	Seed			364	77	
	cf. Lamiaceae	Seed			1		
	Picea	Seed			1		
	Poaceae	Floret			2		
	Polygonum	Seed			1		
	Potentilla	Seed			19	1	
	Viola	Seed			2		
	Unidentified	Flower			1		
	Sclerotia				1	16	
	NON-FLORAL REMAINS:						
	Insect	Chitin				7	
25	FLORAL REMAINS:						

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F17	Unidentified twig	Wood				1	
2N 4E	Root/corm/tuber					70	Modern
26	FLORAL REMAINS:						
F17 2N 4E	Charcoal			X			1.48 g
29	FLORAL REMAINS:						
F17	Root/corm/tuber					1	Modern
3N 4E	Charred tissue			1			0.01 g
	Vitrified tissue			1			0.02
	Charcoal			10			0.23 g
30	FLORAL REMAINS:						
F17	*Picea*	Needle		1			<0.01 g
3N 4E	Charred tissue			2			0.02 g
	Vitrified tissue			9			0.07 g
	Bark scale			1			0.01 g
	Charcoal			X			4.73 g
	Sclerotia				2		
31	FLORAL REMAINS:						
F17	*Picea*	Needle		1			0.01 g
3N 4E	*Claytonia*	Seed			26	2	
	Potentilla	Seed			2		
	Picea	Seed			1		
	Modern Plant Parts					2	
	Sclerotia					13	
	Charcoal			14			
149	FLORAL REMAINS:						
F17	*Carex*	Seed			1		
1N 4E	*Claytonia* (Michelle pulled)	Seed			754		
	Claytonia	Seed			X		Numerous
	Picea	Needle				1	
	Picea	Seed			X		Few

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	Polygonum	Seed			1		
	Potentilla	Seed			X		Moderate
	Viola	Seed			X	Few	
	Unidentified	Leaf				X	
	Unidentified	Flower			1		
	Sclerotia				X	X	Few
	NON-FLORAL REMAINS:						
	Insect	Chitin				X	Few
	Insect	Puparia			1		
150	FLORAL REMAINS:						
F17	Charred tissue			1			0.01 g
1N 4E	Charcoal			X			0.20 g
157	FLORAL REMAINS:						
F12	cf. Lamiaceae	Seed	1				
2N 1E	Unidentified R, *Ribes*-type	Seed	1				
	Carex	Seed			X		Few
	Claytonia (Michelle pulled)	Seed			651		
	Claytonia	Seed			X		Numerous
	Phacelia	Seed			X		Few
	Picea	Needle				X	Few
	Picea	Seed			X		Few
	Polygonum	Seed			1		Seed
	Potentilla	Seed			X		Numerous
	Ranunculus	Seed			X		Moderate
	Viola	Seed			X		Few
	Charcoal			X			Few
	NON-FLORAL REMAINS:						
	Insect	Chitin				X	Few

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W = Whole
F = Fragment
X = Presence noted in sample
g = grams
* = Estimated frequency

Observations from the additional Deadman Lake (42UN2331) samples:

Three charred seeds were found in these samples. A charred Poaceae (grass) caryopsis in sample 24 from Feature 17 (2N 4E) suggests that grass seeds might have been processed, although the grass seed also might have been charred through use of grasses as tinder, in a buffering vegetation layer, or for other purposes. Sample 157 from Feature 12 (2N 1E) yielded a charred probable Lamiaceae seed, suggesting use of a member of the mint family), and a charred Unidentified R seed. The Unidentified R seed looked very similar to *Ribes* (currant, gooseberry), but much smaller than typical *Ribes*.

Many of the samples contained pieces of charred tissue. These charred tissue fragments did not exhibit the morphological characteristics of charcoal, but rather the tissue was somewhat "spongy" in appearance like the charred tissue noted in the samples we floated. One piece of the charred tissue in Sample 14 from Feature 1 (5N 6E) appeared to contain an embedded seed coat fragment, possibly representing a piece of charred, fruity tissue or possibly a chunk of burned ground meal. This tissue fragment would be a good candidate for additional PET analysis to look for starches to aid in identification.

Uncharred seeds in these samples represent modern plants.

Ebots for new charred seed types:

Poaceae (Grass Family)

Members of the Poaceae (grass) family have been widely used as a food resource. Grass grains were normally parched and ground into a meal to make various mushes and cakes. Several species of grass contain hairs (awns) that were singed off by exposing the seeds to flame. Young shoots and leaves were cooked as greens. Roots were eaten raw, roasted, or dried and ground into a flour. Grass also is reported to have been used as a floor covering, tinder, basketry material, and to make brushes and brooms. Grass seeds ripen from spring to fall, depending on the species, providing a long-term available resource (Chamberlin 1964:372; Harrington 1967:322; Kirk 1975:177-190).

Ribes (Currant, Gooseberry)

All species of *Ribes* (currant, gooseberry) produce edible berries. The berries of *R. odoratum* (buffalo currant) are noted to be sweet and flavorful, while others can be very tart.

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Gooseberries have one to three thorns at the bases of the leafstalks and bristly berries; currants generally have spineless twigs and smooth berries. Gooseberries and currants can have red, yellow, orange, purple, or black fruits. The berries were eaten raw, cooked, or dried in the sun and stored for future use. Dried berries were boiled or pounded with animal fat to make pemmican. *Ribes* berries are high in vitamin C and are ready for harvest in mid-summer. Nectar-rich flowers also were eaten, and the dried leaves were made into a tea. The different species of *Ribes* can be found in a variety of habitats, although all require a fair amount of moisture. In mountain areas, *Ribes* shrubs are found in moist soil in shaded or open land (Angell 1981:36-38, 146; Harrington 1967: 262-269; Kirk 1975:87-88; Meuninck 1988:14).

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