THE GOFF CREEK SITE (48PA325): PREHISTORIC BIGHORN SHEEP PROCUREMENT IN THE ABSAROKA MOUNTAINS OF NORTHWESTERN WYOMING

Edited By
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The Wyoming Department of Transportation
WYDOT Project PREB-031-1(44)

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The Office of the Wyoming State Archaeologist

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Wyoming State Parks & Cultural Resources

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Office of the Wyoming State Archaeologist
Department of State Parks and Cultural Resources
Department of Anthropology, University of Wyoming

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TABLE OF CONTENTS

LIST OF FIGURES

List of Tables

CHAPTER 1
INTRODUCTION

Daniel H. Eakin

The Office of the Wyoming State Archaeologist (OWSA) conducted extensive data recovery excavation during the 1995 and 1996 field seasons at the Goff Creek site (48PA325). The investigations were performed at the request of the Wyoming Department of Transportation (WYDOT), as part of project PREB-031-1(44), the Cody-Yellowstone Highway. The excavations described herein were implemented to mitigate adverse effects of highway reconstruction pursuant to stipulations in the 1994 Programmatic Agreement between the Federal Highway Administration, WYDOT, United States Forest Service, Wyoming SHPO, and the Advisory Council on Historic Preservation.

[redacted] The site is about 950 m in length, but only 30-160 meters wide, with a short (150 m long) extension [redacted]. In all, the site covers 8.33 ha (20.6 acres). Elevations range from 1,934 m to 1986 m (6345'-6,515') above sea level. [redacted].

Investigative History

Although the Goff Creek site has been known to local artifact collectors since at least the 1940s, the site was not formally recorded until 1977 when it was formally recorded during a cultural resource survey related to a timber sale. No subsurface investigations were conducted at that time. The site was reinvestigated as part of the class III cultural resource inventory for the proposed reconstruction of US 14/16/20 in 1987, and further evaluative testing was recommended (Eakin 1988). The following year WYDOT authorized formal testing of Goff Creek (Eakin 1993). Six sub-datums were established across the site, five of which were along the proposed highway corridor (1-5) and a sixth was placed [redacted] (Figure 1-3). Datum areas 1 and 5 were situated in topographically higher positions near the eastern and western ends of the site and were characterized by sediments of limited archaeological potential. Three 1 m x 1 m test units excavated in datum area 1 yielded only five artifacts and revealed a relatively thin layer (48-60 cm) of fine-grained deposition overlying gravels. Due to low surface visibility and the potential for buried cultural material, 20 shovel tests were excavated in datum area 5. No cultural material was found in the shallow (3-12 cm) deposits of

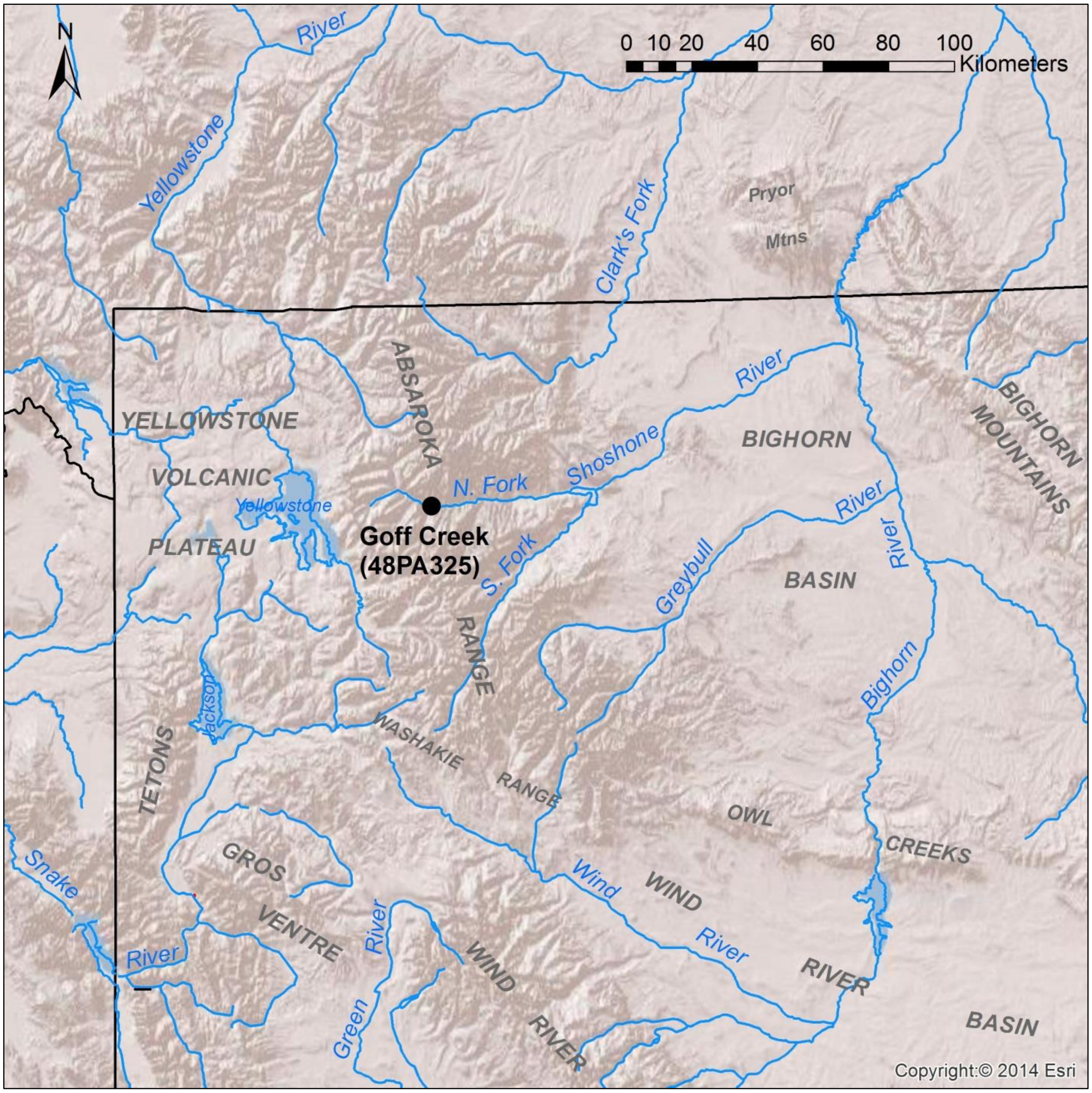

Figure 1-1 Location of the Goff Creek site.

datum area 5. Datum areas 2 and 4 were found to possess little to no potential for buried archaeological deposits, due either to a close proximity of bedrock, or the presence of poorly sorted, coarse-grained sediments containing gravel and boulders.

Datum area 3, located near the center of the site, was situated both on the eastern flank of the Goff Creek alluvial fan and on Shoshone River terraces. Datum area 3 revealed several archaeological components encased in thick sedimentary sequences. Areas adjacent to the Goff Creek alluvial fan were found to possess thick sequences of alluvium and colluvium interbedded with pea-to-grape-sized rounded to sub-rounded pebbles. Sediments accumulating at the base of slopes to the east of the fan consisted of

<u>Redacted</u>

Figure 1-2 7.5' USGS Quadrangle showing location of Goff Creek (48PA325) and surrounding topography.

Redacted

Figure 1-3 Location of test excavation conducted in 1987 at Goff Creek (48PA325).

silty sand and angular gravel. Crossbedded sand and silt units were encountered in terrace areas and indicate past overbank events of varying intensity. Given the high potential for stratified cultural deposits in the this area, 12 1 m x 1 m test units were excavated.

The 12 test units ranged from 35 cm to 2 m in depth, with units 4, 5, and 6 yielding 1,188, 812, and 1,524 artifacts, respectively, most of which were recovered from relatively shallow (0-50 cmbs) contexts. Unit 7 revealed a relatively thick (1.5 m) profile, although the lower 65 cm were represented by mainly high energy fluvial sediments that were not conducive to contextual preservation. Test unit 10, excavated to 2 m below surface, revealed relatively low density archaeological deposits possessing little to no stratigraphic separation. Artifact concentrations between 140 and 170 cmbs (where 73% of the 128 unit artifacts were found) indicated the possible presence of a deeply buried component. No features or other dateable material were recovered during testing. Diagnostic artifacts indicated the archaeological deposits dated to the Late Archaic and Late Prehistoric periods.

Datum area 6 consisted of a rockshelter on the east bank of Goff Creek, just north of the Goff Creek Lodge and well north of the project APE. A steatite bowl was found at this locality in 1964 while excavating for a pump-house. Because the rock shelter was located well outside the APE, no subsurface investigations were conducted during fieldwork.

The 1988 testing at Goff Creek demonstrated that the Datum 3 area contained multiple components. Testing also demonstrated that several areas identified during the inventory phase were either located in areas characterized by sediments having low potential for preserved archaeological context, or were well outside the APE and would not be affected by proposed construction. The Goff Creek site was determined eligible for nomination to the National Register of Historic Places under criterion D. Datum areas 1, 2, 4, and 5 were recommended non-contributing, Datum area 3 was recommended contributing, and Datum area 6 remains unevaluated.

After consultation with WYDOT, USFS, the Wyoming State Historic Preservation Office (SHPO), and the Advisory Council on Historic Preservation (ACHP), the Goff Creek site was selected for data recovery as part of the Cody-Yellowstone project. A data recovery plan (Eakin 1994) was submitted in May, 1994 to WYDOT, the Federal Highway Administration (FHWA), USFS, SHPO, and the ACHP, under a determination of no adverse effect in accordance the then current regulations in 36CFR2800. The plan focused on block excavation as the primary data recovery method, along with specific research goals and objectives based on site testing.

Consultation with the Eastern Shoshone Tribe occurred on May 14th, 1994. Shoshone Elders Haman Wise and Delphine Claire, official tribal representatives, toured the proposed project area and visited most of the NRHP eligible sites. Testing results, proposed impacts and mitigation measures were outlined by OWSA and WYDOT personnel. The Eastern Shoshone tribal representatives requested the site be avoided, although the scope of the project did not allow avoidance as a site management option.

Data Recovery Phase

Data recovery (Figure 1-4) investigations were conducted in a series of ten-day long work sessions in 1995 and 1996. The first field season lasted from June to August, 1995 and included excavation of block areas and dispersed excavation units placed in areas of high potential identified during the 1988 testing. The 1996 work session lasted from March 29th through September 4th. A backhoe was used to remove overburden in the western portion of the site (Area A) so that deeply buried cultural levels discovered in October 1995 were more accessible. A shelter was subsequently constructed in the resulting pit so that excavations could proceed during inclement weather.

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Figure 1-4 Data recovery excavations at Goff Creek.

Other excavation blocks initially opened in 1995 in the eastern portion of the site were also expanded, and several additional areas were also explored. Geoarchaeological investigations were undertaken at the site on June 23rd, September 2nd-4th, and October 22nd -23rd, 1995, and June 27th - 28th, and August 5th-7th, 1996. The purpose of these investigations was to document the geologic and pedologic context of the site, reconstruct the sequence of topographic and environmental change, and use the paleoenvironmental reconstruction to base inferences concerning prehistoric subsistence and settlement. Data collection at the site focused on the Goff Creek alluvial fan and other landforms in the general vicinity.

Data Recovery Plan

Three primary areas of research were identified in the data recovery plan; 1) subsistence practices, 2) site function and spatial relationships, 3) stratigraphic evaluation and occupational history (Eakin 1994). Specific questions within each of these research areas were formulated and helped guide the excavations at the site.

Subsistence Practices

Although a sizeable amount of bone was recovered during the 1988 testing, much of it was unidentifiable. Moreover, no artifacts or features were identified during testing that could shed much light on the subsistence practices or strategies, such as plant use or season of occupation. Therefore, the recovery of a representative sample of faunal and floral remains was a goal of the research design. The emphasis would be to ascertain if the site's inhabitants focused on any particular plant or animal species. Season of site use is intricately tied to the question of subsistence, so another stated goal was to determine, if possible, seasonality.

Activity Area Analysis and Site Function

Tool assemblages can be reliable indicators of general activities that occurred at the site during occupation. Therefore, an analysis of the spatial distribution and relative association of artifacts with hearths and other features is outlined in the research design. It was additionally anticipated that, through addressing this issue, we might gain some insight into the role Goff Creek played as a campsite in the annual subsistence rounds of the site's inhabitants.

Stratigraphic Evaluation and Dating

Testing at Goff Creek revealed evidence for stratified cultural levels. However, it was also discovered that the site has witnessed episodes of channel cutting, mass wasting and bioturbation. Consequently, one goal outlined in the research design was to determine if the cultural levels identified during testing retain integrity. In order to address this goal the data recovery plan called for the collection and submission of charred material from hearths or bulk organic sediments to date the occupations. Another means of reaching the goal was to conduct pedological analyses in order to determine the degree of post-depositional mixing.

Organization of the Report

This report is presented in 13 chapters. In Chapter 2 Eckerle provides an overview of the geologic setting and paleoenvironmental history of the Goff Creek site and surrounding region. Eakin provides a succinct overview of previous research and our current understanding of the prehistory of the Central Rocky Mountains in Chapter 3. The field and laboratory methods are discussed by Eakin in Chapter 4. In Chapter 5 Eckerle and colleagues report on the results of the geoarchaeological investigations conducted at Goff Creek. Clayton, Wedel and Waitkus present the results of the excavations in Chapters 6 through 11, with each chapter reporting on a different area of the site. Lastly, Page provides a summary and discussion of the excavations in Chapter 12.

CHAPTER 2
GEOLOGIC SETTING, PALEOENVIRONMENTAL HISTORY

William Eckerle, Rebecca Hanna, Marissa Taddie and Sasha Taddie

Site 48PA325 is in Park County, Wyoming, [redacted] (Figure 2-1). [redacted]

The Absaroka Mountains are part of the Middle Rocky Mountain Physiographic Province (Fenneman and Johnson 1946). They form an arc of high terrain at the leading edge of the Yellowstone Hot Spot (Good and Pierce 1996). This arc stands as a now dissected plateau, which is formed on 1979 m (6493 ft) thick sequence of Eocene and Oligocene age volcanic rock (Mackin 1937; Thornbury 1965). The Absaroka Range is bound by the Bighorn Basin to the east, the Beartooth Mountains to the north, the Yellowstone Caldera to the west, and the Wind River Basin to the south. High mountain areas were covered by an ice cap during the Pleistocene, and tongues of glacier ice descended into valleys as low as 1999 m (6558 ft). Deglaciation has revealed a glacially sculpted landscape above this elevation.

The North Fork heads on the west slope of Sunlight Peak (3642 m; 11,950 ft) and flows southwestward, down a glaciated, U-shaped, valley to approximately 2249 m (7379 ft). There, the valley narrows into a canyon and turns south to join Middle Creek at Pahaska Tepee (2029 m; 6657 ft). From there, the river flows eastward to its confluence with the South Fork of the Shoshone at Buffalo Bill Dam. Between Wapiti Ranger Station and Wapiti, Wyoming, the canyon widens into a broad valley. Numerous perennial and intermittent streams enter the North Fork in the canyon, some of which head in alpine settings.

The oldest rocks exposed at the surface along the North Fork occur at the confluence of the North and South Forks of the Shoshone River (Fritz 1985). This confluence is just to the west of the Cedar Mountain (Rattlesnake Mountain) anticline. Cedar Mountain anticline (Laramide) trends northeast-southwest and is flanked by a thrust fault on the southwest. Downstream, the Shoshone River canyon cuts this structure nearly perpendicular to its axis. River erosion beginning from a superposed channel (Mackin 1937) has excavated the canyon and exposed the core of the anticline including Precambrian granitic gneiss and Paleozoic sedimentary rocks. Younger, drag-folded middle Jurassic through Cretaceous sedimentary rocks ("The Palisades") are exposed on the footwall to the southwest. The lower

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Figure 2-1 Location of the Goff Creek (48PA325) site.

Eocene Willwood Formation formed as basin fill and is the predominant, exposed bedrock in the valley of the North Fork. Shortly after the Willwood Formation was deposited, Mississippian rocks were thrust over it forming the Heart Mountain Overthrust. Erosion has exposed Mississippian rocks overlying Eocene sediments on Logan, Sheep, and Table mountains above the North Fork/South Fork confluence.

The Heart Mountain Overthrust is buried by the Absaroka Volcanic Supergroup (upper Eocene) in the upper part of the North Fork drainage (Sundell 1993). North and east of the river, the Wapiti Formation forms the surface. It is composed of fine- to coarse-textured volcaniclastic rocks, which include lahars, volcanic breccias, and mudflows. This formation is centered around Sunlight Peak and is composed of andesitic volcaniclastic rocks (Love and Christiansen 1985). The Wapiti Formation is cut by a series of radial dikes (both felsic and mafic), which have their hub around Sunlight Peak (Love and Christiansen 1985).

Southward from the North Fork (along the divide between the North and South Forks of the Shoshone River), the Wapiti Formation is overlain by the Trout Peak Trachyandesite, which is in turn overlain by the Langford Formation. The latter formation is composed of "...dark-colored andesitic [volcaniclastic] rocks and flows underlain by light-colored andesitic tuffs and flows" (Love and Christiansen 1985).

Pleistocene fluvial deposits occur in the study area. Quaternary terrace history of the main trunk of the Shoshone River downstream of the confluence of the North and South Forks as well as the South Fork of the Shoshone have been studied in detail (Mackin 1937; Moss and Bonini 1961; Moss 1974; Palmquist 1983; Albanese 1987a), whereas the terrace sequence of the North Fork canyon has received less attention (Eckerle and Eakin 1997). Terrace history of the Shoshone River basin is complex. Mackin (1937) describes several terrace levels, which occur along the Shoshone near the town of Cody. The highest is the Powell terrace which stands about 300 ft (91 m) above the channel, followed by a Cody terrace set occurring between 120-210 ft (37-60 m) above the channel, and finally the ‘Inner Terrace Flight,’ which occurs from 120 ft to the river. The Powell and Cody terraces are gravel-capped whereas the Inner Terrace Flight terraces are bedrock platforms (straths) with little gravel. Mackin (1937) hypothesized that the Cody and Powell terraces were thinly mantled with gravel developed through lateral corrasion and formed during interglacial periods. Moss and Bonini (1961) demonstrate that the gravel on these terraces is thicker than reported by Mackin in 1937 and suggest that they were glaciofluvial fill terraces. Moss (1974) suggests that the terraces could be traced to terminal moraines in the valley of the South Fork and that the Powell terrace is outwash from the Bull Lake moraine, whereas the Cody terrace formed from outwash exiting the Pinedale moraine. This conclusion is not universally accepted, and some favor Mackin’s conclusion, which is that the Powell and Cody terraces underlie the respective Bull Lake and Pinedale moraines (Pierce 1968). Palmquist (1983) indicates that the Cody terrace submerges into the

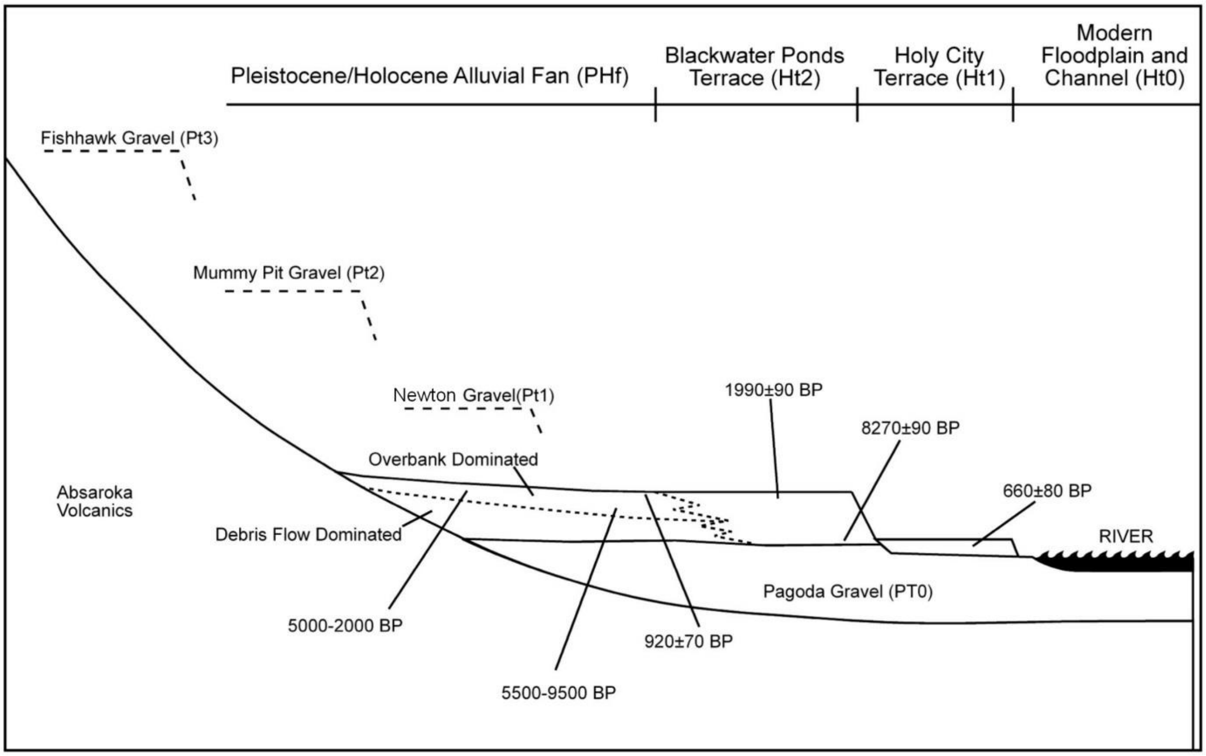

Figure 2-2 Generalized schematic cross-section of the North Fork valley.

Shoshone River floodplain downriver near the confluence of Bitter Creek. Palmquist calculates a long-term, Bighorn Basin incision rate of 0.158 m/1000 years based on the occurrence of Pearlette-like Type O volcanic ash (now considered Lava Creek B).

Love and Christiansen (1985) map portions of the high country at the headwaters of the North Fork as glacial deposits. The glacial U-shaped valley does not extend to the highway. As indicated by Love and Christiansen (1985), the canyon and valley of the North Fork and its principal tributaries are floored by Quaternary alluvium. Landslide deposits are present along the walls of the lower part of the canyon.

Eckerle and Eakin (1997) mapped Quaternary deposits along the canyon of the North Fork of the Shoshone River (Figures 2-2 and 2-3). Well sorted and well rounded, locally-derived bouldery gravel deposits are common. Elevationally, the highest occurs in a gravel pit near Goff Creek at approximately 23 m (75 ft) above the river and is vegetated with Douglas fir. The pit is nearly mined out; no terrace tread is preserved, and the original thickness of this gravel unknown. Some clasts exhibit carbonate rinds suggesting stage II+ morphology (Birkeland 1984, Birkeland et al. 1991) . This deposit is designated as the Goff Gravel (Pt2; designations in parenthesis are those used in Eckerle and Eakin 1997). Because of its relatively low elevation above the river compared to the Cody terrace at the town of Cody, it and lower gravel deposits in the canyon of the North Fork are tentatively correlated to Mackin's Inner Terrace Flight

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Figure 2-3 Latest Pleistocene and Holocene geology of the North Fork (Eckerle and Eakin 1997).

at Cody. Well sorted and well-rounded bouldery gravel deposits within the canyon are thought to have formed aggradational terraces in the canyon, whereas those within the Inner Terrace Flight at Cody are strath-cut terraces. They are thought to be late Pleistocene in age, perhaps Pinedale, with the elevationally lowest (discussed below) being late Pinedale (14,000 BP).

A bouldery gravel terrace is present at ~14 m (46 ft) above the river where it occurs at a distance of approximately [redacted] km downstream from Mummy Cave (designation not defined in Eckerle and Eakin 1997). Part of this terrace is overlain by a small, finer-textured alluvial fan. Both the alluvial fan and the terrace support sagebrush vegetation. A soil formed into the gravel contains a Bt horizon with thin clay skins and a Bk horizon with stage I+ calcium carbonate development. This gravel deposit is referred to as the Mummy terrace. Gravel thickness in this terrace is estimated in excess of 5 m (16 ft), although its base was not observed. Bedrock was not encountered underlying this terrace. A correlate remnant of a bouldery gravel deposit is present at about this elevation immediately downstream and upslope of the Goff Creek Site, although it does not retain a tread.

Numerous remnants of the next lower gravel terrace are scattered throughout the canyon of the North Fork. This is the Newton terrace (Pt1), which is composed of well sorted and well-rounded bouldery gravel forming a tread that stands ~5-6 m (16-20 ft) above the river. In places, this terrace is covered by slope wash, colluvium, alluvial fan, and possible loess deposits. Soil formation is weak with some development of Bw color and stage I calcium carbonate accumulation. Douglas fir and sagebrush occur on this terrace. Like the Mummy terrace, no bedrock was observed underlying the Newton terrace so the thickness of the gravel is unknown.

Still lower in the terrace sequence is a bouldery gravel unit that forms a tread which stands approximately 1-3 m (3.3-9.9 ft) above the river shoreline (Pt0). At some locations this tread is covered by up to 1.2 m of overbank sediment that interbeds with slope wash towards the canyon walls. Moss (1978) identifies this gravel just outside Mummy Cave and suggests that the river scoured the floor of the cave at the level of this gravel. The oldest radiocarbon date from Mummy Cave is 9248±78 BP ; Husted and Edgar 2002). The aggradation of this gravel predates the earliest Holocene. This gravel also occurs distal to the Pagoda Creek alluvial fan where dates from an overlying overbank unit produced a date of 3270±90 BP. We refer to this gravel terrace as the Pagoda terrace. Generally it is overlain by finer deposits and associated vegetation types, discussed below.

The base of the river channel is inset approximately 1-3 meters below the top of the Pagoda gravel terrace tread. Like all the gravel deposits discussed so far, the river bed is armored by bouldery gravel. This bouldery texture contrasts with gravel that forms islands and unvegetated mid-channel bars which is a cobbly texture. The cobbles in the recent bars are derived from the riverbed. Material of this size probably is commonly transported as bedload during high water stages. The presence of the cobbly bars combined with the pre-Holocene dates for the gravel composing the Blackwater Ponds terrace suggests that all of the gravel deposits discussed thus far are Pleistocene-age. Bedrock can be observed in the channel of the North Fork at a few locations. Otherwise, it is difficult to estimate the thickness of the gravel underlying the Blackwater Ponds terrace and the current channel. Given this, it must be assumed that not all of the gravel terraces have been formed by corrasion, but rather some may be aggradational.

Two levels of Holocene, fine-textured terraces are present. The highest (Ht2) stands at about 2-2.5 m (6.6-8.25 ft) above the river and overlies the Pagoda terrace with a thickness of about 0.5-1.5 (2-5 ft). It supports a limber pine and sagebrush vegetation community. This terrace was investigated below (south of) the Firefighters Memorial near Blackwater Creek where it dates from before 8270±90 BP (Cal 9470-9020 BP, 95.4% confidence) to after 1010±80 BP (Cal 1070-730 BP, 95.4% confidence). This location once housed a fish hatchery called Blackwater Ponds, and thus the fine-textured sediments and the terrace they are contained within are referred to as the Blackwater Ponds terrace (Eckerle and Eakin 1997). The deposits which form this terrace are interpreted as Holocene overbank and sheet wash sediments with some slope wash along the canyon margins

A lower fine-textured terrace (Ht1) is also present. A typical example is located near Hanging Rock and is designated as the Holy City terrace. It stands at 1.4-1.8 m (4.6-5.9 ft) above the river and about 0.25-1 m above the top of the Pagoda terrace tread. Like the Blackwater Ponds terrace it is composed of overbank sediment. A radiocarbon date of 1720±50 BP (Cal BP 1700-1550 BP, 68.2% confidence) provides a minimum date for the aggradation of this terrace. Grass-sedge meadow occurs on this terrace.

In addition to the terraces, the canyon also contains alluvial fan deposits at the mouths of side canyons. Some of the fans issue from canyons containing perennial streams while others are intermittent. More moist locations along perennial streams support riparian shrub vegetation whereas sagebrush, limber pine, and Douglas fir dominate elsewhere. The deposits forming these fans vary from silty sands to large boulders (up to 2.5 m diameter). Radiocarbon dates on intact archaeological features from Clocktower Creek fan (48PA1981; Eakin 1999) were recovered from under large bouldery deposits and dated to the late Holocene (1230±60 BP, 720±70 BP). This indicates that some alluvial fans formed during the Holocene (Hf), while others may be Pleistocene-Holocene (Phf) or primarily Pleistocene (Pf). It is often difficult to differentiate these three fan deposits as exposure windows into the core of larger fans are rarely available. Thus, discrimination of Pleistocene from Holocene alluvial fans is based on height above the river and/or radiocarbon dates from buried cultural materials.

The North Fork canyon possesses a continental climate. A strong, elevationally controlled climatic gradient runs through the North Fork area. The higher elevations in the west are wetter and cooler, and the lower elevations to the east are drier and warmer. The average, maximum/minimum

January temperatures range from -4° C (24° F)/-16° C (4° F) in the west to -2° C (26° F)/-14° C (6° F) in the east. Average maximum/minimum July temperature is 23° C (74° F)/2° C (36° F) in the west to 24° C (76° F)/4° C (40° F) in the east (National Oceanic and Atmospheric Administration 1985). Average precipitation ranges from 150 cm (59 in) near Sunlight Peak in the west to 36 cm (14 in) in the east (Soil Conservation Service 1983).

Soils of the North Fork area reflect the climatic gradient as well as parent material differences (Kronenberger et al. 1977). In the east, where the canyon widens, the soils are formed on alluvium, landslide, and slope deposits. The warm and dry climate there results in Argiborolls formed on older and more stable landscapes and Torriorthents on younger deposits. In the wetter and cooler western portion of the area Cryochrepts and Cryumbrepts predominate.

Küchler (1966) maps the major zones of potential vegetation for the North Fork region, and Dueholm (1988) conducted an inventory of the river corridor. As with the soils, these correlate to the east-west climatic gradient. A wheatgrass-needlegrass-shrub steppe (*Agropyron-Stipa-Artemisia*) is present in the warm-dry eastern portion of the valley (Küchler 1966), which is identified as a Wyoming sagebrush steppe community (Dueholm 1988). The central and western parts of the valley are occupied by Montane sagebrush steppe, with limited areas of Greasewood Flats community occurring on T2 terraces. Gravel Strand community occurs on gravel bars in the North Fork valley and its tributaries, and Shrub Carr community occupies wet fine soils (Dueholm 1988). Gallery Forest community occupies the river valley and in the lower reaches is dominated by narrowleaf cottonwood (*Populus augustifolia*). In the upper reaches, cottonwood is replaced by balsam poplar (*Populus balsamifera*). Douglas fir (*Pseudotsuga menziesii*) forms a mid-elevation forest on lower mountain slopes (Küchler 1966), and is identified as Douglas fir terrace woodland community (Dueholm 1988). Higher elevations have a Western spruce-fir (*Picea-Abies*) forest (Küchler 1966). The highest elevations on the drainage divides above the river have alpine meadow (*Agrostis-Carex-Festuca-Poa*) vegetation (Küchler 1966).

Large mammal species such as wapiti (*Cervus canadensis*), bison (*Bison bison*), mule deer (*Odocoileus hemionus*), moose (*Alces alces*), mountain goat (*Oreamnos americanus*), bighorn sheep (*Ovis canadensis*), black bear (*Ursus americanus*), grizzly bear (*Ursus horribilis*), gray wolf (*Canis lupus*), coyote (*Canis laterans*), mountain lion (*Felis concolor*), and bobcat (*Lynx rufus*) are found in the area. Smaller mammals, birds, and fish are also present.

Paleoenvironmental Background

This section presents a review of regional post-glacial paleoenvironments to provide a framework for evaluating site-specific stratigraphic and soils data presented later in this report. Paleoenvironmental change in western North America is intricately tied to global climatic change (Thompson et al. 1993). Modeled Late Pleistocene and Holocene climatic change is also discussed. A paleoenvironmental and archaeological correlation chart illustrates trends in cultural chronology and climatic history (Figure 2-4). Dates are given in radiocarbon years before present (BP) unless specified otherwise.

Regionally, the paleoclimate of the post-glacial era can be summarized as follows. Maximum glacial conditions existed between 20,000 and 15,000 BP when the area was very cold. Although the area is well south of the continental glaciation boundary, alpine glaciers were present in mountainous areas. Deglaciation began around 17,000 BP, and was well underway from 15,000-14,000 BP when cool conditions predominated. This was followed by a period of Late Pleistocene aridity between 14,000-11,500 BP. A cool and mesic interval occurred at around 11,500-10,000 BP, which roughly correlates to the Younger Dryas. Sub-regional differentiation of paleoenvironment becomes prominent during the Early Holocene beginning at 10,000 BP. Drying began at present-day winter-wet locations, whereas conditions remained cooler and moister at present-day summer-wet locations (Figure 2-5). Very dry conditions prevailed at many locations from 7500-6000 BP (early Middle Holocene). A weak mesic trend began at 6000 BP (late Middle Holocene). By 4500 BP, this trend had intensified, prevailing with several perturbations until 1800 BP (early Late Holocene). A drying trend was initiated by 1800 BP (middle Late Holocene) and intensified during the Medieval Warm period between 900 to about 500 BP (late Late Holocene). Cooler conditions returned during the Little Ice Age from 500-150 BP (also late Late Holocene) with at least one major, multi-decadal drought at about 350 BP. The early historic era was dominated by a slightly drier than present climate. These trends are discussed more fully below.

Paleoclimatic Discussion

Glacial (>15,000 BP)

Mountain glaciation was widespread in the region prior to 15,000 BP (Andrews 1987; Clayton and Moran 1982; Porter et al. 1983; Richmond 1986a). During this time, pluvial lake levels in the eastern Basin and Range physiographic province were high (Currey 1990); permafrost was widespread (Mears 1981), and vegetation zones were elevationally depressed (Barnosky et al. 1987; Plager and Holmer 2002). The Peoria loess was being deposited across much of the western High Plains (Forman et al. 2001; Osterkamp et al. 1987).

Paleoclimatic modeling (COHMAP Project Members 1988) for the last glacial maximum (at ~20,000 BP) retrodicts a jet stream that was split into two halves, one north and one south of the Laurentide Ice Sheet, both flowing west to east. The southern stream was depressed far below the present position of the jet stream. Interaction of these streams is modeled as producing strong anticyclonic circulation over the ice sheet with the predicted result of cold, dry, easterly, summer winds. Winters were probably no harsher than at present, but seasonality was much reduced, resulting in colder summers. Average temperature in the study region was 12° C colder than present. The summer monsoon was absent

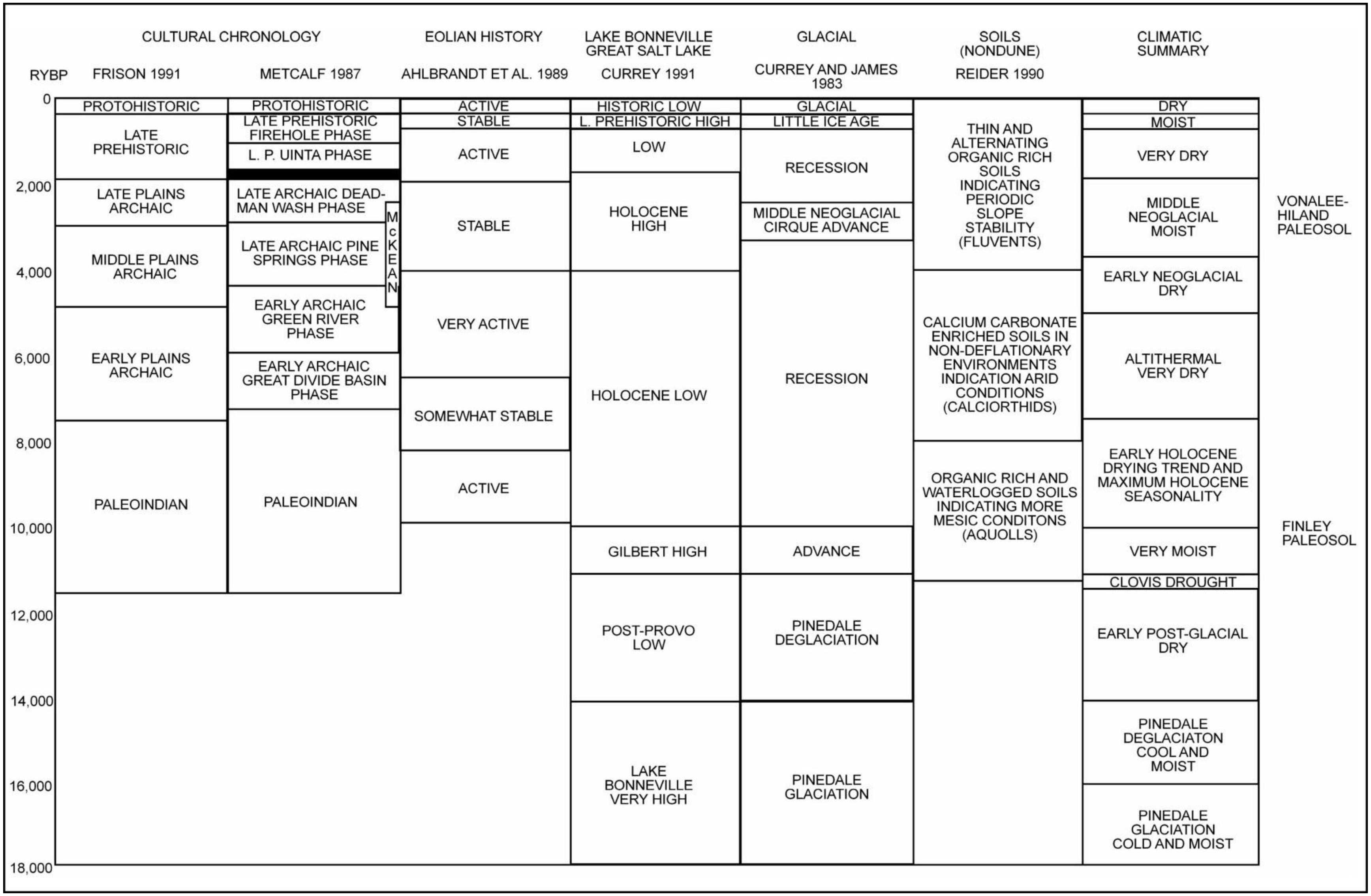

Figure 2-4 Paleoenvironmental and archaeological correlation chart (Eckerle and Hobey 1999 and references therein).

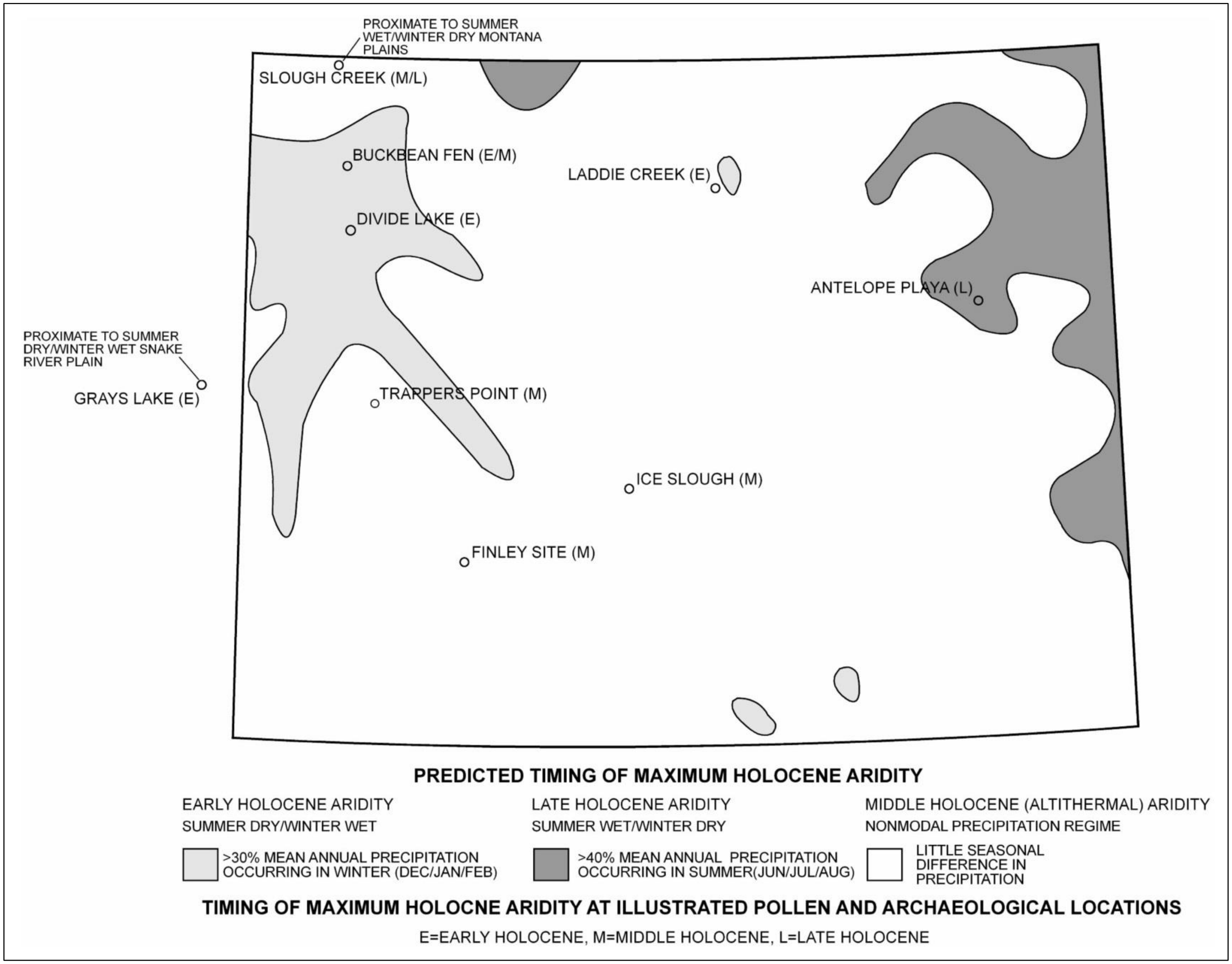

Figure 2-5 Map showing the spatial and temporal distribution of maximum post-glacial aridity.

and the Pacific subtropical high was very weak. Thus, cold, dry conditions are retrodicted for the study region, and proxy data support the model (Thompson et al. 1993).

Deglaciation (15,000-14,000 BP)

Regional data suggest that deglaciation of the mountains and the cessation of the periglacial regime in the basins was well underway by 15,000 years ago (Porter et al. 1983; Richmond 1986a; Teller 1987). Pluvial lake levels dropped to post-glacial lows (Currey 1990), and vegetation zones shifted upward in elevation (Barnosky et al. 1987). Eolian sand activity may have occurred at this time (Ahlbrandt 1974).

Changes in the geometry of the earth's orbit and axial tilt initiated a trend toward warming and an increase in seasonality (COHMAP Project Members 1988). Paleoclimatic modeling predicts the Pacific subtropical high was too weak to provide much moisture to the area. A northward shift of the jet stream occurred as a result of the wasting of the Continental ice cap but the shift was not pronounced enough to draw monsoonal flow into the study region. As a result, dry conditions prevailed.

Immediate Post-Glacial (14,000-11,500 BP)

Around 14,000 BP, changes in the geometry of the earth's orbit and axial tilt initiated a trend toward warming and an increase in seasonality (COHMAP Project Members 1988). Regional data suggest that pluvial lake levels dropped to post-glacial lows (Currey 1990) during this period. Generally, conditions were dry, especially around 12,000 BP (Haynes 1990). Deglaciation of the Continental Ice Sheet progressed (Richmond 1986b; Teller 1987). Vegetation zones shifted upward in elevation (Barnosky et al. 1987).

Latest Pleistocene (11,500-10,000 BP)

Dramatic, post-glacial climatic change occurred on a worldwide scale between 10,900-10,050 BP, correlating to the Younger Dryas. The Younger Dryas cooling event is well documented in Greenland ice cores (Alley 2000; Fiedel 2003). Cooling in the Northern Hemisphere at this time is responsible for the rejuvenation of mountain glaciers in the Rocky Mountains (Reasoner and Jodry 2000; Davis et al. 2003). The Great Salt Lake rose to a post-glacial high-stand at the Gilbert shoreline (Currey 1990) responding to greater runoff from western Middle Rocky Mountains. Eolian sand deposition occurred during this time at the Killpecker Dune Field (Moss 1951; Ahlbrandt 1974). A latest Pleistocene cooling event is well represented in pollen cores from the region (Fall and Zielinski 1995; Plager and Holmer 2002).

Early Holocene (10,000-7500 BP)

Evidence points to divergent paleoclimatic histories in the region during the earliest Holocene.

The Great Salt Lake record indicates that effective moisture began to gradually decrease around 10,000 BP (Currey 1990). Murchison (1989) suggests that the lake fell to an Early Holocene low between 8800 BP and 7800 BP. A minor rise occurred between 7600 BP and 7000 BP before mid-Holocene low levels were reached between 6800 and 6000 BP.

Eolian sand activity occurred at some locations during this period although dune deposits are not as common as during the Middle Holocene (Ahlbrandt et al. 1983). In some areas a soil formed on stabilized eolian sand deposits during this period (Eckerle 1997; Eckerle et al. 2002; Mayer and Mahan 2004).

There is no evidence that cirque glaciers reactivated during the Early Holocene (Davis 1988). Temple Lake cirque in the Wind River Range was essentially ice free after 11,770±710 BP, and alpine cirques were not reoccupied by ice until the Neoglacial era (after about 5000 BP). Pollen data for the region suggest the beginning of a warming and drying trend but not to the degree exhibited during the Middle Holocene (Plager and Holmer 2002). However, in some winter-wet areas like Grays Lake, Idaho, maximum Holocene warmth and aridity seems to have prevailed (Beiswenger 1991).

A well-documented shift in stream systems occurred from high-energy fluvial regimes during the Pleistocene to low-energy regimes during the post-glacial era (Hunt 1953). This probably reflects a reduction in runoff from glacier and snowfield melting. Albanese (1990) and Leopold and Miller (1954) document such a shift in the Powder River Basin. Miller (1992) suggests a similar shift in alluvial regimes for the Wyoming Basin in general. Albanese (1980) and Reider (1980) postulate a transition from perennial to intermittent flow regimes beginning in the Early Holocene in the Owl Creek Mountains. McFaul (1985) reports encroachment of foot slope deposits onto a former alluvial floodplain in the Rawlins Uplift during the Early Holocene. Early Holocene debris flow and slope wash fill valleys that previously exhibited perennial flow (Albanese 1987b, 2001). Larson (1992) reports hill slope instability during the Early Holocene at the Laddie Creek site on the west slope of the Bighorn Mountains. All of this evidence suggests a reduction in stream capacity and an increase in hill slope sediment availability in the Early Holocene, both of which can be interpreted as the result of a shift from higher moisture in the latest Pleistocene/earliest Holocene to reduced moisture after 9000 BP.

Late Pleistocene mammal distributions in the Wyoming Basin and adjacent Great Plains (Walker 1987) suggest that boreal fauna were replaced by steppe forms sometime between the terminal Pleistocene and the Middle Holocene. This was the result of warming and drying in the Early Holocene.

There is some evidence for a continuation of moist conditions during the Early Holocene at some locations. Dahms (1994) reports evidence for slope stability and soil formation in the foothills of the Wind River Mountains dating to before 6700 BP, which suggests adequate moisture and hillslope stability before this date. At Ice Slough on the Sweetwater Plateau, cool and/or moist conditions existed between

10,000-8500 BP (Beiswenger 1991). At Antelope Playa in the Powder River Basin, the Early Holocene is dominated by cool and moist conditions (Markgraf and Lennon 1986). Packrat midden data from the northern Bighorn Basin also suggest cooler than present conditions during the Early Holocene (Lyford et al. 2002). A few dune locations in southwestern Wyoming have evidence for stability during the earliest part of the Early Holocene (Eckerle et al. 2002).

The general circulation model retrodicts summer insolation and seasonality at post-glacial maximum values with worldwide solar radiation 8 percent higher in summer and 8 percent lower in winter than at present for the earliest Holocene. Worldwide temperatures were as much as 2-4° C higher than at present during this time (COHMAP Project Members 1988). In response, seasonality is thought to have been pronounced, and summer warming caused the jet stream to shift northward producing stronger monsoonal flow from the Gulf of Mexico and the Sea of Cortez (Thompson et al. 1993).

The interaction of mountainous topography with both the Early Holocene summer-insolation maximum (Davis 1984) and the northern migration of the jet stream caused spatial variation in the timing of periods of maximum post-glacial moisture and maximum post-glacial aridity (Millspaugh et al. 2000; Whitlock and Bartlein 1993; Whitlock et al. 2003). This led to contrasting wet and dry climatic trends during the same time frame and may explain the fact that maximum Holocene aridity occurred in the Early Holocene in some areas but not until the Middle Holocene in others.

Early Middle Holocene (7500-6000 BP)

Aridity intensified in most of the region during the early Middle Holocene. This marks the first half of the postulated dry Altithermal interval that dates to 7500-5000 BP (Antevs 1955). The initial portion of this period (7000-7500 BP) coincides with a worldwide, episode of cooling, the so-called ‘early to mid-Holocene transition’ (EMHT; Stager and Mayewski 1997). This event is thought to have produced dry and windy conditions in the interior United States (Alley et al. 1997).

Some locations in the region experienced eolian deflation, while aggradation prevailed downwind from sand source areas. Ahlbrandt et al. (1983) propose maximum Holocene dune activity in the Wyoming Basin during the early Middle Holocene. At the Finley site, which is near the head of the Killpecker dune field, this eolian activity produced deflation, whereas massive eolian sand accumulation occurred at sediment trap areas like the Clear Creek location in the Seminoe-Ferris dune field (Gaylord 1982, 1990). At Seminoe-Ferris, the peak period of Holocene sand accumulation occurred between 7500-7000 BP. Several periods of stability are noted, and one is bracketed by dates of 6460-5940 BP. Gaylord (1990) interprets this as supporting the idea that the early Middle Holocene was punctuated by a period of increased moisture as suggested by Benedict (1981) for the Colorado Front Range. However, Benedict's (1981) dates (7200-6400 BP) do not significantly overlap with Gaylord's (1990) (7500-7000 BP, 6460-

5940 BP). Similarly, the Great Salt Lake record contains two minor moist periods within the overall xeric Early Holocene through early Middle Holocene span. These moist periods are at 7600-7000 BP and then again at 6000-5200 BP. Miller (1992) suggests a period of dune stability between 7500-7100 BP. Miller's dates overlap well with the earlier mesic spike at the Great Salt Lake. Otherwise, there is little or no overlap in these records and little support for a region-wide period of increased moisture during the early Middle Holocene. Several studies in the western United States suggest that eolian activity correlates with La Niña events, and that these events might have been more common during the early Middle Holocene (Menking and Anderson 2003). Twentieth century corollaries suggest that dune field destabilization and sand mobilization result from greater than 25 percent deficit in growing season precipitation, which correlates with La Niña conditions (Forman et al. 2001).

Xeric-induced hillslope instability in the foothills of the Wind River Mountains occurred from 6700-4800 BP (Dahms 1994) suggesting aridity. Regionally, the palynological record suggests aridity and the altitudinal lowering of vegetation communities (Plager and Holmer 2002). Pollen records indicate that Holocene drying was pronounced in the southern Yellowstone area between 9000-5000 BP (Baker 1976; Whitlock and Bartlein 1993). A few records suggest a later persistence of aridity. Beiswenger (1991) documents maximum Holocene aridity at Ice Slough between 8200-3200 BP. Fall et al. (1995) propose that the Wind River Mountains were driest between 5400-3000 BP. However, woodrat midden data from the Bighorn Basin indicate that the early Middle Holocene was warmer and drier than the preceding Early Holocene (Lyford et al. 2002).

Great Salt Lake lowered between 6800 and 6000 BP (Murchison 1989). Slightly higher lake levels preceded this low (7600-7000 BP) and followed it (6000-5200 BP). Low lake levels and aridity returned near the end of the early Middle Holocene and continued until 4500 BP (Don Currey, personal communication 2004). Neither of the minor high-stands approached the magnitude of the terminal Pleistocene (11,000-10,000 BP) or the middle Neopluvial (~4500-3000 BP) high-stands, which were caused by significantly increased moisture.

The mid-Holocene alluvial history at many locations suggests that reduced stream flows began in the Early Holocene and continued through the early Middle Holocene. Flash flood (debris flow) and slope deposits form the bulk of sediments at confined valley locations including Sage Creek (McFaul 1985), Indian Creek (Albanese 1987a), Barton Gulch (Eckerle 1988; Davis et al. 1989), Guffy Peak (Albanese 1980; Reider 1990), Split Rock (Albanese 1987b), and Dead Indian Creek (Eckerle 1990). At some former alluvial locations, eolian activity predominated (Miller 1992) and choked alluvial systems with sediment. Miller (1992) reports a rarity of overbank aggradation during this time due to lowered stream energy. Early and early Middle Holocene deposits generally form the lower part of what has been termed the Kaycee Formation (Leopold and Miller 1954), which is largely composed of slope wash.

Larson (1992) documents less slope activity at the Laddie Creek site during the early Middle Holocene than during the Early Holocene. This evidence, along with evidence for drying at Antelope Playa in the Powder River basin during this time interval, suggests that present day summer-wet locations may have different paleoenvironmental trajectories than winter-wet locations (Figure 2-5).

Late Middle Holocene (6000-4500 BP)

Climate modeling suggests that by 6000 BP summer temperatures were still 2-4° C higher, but began to decline in response to decreased summer insolation (COHMAP Project Members 1988). Other modeling combines the influence of solar input and volcanic aerosols to predict Holocene climatic change (Bryson 1994). This model predicts that 5000-4000 BP was transitional between the generally dry winters and warm/wet summers of the early Middle Holocene and the warmer and wetter winters of the Neoglacial episodes after 5000 BP. Thus, as modeled, the late Middle Holocene was transitional.

The Great Salt Lake record indicates that conditions of relatively low effective moisture continued into the period between 5000-4500 BP (Currey 1990; Don Currey, personal communication 2004). Pollen records from the southern Yellowstone area indicate that xeric conditions began to ameliorate after 5000 BP, a trend that has continued up to the present. This is documented at Divide Lake (Whitlock and Bartlein 1993) and Buckbean Fen (Baker 1976). Beiswenger (1991) documents aridity continuing through the late Middle Holocene at Ice Slough in the Wind River Basin. As mentioned above, Holocene drying began much later in summer-wet locations, like Antelope Playa, with aridity beginning after 7000 BP and especially after 3000 BP (Whitlock and Bartlein 1993), but these are exceptions.

There is evidence that eolian activity persisted relatively unabated from 5000-4500 BP in some areas. At the head of the Killpecker dune field, eolian sand began to accumulate in the Upper Sand after 5845±115 BP marking a transition from a long deflationary period (Ahlbrandt 1974). Ahlbrandt et al. (1983) suggest that sand deposition prevailed from 5800-4200 BP. Gaylord (1990) indicates that sand accumulation continued after a stable, mid-Holocene period dating from 6400-5900 BP and that a late Middle Holocene peak in sand accumulation occurred between 5900-4500 BP.

The late Middle Holocene has sometimes been referred to as the "early Neoglacial," however in most of the study region a resurgence of cirque glaciers did not begin until the very end of the period. By around 4700 BP (5000 ka), small cirque glaciers had begun to occupy high cirques in the Wind River Mountains (Dahms 2002). In other ranges, a shift in cirque lake sedimentation from fine to coarse textured sediment occurred at around 5000 BP and is thought to coincide with the beginning of increased Neoglacial runoff (Dahms 2002).

The alluvial record for the late Middle Holocene indicates that conditions remained similar to those that existed during the early Middle Holocene interval. Powder Wash in the Washakie Basin

(48SW7933) was aggrading by foot slope and lateral fan encroachment during this period (Eckerle and Hobey 1994). Similar relationships that show a continuation of early Middle Holocene depositional processes are present at Indian Creek (Albanese 1987a; Ottersberg 1987), Barton Gulch (Eckerle 1988; Davis et al. 1989), and Dead Indian Creek (Eckerle 1990).

Miller (1992) reports a rarity of overbank aggradation during this period and attributes this to down cutting and massive valley stripping brought on by more moist conditions and increased stream competency. This conclusion fits with Miller's reconstruction of dune stability and moist conditions during the early Neoglacial but is at odds with several of the investigations cited above. Both early Middle Holocene and late Middle Holocene alluvium are rare in the Powder River Basin (Albanese 1990). Some late Middle Holocene alluvial locations contain alternating fluventic A horizons suggesting a several alternating moist and dry episodes (Reider 1990).

Early Late Holocene (4500-1800 BP)

The highest Holocene lake levels occurred at Great Salt Lake between 4500-1800 BP (Don Currey, personal communication 2004). Pollen records indicate a continuation of previously established trends with summer-dry areas becoming moister and summer-wet areas drier (Whitlock and Bartlein 1993). Ahlbrandt et al. (1983) indicate that dune fields were generally not active during the beginning of the late Middle Holocene. Continued but lessened sand accumulation occurred from 4500-2200 BP at which time the Seminoe-Ferris dune field stabilized.

This time interval is also known as the 'middle Neoglacial.' Several periods of glacial activity are documented within high elevation cirques in the Wind River Range (Dahms 2002). The first glacial pulse formed the Alice Lake allochthon, which aggraded from 4670 to 3600 BP (5500-4000 ka). Another pulse occurred during the Black Joe glaciation at an estimated 2000-1500 BP (Dahms 2002).

Dahms (1994) observed evidence for renewed soil formation on slope soils in the Wind River Mountains dating to after 4800 BP which he attributes to increased moisture. Eckerle (1989, 1997; see also Albanese and Frison 1995) documents a moderately developed paleosol (i.e., Vonalee-Hiland paleosol) that formed on eolian sand in the Wind River Basin at this time. Dates generated by the eolian sand studies indicate that eolian activity (deposition with intermittent deflation) began in the Early Holocene and continued through the late Middle Holocene. Eolian activity ceased by the early Late Holocene when the soil formed. This paleosol consists of either a weathered Bw horizon (structural development and/or oxidized iron), or an illuvial, clay enriched Bt horizon. Albanese (1989; Albanese and Frison 1995) noted the presence of this soil in the Lost Soldier area where he documented eolian activity with a soil forming on stabilized sand after 3600 BP. Sites in southwestern Wyoming that have evidence of eolian sand activity (deposition and deflation) in the Middle Holocene followed by stability (non-deposition and non-deflation) during the early Late Holocene include the Disney site in the Muddy Creek basin 3(Rood et al. 1992), 48UT122 in the Blacks Fork/Granger area (Eckerle 1991), and the Trappers Point site near Daniel (Eckerle and Hobey 1995). In addition, research in the Deer Hills west of Marbleton, Wyoming (Eckerle 1993) indicates that eolian sand shadow deposits that had been active during the late Middle Holocene became stabilized during the early Late Holocene. As a result of this stability a soil formed which contains a Bw horizon of oxidized iron staining and blocky structure development. This soil has remained at the surface in a large portion of eolian sand deposits, including major portions of the Wind River Basin, Casper Dune Field, and Deer Hills (Eckerle 1989). This suggests that Middle Holocene eolian sand activity followed by early Late Holocene landform stability are high order geomorphic events within the Holocene, whereas alternations of eolian deposition and deflation during periods of general sand mobility reflect lower order events. Miller (1992), on the other hand, suggests that the period of 6000-5000 BP was a dominant period of increased moisture, and greater dune field stability.

The presence of the early Late Holocene Vonalee-Hiland paleosol (Eckerle 1989) suggests that shallow-rooted plants like grasses were widespread and had the effect of stabilizing dunes during this period. Given adequate moisture, shallow-rooted species can prevent erosion in sand provenance source areas and truly stabilize dune fields. This paleosol is thought to have formed from an increase in meteoric water, as well as from stored moisture.

Woodrat midden data from the Bighorn Basin indicate that the period from 4400 BP to 2700 BP was cooler and wetter than today, and markedly so in comparison to the preceding dry Middle Holocene (Lyford et al. 2002). There is evidence for a resurgence of cool conditions with higher timberlines and renewal of cirque glaciers at this time (Benedict 1985; Currey and James 1982; Denton and Karlén 1973; Zielinski 1987). Mesic indicator species dominate small mammal collections from deposits in Yellowstone National Park dating from 3200 BP to 1100 BP (Hadly 1996).

Middle Late Holocene (1800-900 BP)

Moderately dry conditions returned sometime after 1800 BP. According to Ahlbrandt et al. (1983) dune fields reactivated between 2000-1000 BP. Currey (1990) and Murchison (1989) report the beginning of a recessionary shoreline period at the Great Salt Lake at 1800 BP. Bison procurement seems to become more common during 1200-900 BP at sites with possible Avonlea affiliations. This increase in bison procurement may be the result of purely cultural process; however a return to slightly more moist conditions during this 300-year span is also possible.

Late Late Holocene: Medieval Warm Period (900-500 BP)

Records from various parts of western North America suggest a period of aridity occurred that correlates to the Medieval Warm Period of Europe (Graumlich 1993). Locally, it seems appropriate to call this event the "Little Altithermal." Lake levels in the Great Salt Lake fell to post-Altithermal low levels during this time (Currey 1990; Murchison 1989). Forest fire frequency increased during this time period (Whitlock et al. 2003). This episode is well represented in pollen cores from the region (Plager and Holmer 2002). An episode of post-Altithermal eolian activity dating from 1000-500 BP correlates to this period (Ahlbrandt et al. 1983). There are no glacial episodes dating from this time (Dahms 2002; Davis 1988). Xeric indicator species dominate small mammal collections from deposits in Yellowstone National Park during this period (Hadly 1996).

Late Late Holocene: Little Ice Age (500-150 BP)

A final high stand of Great Salt Lake occurred in the terminal prehistoric era (Currey 1990). Murchison (1989) places this event at about 450-150 BP. Thereafter, the lake dropped to modern levels suggesting a drier historic climate. Ahlbrandt et al. (1983) suggest that dunes stabilized during this period and remained stable until at least 220±90 BP. Good evidence for Holocene glaciation dates to the Little Ice Age. This glaciation is termed the Gannett Peak in the Wind River Range where it dates to 500-150 BP (Dahms 2002; Richmond 1986a). Temperatures during this period were 1 to 3° C lower than present day (Munroe 2003; Plummer 2003). Mesic indicator species reappear in small mammal collections from deposits in Yellowstone National Park dating to the Little Ice Age (Hadly 1996). Analysis of oxygen isotope and tree ring data in the Wind River Mountains indicates that temperatures have risen since the end of the Little Ice Age (Plummer 2003). Some periods of drought occurred during this period. A severe multi-decadal 'megadrought' occurred in the late Sixteenth century (~350 BP) (Gray et al. 2003; Stahle and Fye 2003).

CHAPTER 3
CULTURAL CONTEXT

Daniel H. Eakin

A highly developed cultural chronology provides a firm grasp on time perspective, an increment of archaeological research necessary before more advanced objectives can be addressed (Thomas 1979). A cultural chronology should be considered no more than a tool to position and organize technologic and other changes characterizing cultural systems through time. The criteria used to construct a cultural chronology are based upon the more durable esthetic or utilitarian objects usually comprising only a small increment of a material culture. Once an item has been determined temporally diagnostic - usually through stratigraphic comparisons or radiocarbon dating - it can be used as a time indicator (Frison 1991:15-19). Cultural chronologies of the Northwest Plains and Intermountain areas have primarily developed from projectile point typologies (Mulloy 1958; Frison 1978a). Other criteria such as ceramics, association with extinct fauna, and in some cases geomorphic setting have been used as temporal indicators (see Frison 1991:267-275).

Systematic investigation of archaeological sites began in the North Fork Valley in the early 1960s with the discovery and excavation of Mummy Cave (Husted and Edgar 2002, Figure 3-1). At that time the stratigraphic record of Mummy Cave (located about 8.8 km downstream from the Goff Creek site) was considered one of the best known because the 38 radiocarbon dated levels provided one of the most complete prehistoric chronologies in the central Rocky Mountains (Wedel et al.1968). Cultural levels spanning 9000 years of Holocene time provided a relatively complete succession of human occupation for the area along with associated projectile points and other artifact types.

In addition to the cultural sequence, the Mummy Cave investigations contributed to the initial recognition of several important patterns that would become the focus of research in coming decades. One was evidence for specialized mountain-adapted culture beginning at least in the Late Paleoindian period. Similar patterns have continued to be documented in the region and now comprise part of the conceptual basis or paradigm for early occupations of much of the Rocky Mountains (Husted 1969). Another was evidence for bighorn sheep’s role as a primary human food source for a considerable period of time. In later years Frison and others added to these ideas, which greatly enhanced and refined models pertaining to high elevation adaptations (Frison 2004). Another contribution of the original Mummy Cave investigation was the pattern of fluvial degradation recorded in its lower levels which destroyed archaeological deposits that may have once been there. A similar pattern was documented during our

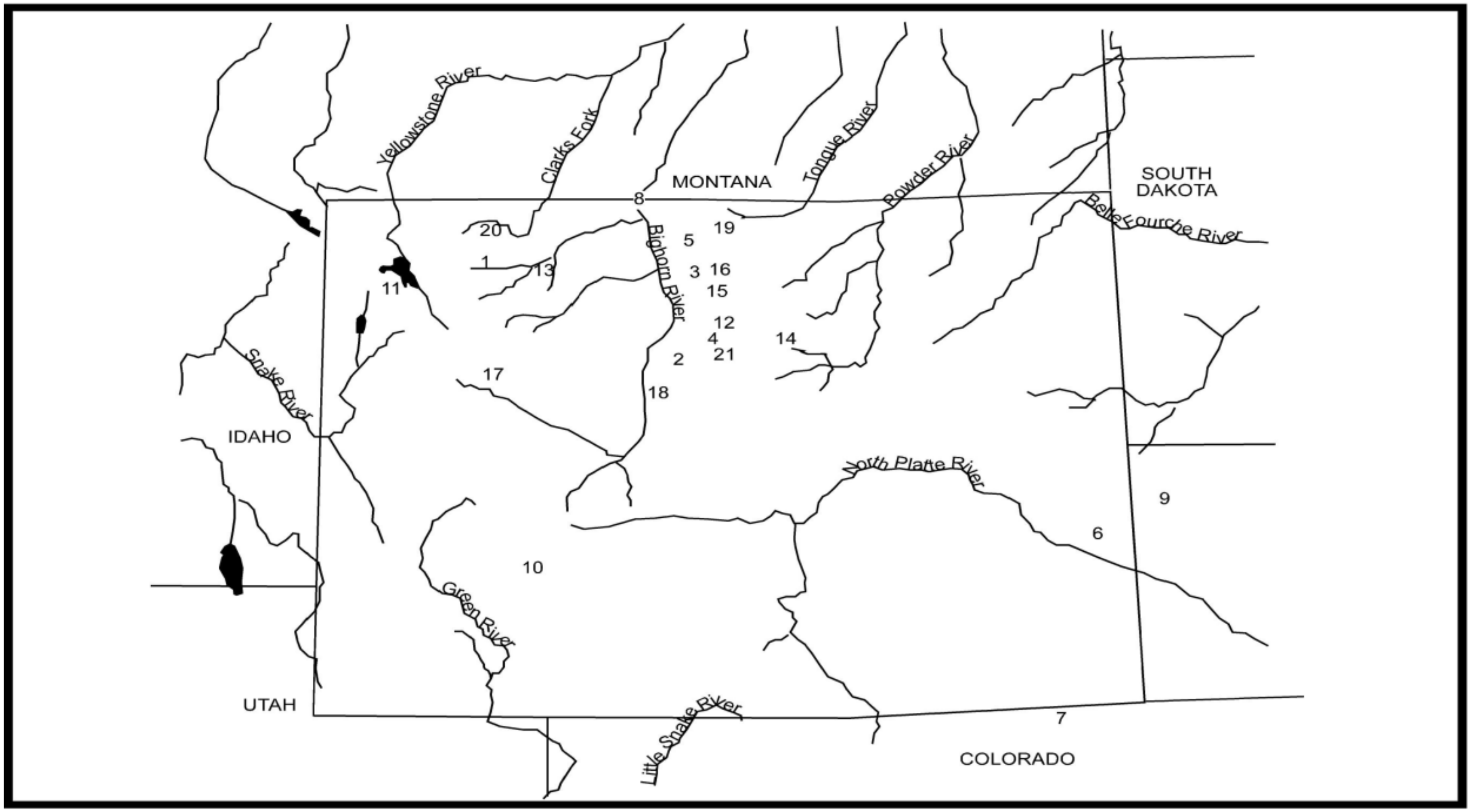

Figure 3-1Sites discussed in text: 1) Goff Creek; 2) Mummy Cave; 3) Medicine Lodge Creek; 4) Bush Shelter; 5) Hansen; 6) Hell Gap; 7) Lindenmeier; 8) Big Horn Canyon sites; 9) Hudson-Meng; 10) Finley; 11) Osprey Beach; 12) Laddie Creek; 13) Horner; 14) Schiffer Cave; 15) Southsider Cave; 16) Paintrock V; 17) Lookingbill; 18) Wedding of the Waters; 19) Granite Creek; 20) Dead Indian Creek; 21) Spring Creek Cave.

investigation of sites up and down the North Fork Valley in the 1980s and 1990s. At the Goff Creek site, 16 km east of Yellowstone Park, Cody Complex artifacts found directly above high energy fluvial gravel, provided a possible maximum-age limit for archaeological materials within the post-Pinedale Shoshone River channel.

Apart from McCracken's (1978) interpretation of the stratigraphy at Mummy Cave, the only detailed analysis of the Mummy Cave material was conducted by Hughes (2003). In that study Hughes (2003) addressed the effects of changing Holocene climate on the annual range of bighorn sheep and how these changes could have influenced the occupation history of Mummy Cave. The study used sheep and deer remains and oxygen isotope analysis to argue that human use of Mummy Cave was greater during the Early Holocene because habitat at that time favored greater numbers of bighorn sheep, whereas after the mid-Holocene cooling around 4000 BP, humans refocused their subsistence activities to lower elevations due to greater numbers of sheep in those areas. However, the radiocarbon dated occupations documented elsewhere in the valley throughout the period of WYDOT-sponsored investigations may not agree with those findings (Eakin 1989, Eakin and Miller 1989). Among other things the Hughes (2003) study cleared up some lingering problems of stratigraphy within the cave and provided several new radiocarbon dates for various cultural components from samples collected in the 1960s.

The upper North Fork valley is well within the Absaroka Mountains, and archaeological sites found there reflect a subsistence strategy geared toward a wide assortment of locally available raw materials and food resources. However, as the North Fork flows from the mountains, across the Bighorn Basin to join the Bighorn and eventually the Yellowstone River on the plains of Montana, it is only natural to assume that the environs of the upper North Fork were visited and used by various plains and mountain-oriented groups throughout the Holocene. Some non-local toolstones found at various sites on the North Fork certainly indicate this, and the possibility that prehistoric populations had a wide geographic range.

Paleoindian Period

The Paleoindian period includes the immediate post-glacial through earliest Holocene time as outlined in Chapter 2 and includes Clovis, Goshen/Plainview, Folsom, Agate basin and Hell Gap. The early Paleoindian period is not well represented on the North Fork. No sites of this age were found over the years of investigation, and there were a few reports by local residents of fluted point finds and other possible early Paleoindian projectile points. Unfortunately none of the reports were substantiated. The lack of early Paleoindian materials probably lies in the lack of exposed earliest Holocene landforms in the upper portion of the North Fork Valley. The oldest archaeological remains found in Holocene overbank sediments within the modern river trench appear to be of Cody Complex age (Eakin and Eckerle 2005).

This does not rule out the possibility that deeply stratified alluvial fans or buried Pleistocene terraces or other landforms above the T2 might contain evidence of these earlier Paleoindian occupations.

The temporal range of the Clovis point, one of the oldest known point types in North America, is becoming better known and calibrated radiocarbon dates from several sites cluster around 13,500 BP (Frison 1991:39). Based on their widespread occurrence as surface finds, Clovis groups exploited ecozones from the lower elevations of the plains and interior basins to above timberline. The Colby site located in the central Bighorn Basin, just east of Worland, Wyoming, produced several diagnostic projectile points along with other cultural material in direct association with the remains of at least six mammoths (Frison and Todd 1986).

Goshen points (or perhaps more properly Goshen/Plainview) either fall between Clovis and Folsom or may be contemporaneous with both. More radiocarbon dated Goshen sites need to be found before the true cultural and temporal context are known. What little is known of the Goshen Complex comes from several sites in eastern Wyoming and southeastern Montana (Frison 1996). In the Bighorn Basin, Goshen/Plainview points were recovered from the excavations at the Medicine Lodge Creek site and at Bush Shelter, located about 50 km to the south of Medicine Lodge Creek (Frison and Walker 2007). Some researchers suspect that Goshen may be one of the earliest representatives of the mountain oriented adaptations (Frison and Walker 2007:36). No Goshen points are known from the North Fork Valley. Folsom projectile points date from about 11,000 to 10,500 BP (Frison and Stanford 1978). Some sites of this age suggest that the primary focus of Folsom groups was big game hunting. Other sites like the Hanson site in the northern Bighorn Basin (Frison and Bradley 1980), the Hell Gap (Irwin-Williams et al. 1973) and Lindenmeier sites (Wilmsen and Roberts 1978) indicate a broader based spectrum of hunting and gathering encompassing scheduled movement and utilization of a wide variety of large and small mammals (Frison 1983a:111).

Agate Basin projectile points date from about 10,500 to 10,000 BP (Frison and Stanford 1978). In Wyoming, classic Agate Basin age sites may represent more of a plains phenomenon, since they have been documented mainly to the east of the North Fork area in the Powder River Basin. No Agate Basin age sites have been found in the Bighorn Basin. A number of lanceolate projectile points considered to be Agate Basin variants have been recovered in the northern and western parts of Wyoming. Such points have been reported from Mummy Cave (Husted and Edgar 2002), the Bighorn Canyon cave sites in the Bighorn Mountains (Husted 1969), as well as Medicine Lodge Creek (Frison and Walker 2007). Although the radiocarbon dates are somewhat late (8700-8100 BP), Husted (1969) believes the parallel-obliquely flaked lanceolate points from cultural layers 8 through 12 in Mummy Cave and the Bighorn Canyon cave sites represent an early phase of mountain occupation and considers these point types to be derived directly from the Agate Basin complex, an assessment that is supported by Bradley (2010).

The Hell Gap complex follows Agate Basin and has been dated between 10,000 and 9500 BP No Hell Gap sites are known from the Bighorn Basin. This cultural complex is commonly associated with plains environments and was apparently a highly specialized technology centered on the exploitation of bison. Several large bison kill sites are known of this age from both Wyoming and Colorado (Frison 1974; Stanford 1978).

The Alberta cultural complex follows Hell Gap and dates from about 9600 to 8600 BP (Agenbroad 1978). Although similar to point types of the Cody Complex, Alberta points remain distinct as a result of finds at the Hudson-Meng (Agenbroad 1978) and Finley sites (Frison 1991:62-65). Most of the evidence for the Alberta Complex has been gained through bison kills.

The Cody complex is defined by the presence of Eden and Scottsbluff points and the distinctive Cody knife (Jepson 1953; Frison 1991:181-186; Frison and Todd 1987). Radiocarbon dates from various sites show that the Cody complex lasted from about 9300 BP to 8500 BP (Frison 1991:26). Surface finds of Cody Complex material range from the interior basins to timberline. Although no evidence for Cody Complex was found in Mummy Cave, a Cody Complex site was found at the Goff Creek site. This indicates that this complex should not be viewed strictly as a Plains manifestation (Eakin and Eckerle 2005). The Osprey Beach site, a campsite located even farther west along the shore of Yellowstone Lake in Yellowstone National Park, leaves little doubt that an advanced mountain-oriented subsistence strategy was well within the milieu of Cody Complex groups (Johnson et al. 2004). To the east of the North Fork area, Cody Complex age levels are known from foothill settings at both the Medicine Lodge Creek (Frison and Walker 2007) and Laddie Creek (Larson 1992) sites in the eastern Bighorn Basin and suggest small scale hunting and gathering. The Horner site, a large bison kill located on the Shoshone River a few kilometers east of Cody, was excavated by Princeton University and the Smithsonian Institution in the 1940s and 1950s and in the 1970s by the University of Wyoming (Frison and Todd 1987). Excavations revealed a campsite and associated kill-processing areas where several procurement episodes occurred. Together Cody Complex sites indicate groups that employed both small scale hunting and gathering in both mountain and basin settings, as well as the periodic exploitation of bison to obtain large volumes of meat and other useful items that these animals supplied.

A few archaeological sites, some dating as early as middle Paleoindian Period, have given archaeologists reason to believe that a divergence in subsistence strategies occurred between the plains and mountains at some point during the Paleoindian period (See Frison 1991, 1983b; Husted 1969). A wide variety of diagonally flaked lanceolate and split or expanding base projectile points are typical for this time. Some of the point types are associated with plains bison kills (Mulloy 1958), while others are known from mountain-foothill rockshelters (Frison 1983a:120) or mountain valley settings (Eakin and Eckerle 2004). A common find in the Bighorn-Absaroka mountains are a variety of stemmed, eared and bi-beveled projectile points which are also contemporaneous with terminal Paleoindian lanceolate projectile points. Pryor Stemmed and Lovell constricted (Husted 1969) are names given to two of these point types. These complexes seem more restricted to upland areas, being represented most often in stratified rockshelter sites and as surface finds in many areas near the mountains. Several important sites providing information on these little known complexes include Mummy Cave (Husted and Edgar 2002), Schiffer Cave in the Bighorn Mountains (Frison 1973), Medicine Lodge Creek, Laddie Creek, Southsider Cave, Paintrock V, the Lookingbill site (Frison 1976, 1978a, 1983b) and the Bighorn Canyon caves (Husted 1969). Though no diagnostic projectile points were recovered, the Blackwater Creek site, located approximately 7 km downriver from the Goff Creek site, produced a fire hearth encased in overbank sediments just above river cobbles that radiocarbon dated to 8270±70 BP (Eakin 1996).

The Archaic Period

The Archaic period follows the Paleoindian period. The Archaic is most clearly defined by a change in projectile point styles that most often include the incorporation of notching as part of the haft design. A number of distinctive side-notched points illustrate this change during the early phase of the Archaic, but these proliferate into corner, basally notched and eared forms within a few thousand years. Other noted changes include an increase in the frequency of prepared seed grinding implements, and highly sophisticated methods of procuring bison and mountain sheep.

The Early Archaic

The Early Archaic period lasted from about 8000 BP to 5000 BP and is within the Early Middle Holocene as outlined by Eckerle in Chapter 2. This period is thought to coincide with the Altithermal climatic episode (Antevs 1955), a time when human groups shifted their subsistence focus from the drier plains and interior basins to the higher elevation areas retaining more effective moisture (Mulloy 1958). These ideas had a profound influence on the thinking of archaeologists and in some cases influenced interpretations concerning the distribution of archaeological sites in many parts of the west (Husted 1969; Benedict 1981; Reeves 1973; Frison 1976).

Much of what is known about the Early Archaic in Wyoming comes from cave and rockshelter sites in foothill/mountain settings. These often yield deeply stratified deposits, often rich in perishable goods that would otherwise be absent in open sites. The few excavated Early Plains Archaic sites indicate that much of the activity was carried out by comparatively small groups of people. Early Archaic components are well defined in Mummy Cave and represented by radiocarbon dates of 7600 BP to 5250 BP, a variety of side-notched projectile points, and numerous stone and worked bone tools (Husted and Edgar 2002). Other sites in the Bighorn Basin include Wedding of the Waters Cave, Southsider Cave, Paintrock V and Granite Creek rockshelters (Frison 1978a). The Goff Creek site contained evidence of several Early Archaic occupations in relatively good context. All of these sites yielded similar assemblages indicating activities centered around exploitation of mountain sheep, deer and smaller mammals.

The Middle Archaic

The Middle Archaic period lasted from about 5000 to 3000 years ago (Frison 1991:33) and roughly coincides with the Late Middle Holocene. Middle Archaic projectile points are represented by a variety of lanceolate, stemmed, side-notched, corner-notched and eared forms, mainly of the McKean complex (Mulloy 1958). Husted (Husted and Edgar 2002:139) proposes a Great Basin/Shoshonean origin affiliation based on a regional pattern of projectile point styles (see Jennings 1986). Middle Archaic groups carried on hunting and gathering activities over most of Wyoming from the plains and interior basins to above timberline and created numerous sites (Wedel 1983). Subsistence activities in the foothill/mountain areas remained similar to those of the Early Archaic, as indicated by assemblages excavated from rockshelter and other sites. Middle Archaic components at the Dead Indian Creek site in the Clark's Fork Valley were characterized by reliance on locally available toolstones, mule deer, and to a lesser extent mountain sheep (Frison and Walker 1984). Frison (1991) believes Middle Archaic groups moved seasonally and exploited a wide range of ecological situations. Middle Archaic occupation is well represented in levels 28-30 in Mummy Cave (Husted and Edgar 2002) where both Oxbow and McKean lanceolate as well as other forms were recovered in association with dates ranging from about 5200 to 3000 BP The Moss Creek site, located 10.5 km downstream from Goff Creek contains several Middle Archaic components in an open-air setting. A relatively small Middle Archaic component was also excavated at Goff Creek

The Late Archaic

The Late Archaic lasted from about 3000 BP to about 1500 BP (Frison 1991:34). Most, but not all, of this period coincides with the Early Late Holocene. Late Archaic sites have been documented all across Wyoming, in both plains and mountain settings. Evidence from foothill/mountain sites indicates continued occupation of caves and rockshelters. Several sites such as Wedding of the Waters Cave (Frison 1962), Spring Creek Cave (Frison 1965), Mummy Cave (Husted and Edgar 2002), and the Big Horn Canyon caves (Husted 1969) have produced extensive collections of material, including perishable goods reminiscent of Desert Culture of the Great Basin. Sites at lower elevation suggest higher population densities and increased exploitation of interior basin areas compared with earlier times (Frison and Wilson 1975:29). Sites are often represented by extensive lithic scatters, stone circles, fire hearths and ground stone.

Corner-notched projectile points are perhaps the most common horizon marker for the Late

Archaic period. Within this a particular style of projectile point characterized by wide corner notches, known as Pelican Lake, is well known from the plains of southern Saskatchewan to Colorado where they are found in association with a number of sites (Wettlaufer 1955; Wettlaufer and Mayer-Oakes 1960). Pelican Lake occupations were found at Medicine Lodge Creek in the eastern Bighorn Basin (Frison 1991:103) as well as the Osprey Beach site in Yellowstone Park (Johnson et al. 2004). Very similar projectile points, with nearly contemporaneous dates were found in layer 32 at Mummy Cave, although no "Pelican Lake" association is mentioned in the discussion for the Late Archaic levels (Husted and Edgar 2002). Well preserved campsites containing Pelican Lake projectile points were found during highway investigations at the Pagoda Creek and Goose Rock sites (Eakin 1989, 1993). Both sites greatly add to our knowledge of Late Archaic subsistence in the area, because unlike the Mummy Cave material which formed from a succession of spatially restricted occupations superimposed upon one another, the Pagoda Creek and Goose Rock assemblages provide task specific information formed under an open-air setting. High numbers of mountain sheep remains at the Pagoda Creek site provide important time-depth information for intensive use of bighorn sheep (Frison 2004:160).

The Late Prehistoric

The Late Prehistoric period is most clearly marked by the appearance of a variety of small corner and side-notched projectile points representing the introduction and widespread adoption of the bow and arrow (Frison 1978a). The Late Prehistoric period lasted from about 1500 BP to the first contact with Europeans or European goods at around 300 or 250 BP. Climatically this period coincides with the short-term perturbations characterizing the late-late Holocene of Eckerle (this volume), which included a late-Holocene warm period as well as the Little Ice age. Archaeological sites of this age are common throughout Wyoming. They are reminiscent of Late and Middle Archaic sites in that stone circles, lithic scatters and ground stone are common. Several relatively unrefined types of pottery also mark the Late Prehistoric. Mulloy (1958) has documented the Intermountain tradition and attributes it to Shoshonean origins. Steatite was also a preferred material for vessel manufacture, but only limited amounts of this material has been documented in the North Fork valley, a pattern perhaps attributable to the recency of its appearance in the record and relatively great source distances (Frison 1982). Culture Layers 36, 37 and 38 in Mummy Cave, date to the Late Prehistoric. A variety of artifacts were recovered from these levels including, projectile points of the Rose Spring type, widely regarded as Shoshonean in origin (see Husted and Edgar 2002 for discussion), probable Avonlea projectile points, considered by some as Athapaskan (see Davis 1988), as well as tri-notched and Cottonwood triangular points, also considered Shoshonean (Jennings 1986).

Over a period of several decades much time and energy has been devoted to the documentation of high altitude bighorn sheep trapping, a procurement strategy that appears to have Shoshonean origins and may have been widespread in portions of the Central Rocky Mountains during at least the later part of the Late Prehistoric and Protohistoric periods (Frison et al. 1990). The traps are characterized by drive lines, often a hundred or more meters in length, which lead to a terminal catch pen. Two traps have recently been identified in the North Fork Valley (Eakin 2011), and as the area lies in what was probably prime bighorn sheep country, it is probable that some of the Late Prehistoric occupation found in the valley is related to Shoshonean groups involved in these subsistence practices.

CHAPTER 4
METHODS

Daniel H. Eakin

Field Methods

Excavation Procedures

The data recovery plan (Eakin 1994) called for expansion (in checker-board fashion) of test units containing important stratigraphic or occupation-level information. If buried features were encountered, a 3 x 3 m block area would be expanded around the feature. If activity areas extended past the 3 x 3 m area then the block area could expand to a 5 x 5 m area. In addition to block areas, up to 30 exploratory test units could be excavated in areas that had not been evaluated during the testing phase.

A transit was used to establish a grid system over the area prior to excavation. The grid consisted of a series of north-south and east-west base lines, aligned on true north, from which 1 x 1 m excavation units could be established. The primary grid datum was an arbitrary point located 100 m west and 100 m south of the excavation area. An "X" incised into a large boulder at the uphill end of the site was used as an elevation benchmark of 100.00 m. Steel spikes were used to mark one or two meter intervals along baselines. Distance in meters north and east from datum was used to establish excavation unit location. Once excavation unit corners were laid out, a string was stretched around corner spikes to establish wall limits and surface elevations. Elevation control was maintained by elevations marked on a wooden stake placed adjacent to an excavation unit. Stake elevation was determined by sighting on a stadia or metric tape placed on the elevation datum to derive barrel height, and then subtracting the distance to the top of the stake from barrel height elevation, again using a metric stadia or measuring tape. Graph paper was used to track both grid base-line and excavation unit location. As each additional excavation unit was established, its location was marked on the grid map along with excavator's initials and height of the elevation control stake. When a unit excavated during one of the previous testing phases was encountered, it was incorporated into the grid by measuring and plotting its corners and overall outline on both the grid map and appropriate unit and unit-level forms.

Elevation control for levels and artifact elevations were maintained by use of a string and line level attached to a wooden stake. String elevation was determined by subtracting from the top of the stake to the nearest 1 cm (i.e., 99.29). Artifact elevation was derived by measuring downward to the desired location using a metric tape and then subtracting the reading from the string elevation. Horizontal artifact provenience was recorded as the distance, to the nearest centimeter, from the southwest corner of an excavation unit. These two measurements were then combined with the whole-number grid value of the individual unit to derive an X-Y decimal coordinate. Depth, or Z-value, was determined by an artifact's vertical position relative to the elevation datum. X-Y values were determined by measurement to the center of the artifact; Z values were determined by measurement to the bottom, or lowest position of an artifact. Provenience for screen items was maintained by listing the X-Y value of the excavation unit, the 50 x 50 cm quadrant represented, and the upper and lower Z values of the excavation level represented.

Sediment removal was by use of trowels and shovels. Excavation proceeded in arbitrary 10 cm levels. A field specimen (FS) number was assigned to each item or screen bag and written, along with its three dimensional provenience, on a field catalog form. Individual items were also plotted on a unit level form in order to compile a visual record of artifacts and other material found within a given excavation level. Stone and bone screen items were sorted separately and assigned separate numbers. Field specimen numbers and all appropriate provenience information were written on bags used to transport items back to the lab for analysis. Fire-cracked rock was recorded on level forms and described. Fire-cracked rock associated with a feature was recorded, photographed, and weighed. No fire-cracked rock was collected. Notes were compiled by each excavator for each excavation level. Summary notes were compiled upon completion of an excavation unit, and appropriate wall profiles were either drawn or photographed. A Munsell book of colors was used as a standard for soil and sediment coloration. Excavation was terminated upon contact with coarse-grained sediments, usually at around 1 m deep in the data recovery area.

Screen inserts having 1.5 mm mesh were used to screen sediments collected from each excavation level quadrant. Once loose sediments passed through the mesh, the insert was removed from the shaker-screen and transported to a water filled stock trough (loaned by USFS), where on-site water screening was performed. Bags filled out with appropriate provenience information were placed with the insert during the drying process.

Hearths usually appeared as circular or semi-circular charcoal-stained basins. Once defined, hearths were exposed in plan- view and mapped on the appropriate unit-level form. Hearths were labeled with their individual excavation unit designation, and then with a number representing the order in which they were found in that unit. Hearths found in units excavated prior to the data recovery phase were numbered by first applying the year of the test investigation, followed by the sequential test unit number, followed by the order in that unit in which the hearth was found. A feature form was used to record the size and shape of the hearth and to collect additional information used to describe hearth morphology. Hearths were not excavated in accordance with the arbitrary levels of the excavation unit. Instead, the hearth was first sectioned, and one-half of the interior sediments were removed in 5 cm levels until the basal contact was reached. If recoverable charcoal was present, it was collected by use of metal tools and stored in an aluminum foil pouch. Profiles and photographs were then recorded, after which the remaining portion of the hearth was removed. Hearth fill was collected in one-gallon zip-lock bags and returned to the lab for flotation analysis and in some cases radiocarbon dating.

Radiocarbon samples submitted for radiocarbon analysis were collected in such a way as to eliminate or minimize contact with potential organic contaminants such as skin oils or mixing with potentially contaminating organics such as carbon from a non-archaeological context. Hearth-fill sediments were used either in bulk or as a supplement to the original sample if insufficient amounts were originally collected in the field. All charcoal samples were submitted to Beta Analytic, Coral Gables, Florida, for radiocarbon analysis.

Field methods remained unchanged at the site through the 1995-96 investigations. The general approach was based on the inference that hearths served as loci for activity areas. Excavation of these areas was one of the original goals of the project, and it was thought recovery of archaeological data contained in these areas would lead to a better understanding of prehistoric adaptations in the area.

Backhoe Use

A rubber-tired backhoe was used to excavate trenches for constructing soil and sediment profiles at the site. A backhoe was also used to excavate overburden from Area A, prior to the erection of the excavation shelter.

General Profiling

Investigated locations include: excavation units within the site area, backhoe trenches, and the cutbank along the North Fork (Shoshone River). Exposures are described and representative sections are presented documenting all pertinent stratigraphic and soil horizon information. The methodology used for fieldwork and analysis is summarized below. Conventions used for sedimentary descriptions are presented first, followed by pedogenic description terminology.

Strata Descriptions

The deposits in each location are divided into strata based on similarities and differences in texture or sedimentary structure. All strata are designated by a Roman numeral. Since strata often exhibit a range of characteristics due to bedding and facies changes, subdivisions are sometimes used to encompass this variability (e.g., Stratum Ia, Ib, Ic), and the type of variability is specified in the field notes. Soil horizon documentation is addressed below.

Geological descriptive methods used for this investigation generally adhere to Compton (1985). The modified Wentworth Scale (Dietrich et al. 1982) is used throughout. Color terminology follows the Munsell system. Roundness descriptions are those presented by the American Geological Institute (Dietrich et al. 1982). Names for mixtures of sedimentary materials also conform to standards of the American Geological Institute. Sandstone terminology is that presented by Compton (1985), and coarse grained sedimentary rock terminology is from Dietrich et al. (1982). Travis (1955) is followed for all other sediment naming conventions. Unconsolidated equivalents are used throughout, e.g., conglomerate=gravel, sandstone=sand, mudstone=mud. When gravel is present in a deposit, the following terms are used to indicate its percentage: slightly gravelly = 0.01 percent to <5 percent; gravelly mud/sand = 5 percent to <30 percent; muddy/sandy gravel = 30 percent to <80 percent; and gravel = >80 percent (Folk 1980).

Soil Horizon Descriptions

Soil horizons are designated using Birkeland's (1984) modified system (Soil Survey Staff 1981), where all vertical subdivisions of an individual master horizon are listed before the buried soil subordinate element (b) is added (e.g. Bt1b, Bt2b, Bt3b). The numbering of vertical subdivisions begins with 1 (Soil Survey Staff 1981). The designations following the b (b2, b3, etc.) are reserved for the sequential number of buried soils below (older than) the surface soil. Note that the "b" element, which is used for buried soils, corresponds to Soil Conservation Service usage for designating a buried genetic horizon (Soil Survey Staff 1981).

Another of Birkeland's modifications that was utilized is the ">" symbol, which designates a horizon in a state of major genetic transition. The designation to the left of the symbol indicates characteristics that formed when the buried soil was a surface soil. On the right of the symbol is the designation of characteristics that are thought to be the result of post-burial pedogenesis (engulfment) or polygenetic processes (e.g., Ab>Bk).

Soil horizons are described using the conventions prescribed by the Soil Survey Staff (1981), and classified using Soil Taxonomy (Soil Survey Staff 1975). Carbonate and gypsum stage descriptions follow a six stage classification (Birkeland 1984).

Soil Developmental Stages

Birkeland (1984; Birkeland et al. 1991) has reviewed the literature on soil chronosequences in the arid and semi-arid western U.S. A general, time dependent sequence of horizon formation can be identified and includes from youngest to oldest: A (surface organic accumulation); Bw (oxidation or structural development); Bt (clay accumulation) and Bk (calcium carbonate accumulation); and K (very well developed calcium carbonate accumulation) and Bqm (very strongly developed gypsum accumulation). In terms of taxonomic classes this sequence would read as follows (also from youngest to oldest): (1) Orthents; (2) Camborthids; (3) Argids and Calciorthids; and (4) Paleargids and Paleorthids. These soil classes are referred to by the subjective, but useful, terms of weakly, moderately, well, and very well developed.

Laboratory Methods

Data recovery efforts at the Goff Creek Site produced a large quantity of material, including over 200,000 chipped stone and bone artifacts, along with lesser numbers of other items such as floral remains. The first stage of laboratory analysis involved processing the entire assemblage. This included sorting and cross-checking bagged items against field notes and the FS number assigned in the field, washing and assigning catalog numbers to these items after the process was completed. Cataloging of the assemblage was performed in accordance with guidelines established for curating artifacts at the University of Wyoming Archaeological Repository (UWAR), in Laramie, Wyoming. The second stage consisted of separating out the artifact classes for more specific analysis. Initial cataloging data was combined with the analytic data to form the final curation record.

Provenience data were revised for artifacts recovered during earlier testing phases so that they could be listed within the appropriate excavation grid unit. This involved hand plotting artifacts on graph paper, overlaying the graph paper in its appropriate grid location and then measuring from the appropriate unit corner the new distance and depth which was then recorded on an analysis form. In order to maintain catalog numbers, however, no catalog numbers were changed in this process, only artifact provenience.

Lithic Analysis

Lithic analysis is after Sullivan and Rosen (1985); definitions are provided in Table 4.1. For the purposes of this analysis, the following classifications were used. Primary flakes are considered the initial flakes removed from a stone core during core reduction. Primary flakes possess between 75% and 100% cortex on the dorsal surface and a single dorsal flake scar. Secondary flakes are indicative of further core reduction, exhibit one or two dorsal scars, and possess between 75% and 1% cortex. Tertiary flakes represent the final stages of core reduction, preparation, or tool manufacture. They exhibit numerous dorsal scars and less than 1% cortex. A biface reduction flake possesses a variable cortex, several dorsal flake scars, a prepared and lipped striking platform, and is relatively thin and highly curved along the longitudinal axis. Tools were classified into several types based on morphology, e.g., projectile points, bifaces, drills, scrapers, retouched, and utilized flakes (Francis 1983). Bifaces are classified after Frison and Bradley (1980; Table 4.1). Tools were measured with a 0-150 mm electronic digital caliper. Use wear analysis followed Ahler (1971), Keeley (1980) and Tringham et al. (1974). Use wear categories include no use, cutting of soft materials, scraping of hard material, scraping of semi-hard material, and cutting of wood shafts.

Maximum length, width, and thickness measurements were taken of all tools. Additional measurements of projectile points include: maximum blade width, blade length, base width, base length, haft width, notch depth, notch width, proximal notch angle, proximal notch length and depth of basal

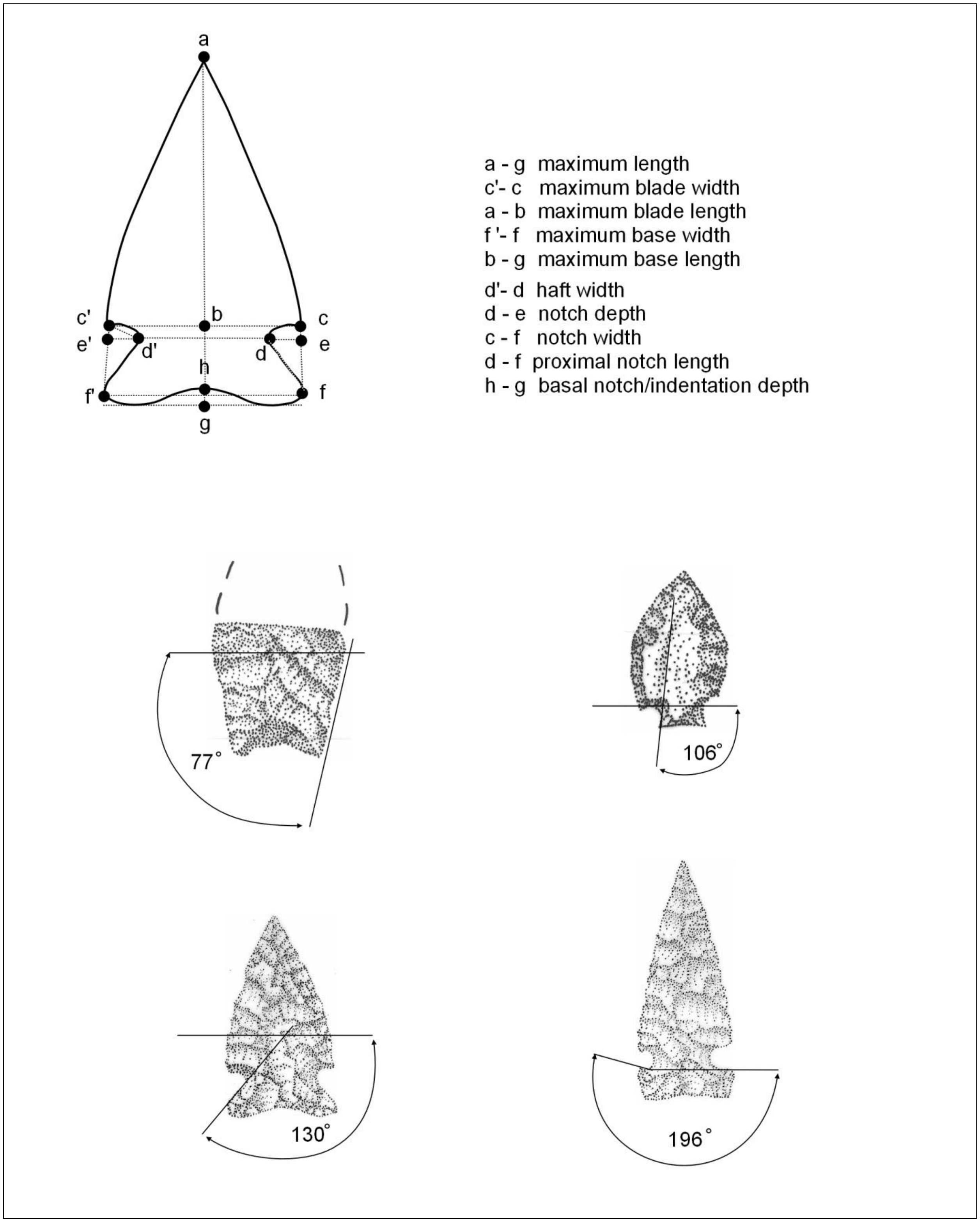

Figure 4-1 Reference points for projectile point measurements and example of proximal shoulder angle.

Table 4-1. Prehistoric artifact definitions and classification system.

ARTIFACT TYPE	DESCRIPTION
Debitage	
Primary Flake	Unmodified flake having between 75% and 100% cortex on the dorsal surface. Striking platforms are generally unprepared.
Secondary Flake	Unmodified flake having between 1% and 75% cortex on the dorsal surface and one or two dorsal flake scars. Striking platforms are generally unprepared.
Tertiary Flake	Unmodified flake having 1% or less cortex on the dorsal surface and generally three or more dorsal flake scars.
Bifacial Thinning Flake	Unmodified flake with no cortex on the dorsal surface, numerous dorsal scars running in several directions, and prepared, lipped striking platforms. Such flakes generally are very thin and are highly curved along the longitudinal axis. The platforms of lipped flakes often have flake scars on both the dorsal and ventral surfaces.
Shatter	Material produced during lithic reduction having no definable dorsal surface, or more than one dorsal surface. The piece generally has no definite flake attributes (striking platform, bulbs of percussion, etc.) .
Debitage Breakage (after Sullivan and Rozen 1985:759; Prentiss and Romanski 1989:89-99.)	
Level I	Complete flake with a single ventral surface, a point of applied force, and intact flake margins.
Level II	A portion of a flake with a single ventral surface, a point of applied force, but not having complete flake margins. This is a proximal flake fragment.
Level III	A portion of a flake with a single ventral surface, no point of applied force, and incomplete margins. Can be either a medial or distal flake fragment.
Level IV	A nonorientable flake fragment having a single ventral surface, no point of applied force, and no intact flake margins.
Level V	A piece of debitage with no discernible ventral surface, point of applied force, or intact flake margins. Usually considered shatter or debris.
Cores	Any nucleus of raw material from which flakes have been detached.
Random Flaked	Nucleus has flakes detached in no apparent pattern, with or without platform preparation.
Bipolar	Nucleus has two opposing striking areas, one being struck by a hammer-stone and the other area, where the core was resting on an anvil.
Unidirectional	Nucleus has flakes detached in one direction only. Usually has some sort of platform preparation.
Bifacial	Nucleus has flakes detached from two opposing sides. Similar to a Stage I biface.
Tested Cobble	Nucleus has had only one or two flakes detached making the core type determination tenuous at best.

Table 4-1. Prehistoric artifact definitions and classification system.

ARTIFACT TYPE	DESCRIPTION
Modified Materials	
Projectile Point	Generally a bifacially flaked implement with pointed distal end and basal modification (Chapman 1977:413). Their primary function is assumed to have been to puncture and cut flesh. Other uses, such as cutting and scraping, have been reported (Ahler 1971:117-118).
Biface	An implement with flake scars across both the dorsal and ventral faces (Francis et al. 1985).
Stage I	Biface retains cortex or original flake surface of the raw material from which they were made (Frison and Bradley 1980:31).
Stage II	Biface at early stage of percussion shaping: little actual thinning, margins and cross-sections irregular, tendency for thick and blocky cross-section (Frison and Bradley 1980:33).
Stage III	Biface at middle stage of percussion shaping: evidence of initial percussion thinning and margin regularizing in the form of regularly spaced flake scars and even cross-section (Frison and Bradley 1980:33).
Stage IV	Biface at final stage of percussion shaping prior to pressure flaking; specimen usually thin with regularized margins, flake scars tend to terminate at the mid-line (Frison and Bradley 1980:33, 39).
Stage V	Biface pressure flaked to form the shape of a projectile point, just prior to notching (Frison and Bradley 1980:39).
Uniface	A tool having only one intentionally flaked face. This is different from a biface reduction flake.
Scraper	Generally a unifacially flaked or retouched implement with a steep, convex working edge. The working edge generally exhibits distinctive step-fracturing use wear.
Spokeshave	Generally a unifacially flaked concavity along one or more edges or portions of edges of a flake or tool. The modified area is thought to have been used to reduce the diameter of the material being modified. Also commonly part of a compound tool.
Retouched Flake	Flake with an intentionally modified edge usually considered a result of resharpening; sorted by unifacial vs. bifacial retouch.
Utilized Flake	Flake showing edge modified by use only.
Ground Stone	Generally a coarse grained stone with a rough surface texture used to reduce the material being ground to a different shape or consistency.

notch or indentation (Figure 4-1). Measurements of extremely small fragments, such as ear fragments, remained basic.

Portion is defined as follows: 1) complete - entire tool is present; 2) proximal - proximal is used to pertain to that portion of the tool nearest the user; 3) medial - the mid portion of the tool; 4) distal - that portion of the tool farthest from the user, such as a projectile point tip; 5) longitudinal - pertains to the long-axis of an object; and 6) indeterminate - when a portion is unknown. The maximum dimensions of debitage and tools were recorded on an interval scale with seven size grades between 7 cm (2.75") and 0.25 cm (1/8").

Raw material characteristics, discussed below, were recorded and used as distinguishing criteria for lithic variables. After identification, lithic data were encoded and entered into an EXCEL file for analysis and statistical manipulation.

Several lithic material types are present in the artifact assemblage from the Goff Creek site. Most of these possess distinguishing characteristics that provide dependable source identification in the laboratory. Most types are represented by a sufficient number of examples to conclude that the prehistoric inhabitants had a thorough knowledge of toolstone sources in the region. The following discussion reviews toolstone types recovered and their origin relative to site proximity.

Many grades and colors of Eocene cherts and porcellanites (siltstone) are available from the Absarokan Supergroup. The high soluble silica content of this formation, which surrounds the Goff Creek site on all sides, provided a favorable environment for penecontemporaneous formation on high-quality toolstone (Miller 1991:452). The Eocene cherts range in color from a translucent clear to opaque white, from green to brown, and often vary from darker purples to browns to black. The porcellanites range in color from tan to brown to gray, and are often variegated by impurities. Silica-permineralized (silicified) wood, “petrified wood” to some, is a replacement chert formed as interstitial silica is deposited in the wood cells, thus preserving its original structure (Bates and Jackson 1984:468). Silicified wood of many different colors, textures, and grades is common in the Absarokan Supergroup.

East of the Absaroka Range, in the Bighorn Basin, more ancient Paleozoic formations are exposed. The Madison (Mississippian), Tensleep (Pennsylvanian), and Phosphoria (Permian) all possess the potential for chert or orthoquartzites. Mesozoic formations such as the Morrison and Cloverly (Jurassic) also outcrop in the Bighorn Basin and also provide high-quality toolstone at various localities. Various formations are known for different toolstones, for example; the Madison Formation, chert; Tensleep Formation, orthoquartzite; Phosphoria Formation, chert; and the Morrison Formation, both chert and orthoquartzite, to name a few. The Madison cherts exhibit a variety of colors including white, gray, orange, brown and yellow. They can also be variegated or contain mineral inclusions, especially dendrites. Phosphoria chert is opaque, ranging from bright red to maroon in color. Orthoquartzites, silicacemented sands in which the individual grains are visible (Bates and Jackson 1984), were utilized from both the Tensleep and Morrison formations. The Tensleep orthoquartzite ranges in color from light gray to tan to light red or pink. Morrison orthoquartzites are variegated, but are commonly gray, blue, yellow or red. Morrison Formation cherts have also been reported by Frison and Bradley (1980) to vary from opaque to translucent and also to occur in a variety of colors from deep red to white or variegated. They also report a translucent yellow chert from facies of the Morrison Formation. Exact source locations for these materials are complicated in that the stratigraphic column outcrops sporadically around basin margins as well as parts of the interior. To make matters even more complicated, in many instances cherts from the Madison and Morrison formations along with high quality cherts and silicified wood from the Absaroka Supergroup can be so similar to one another as to be macroscopically indistinguishable.

Metaquartzite, a metamorphic rock, differs from sedimentary orthoquartzite in that individual silica grains are no longer distinguishable (Bates and Jackson 1984). Metaquartzite generally originates from metamorphic facies within certain Paleozoic formations, such as the Flathead (Cambrian) and is commonly available as resistant cobbles on Pleistocene terraces.

Obsidian is typically a black, brown, red, or green, rhyolitic volcanic glass (Bates and Jackson 1984). While Obsidian Cliff in Yellowstone National Park, is one of the best known sources, many others exist, including those of welded tuff which can be glassy and obsidian-like or grainy and quartzite-like. Although none of the obsidian from Goff Creek was submitted for source analysis, obsidian and tuff recovered from the Moss Creek site has been tied to several sources including: Obsidian Cliff in Yellowstone National Park, Teton Pass in the Teton Mountains, Packsaddle Creek in the Big Hole Mountains of eastern Idaho, and Lava Creek Tuff, near the Grassy Lake Dam in the Targhee National Forest (Eakin 2012).

Another category of igneous rocks includes those of basalt, andesite and dacite. All are generally extrusive igneous rock typically found in the Absaroka-Yellowstone region and commonly associated with dikes, sills or flows of igneous origin.

Faunal Analysis

Analysis of archaeological faunal assemblages can provide valuable information pertaining to site function and human behavior (Frison 1991:267-88) as well as providing information relating to both the local and formational environments of the site (Schiffer 1987:187). Faunal analysis consisted of recording four general attribute classes: 1) bone provenience; 2) taxonomic identification; 3) skeletal element identification; and 4) cultural and physical modification of the bone. When present, other attributes were recorded, including portion, segment, side, age, epiphyseal fusion, sex, burning, breakage, butchering, and number of fragments. All faunal materials were identified using the University of Wyoming, Department of Anthropology comparative faunal collection. After analysis and identification faunal data were encoded and entered into an Excel file for analysis and statistical manipulation. All field notes, maps, photographs, and project records are housed at the Office of the Wyoming State Archaeologist, Laramie. All collected artifacts have been curated at the Department of Anthropology, University of Wyoming curation facility.

Spatial Analysis

Artifact density contour maps were generated for higher-density components using Golden Software Surfer 8 and Microsoft Excel 2000. Artifact totals for each unit quadrant were determined and the number assigned to the quad center. This results in four equally distributed data points per unit. The eastings, northings and totals were entered into an Excel spreadsheet which Surfer used to generate the contour maps. Surfer software extrapolates contours to the assigned borders of each map. Rocks and features were plotted on the Surfer generated maps by importing scanned unit level maps, scaling them to that of the contour map, and then tracing over them. This was then imported as a layer which was placed on the contour image. Finally, symbols and descriptive labels were inserted.

Post classed (point plot) maps were also generated in Surfer 8 and Excel 2000. The data consist of easting, northing and artifact type. After the map is generated the parameters of the unit information and the artifact type are set. Rocks, features, symbols and descriptive labels are done in the same manner as for contour maps.

Macrofloral Analysis

A total of 16 hearths were examined for macrofloral remains. Hearth fill samples from 11 features recovered during data recovery were submitted to High Plains Macrobotanical Services for analysis (Appendix C). Several samples from one feature were also analyzed by Havner and McFaul (Appendix D). Methods used in these analyses are found in the appendices.

CHAPTER 5
GEOARCHAEOLOGY

William Eckerle, Rebecca Hanna, Marissa Taddie and Sasha Taddie

Background to Site Formation Processes

A discussion of pertinent aspects of site formation and destruction processes is presented here. The following categories are summarized, which generally follow Gifford (1978): occupation trampling, post-occupational (preburial) dispersal, burial dispersal, and post-burial dispersal. Zones of cultural materials and features are referred to as components, and the designations are those assigned by the Office of the Wyoming State Archaeologist. Geoarchaeological contextual integrity is an assessment of the likelihood that artifacts are recovered near the location they were lost, discarded, or abandoned (behavioral context). As presented here, an assessment of high geoarchaeological context is an inference that the recovered cultural material is in near-behavioral context and is not vertically mixed with other cultural material that might be significantly younger or older. Moderate geoarchaeological context is reserved for cultural levels that might have relatively minor horizontal displacement and vertical mixing. An assessment of poor geoarchaeological context is used where there is evidence for significant post-occupational horizontal movement or where there is the potential for the mixing of occupation debris, which could have been deposited over a long time span. The principles outlined here are used to evaluate the context of the buried components at 48PA325 later in this report.

Occupation Trampling

The magnitude of occupation trampling (treadage and scuffage) varies as a result of the texture of the substrate and the intensity of occupation traffic (Schiffer 1987). Moisture content is also a factor (Deal 1985). Experimental studies indicate that an occupation "churn zone" is formed in loose substrates. Well sorted sands produce the thickest trample zones, which range from 5-16 cm in thickness (Table 5-1) (Gifford-Gonzalez et al. 1985; Stockton 1973). Loamy sand will develop a 3-8 cm trample zone (Villa and Courtin 1983), whereas loams produce "almost no" churn zone (Gifford-Gonzalez et al. 1985). Clayey sediments, likewise, require extremely high levels of traffic or saturation to a mud state to produce any churn zone (William Eckerle, unpublished field observations). Pedestrian traffic on cobble or larger size clasts will not produce a trample zone at all (Hughes and Lampert 1977).

Trample zones can be viewed as both a positive and a negative aspect of site formation. Churn zone development on a soft substrate has the effect of blurring the occupational record of stratified sites (Hughes and Lampert 1977; Villa 1982). The positive aspect of churn zones is that their formation quickly hides artifacts and makes them unavailable for site cleaning and secondary refuse disposal (Schiffer 1987). In addition, items are much easier to lose in soft substrates (Schiffer 1987). As a result there is a higher potential for discriminating areas of high primary-discard (lodges, hearth activity areas, etc.) from those of low primary-discard in soft substrates. Additionally, there is probably less scuffage (horizontal artifact dispersal due to foot traffic) on loose substrates than on firm ones because items are less likely to skid.

Table 5-1 Occupational churn zones based on substrate texture.

SOIL TEXTURE	COMMON DEPOSITIONAL ENVIRONMENT	CHURN ZONE (cm)	HORIZONTAL SCUFFING	EASE OF CLEANING	IDENTIFY ACTIVITIES	IDENTIFY DOMESTIC AREAS
sand	aeolian dunes, well sorted fluvial sands	5-16	low	low	high	low
loamy sand	some slope deposits and alluvium	3-8	moderate	moderate	moderate	moderate
sandy loam and finer	overbank deposits, lacustrine deposits, and most slope deposits	<5	high	high	low	high

Post-Occupational Dispersal

Post-occupational (but preburial) dispersal can alter the contextual integrity of surface archaeological materials. In general, soft substrates tend to hold onto artifacts after they have settled in to the surface (Wandsnider 1988). Additional trampling by animals, slope processes, and eolian movement are the major categories of post-occupational dispersal. However, trampling by animals, even in environments with high populations of hoofed ungulates, is a slow process (Gifford and Behrensmeyer 1976).

Slope wash and colluviation are two common processes that transport surface artifacts. The process of colluviation occurs commonly on relatively steep (>15°) slopes (Rick 1976). Colluviation is gravity driven transport in which heavier and denser materials move further down slope than lighter, less dense items (Rick 1976). Slope wash, on the other hand, involves transport in a sheetflow layer of water during storms (Butzer 1982; Reineck and Singh 1980). It can occur on low angle slopes, especially if vegetation is sparse and infiltration levels are low. This type of transport follows hydrodynamic rules in that smaller, less dense material, is transported the furthest down slope.

Eolian transport of surface artifacts can occur whenever windshear exceeds the hold of gravity (Bagnold 1941). This can be a major source of dispersal for small artifacts unless they quickly become buried (Wandsnider 1988). Eolian transport is not confined to dune fields but can occur whenever wind conditions are suitable. It is most effective on locations with minimal vegetation cover.

Burial Dispersal

Artifact dispersal occurs in most depositional environments (Butzer 1982). An exception to this is eolian silt (loess) environments. Lack of dispersal in loess is the result of a low surface wind shear (because vegetation is usually present) and low impact energy of silt particles. Many surface sites on flat, vegetated surfaces are eventually, albeit slowly buried by silt. Depositional environments can be ranked into two categories of potential burial dispersal. The relatively low energy category includes alluvial overbank, sheetflow (including slope wash), and eolian sand environments. The high energy category includes alluvial channel, debris flow, and colluvial depositional environments. For most water and air entrained sediments, artifact movement is a function of size and density (Gifford and Behrensmeyer 1976). Frison et al. (1988) propose a simple rule-of-thumb for determining the depositional dispersal of buried lithic artifacts. This rule states that any artifacts smaller than the break off point for the coarsest 10 percent of a sediment sample (finer than the 90th percentile) were probably moved during burial.

Post-Burial Dispersal

A wide range of processes can act to disperse archaeological residues after burial. Erosion and subsequent redeposition can produce a secondary deposit that contains no integrity (Butzer 1982; Schiffer 1987). Many other dispersal processes are possible (Butzer 1982; Schiffer 1987; Wood and Johnson 1978), including soil formation, fauna burrowing, plant growth (including tree tip-out), and turbation from repeated ground freezing (frost heave).

Geomorphology

Site 48PA325 (Figure 5-1) is situated about [redacted] downstream from the confluence of Goff Creek and the North Fork. Goff Creek flows southward, 7 km (4.4 mi) from its divide near Sleeping Giant Mountain (elevation 3412 m; 11,194 ft) to its mouth (elevation 1933 m; 6340 ft) where it forms an alluvial fan on the canyon floor. Average elevation of the site is 1940 m (6365 ft). Goff Creek Site occupies the inside of a sharp bend in the North Fork. Overall, flow of the North Fork is west to east, however the direction of the river immediately upstream from the site is southward and then bending back to east as it flows past the site. Fishhawk Creek, a north-northeastern flowing tributary of the North Fork, enters the river on the opposite side of the canyon directly to the south of the site. The canyon bottom is 400 m (1312 ft) wide in the site vicinity.

Bedrock is the Wapiti Formation, which is composed of andesitic, volcaniclastic rocks: commonly mudflows, conglomerates, and breccias (Love and Christiansen 1985). The bedrock is easily weathered, friable, and erodes into fluted cliffs and hoodoos. Its matrix weathers to fine or very fine grained sand. Bedrock slopes predominate on the south side of the North Fork. They rise at a 60% grade from the canyon margins. A well rounded and well sorted gravel deposit occurs in a gravel pit 23 m

REDACTED

Figure 5-1 Location and topography of the Goff Creek site.

(75 ft) north of the site on the canyon wall. Another, lower gravel deposit is situated at 13 m (43 ft) above the site, to the northeast on the canyon wall. These are discussed more fully in the introduction section of this report. They are estimated to be late Pleistocene age.

A bouldery and cobbly riverbed is present in the channel of the North Fork on the south margin of the site and merges with slightly higher gravel, which may correlate to the latest Pleistocene Pagoda gravel (Pt0). A Holocene-age terrace forms the north riverbank where it overlies these gravels. It is composed of approximately 1 m of overbank sediments. Geomorphologically, this terrace correlates to the latest Holocene Holy City terrace (Ht1). In total, the tread at the site stands at 1.4 m (4.6 ft) above the river shoreline. The early through late Holocene, Blackwater Ponds terrace (Ht2) is absent at the site but occurs at other locations in the North Fork (e.g., downstream from site 48PA325). The Holy City terrace (Ht1) is separated from the higher, northwestern portion of the site by a partially filled back-channel chute.

Fluvially reworked, bouldery to cobbly, fan gravel (Pf) forms a steep, cutbank immediately adjacent to the filled back-channel (not shown on Figure 5-3). These fan gravels were deposited by Goff Creek during high energy discharge events. Fan gravel deposits similar to these (PHf, Hf) are a common feature to most tributaries of the river, and are described in the Project History and Environment section above. Much of the coarse-textured fan sediment at site 48PA325 probably dates to the late Pleistocene-early Holocene. Scattered large to very large boulders on the downstream aspect of many fans suggest that some bouldery fan deposits are reworked and dispersed downstream by high energy, main-stem, river floods. This gravel deposit (PHf) underlies most of the site and is buried by progressively thicker, Holocene-age, finer-textured fan deposits (Hf) towards the toe of the fan, to the south. Hf deposits taper out near the south margin of the coarser (PHf) fan gravels where a scarp descends to the Holy City terrace (Ht1). A Pleistocene-age, terrace tread composed of well sorted and well-rounded bouldery gravel stands approximately 6 m (20 ft) above the riverbank immediately to the east and downstream of the site. It is correlated to the Wisconsin Newton terrace (Pt1). Just to the west and north of the site are several 1- to 3-m (3.3- to 10-ft) deep abandoned distributary channels of Goff Creek that are rimmed by Pf deposits. The mouth of the presently active channel of Goff Creek is situated approximately 300 m (984 ft) northwest of the site. A slope immediately to the north of the site is a terrace scarp formed on Pleistocene terrace gravels (Pt2 and Pt3).

Stratigraphy and Soils

Stratigraphic and soils documentation are described from several locations within site. Most documentation describes the major excavation blocks on the Goff Creek fan (Figure 5-2). Backhoe trenches and other scattered excavation unit profiles are described below under the headings of Area A

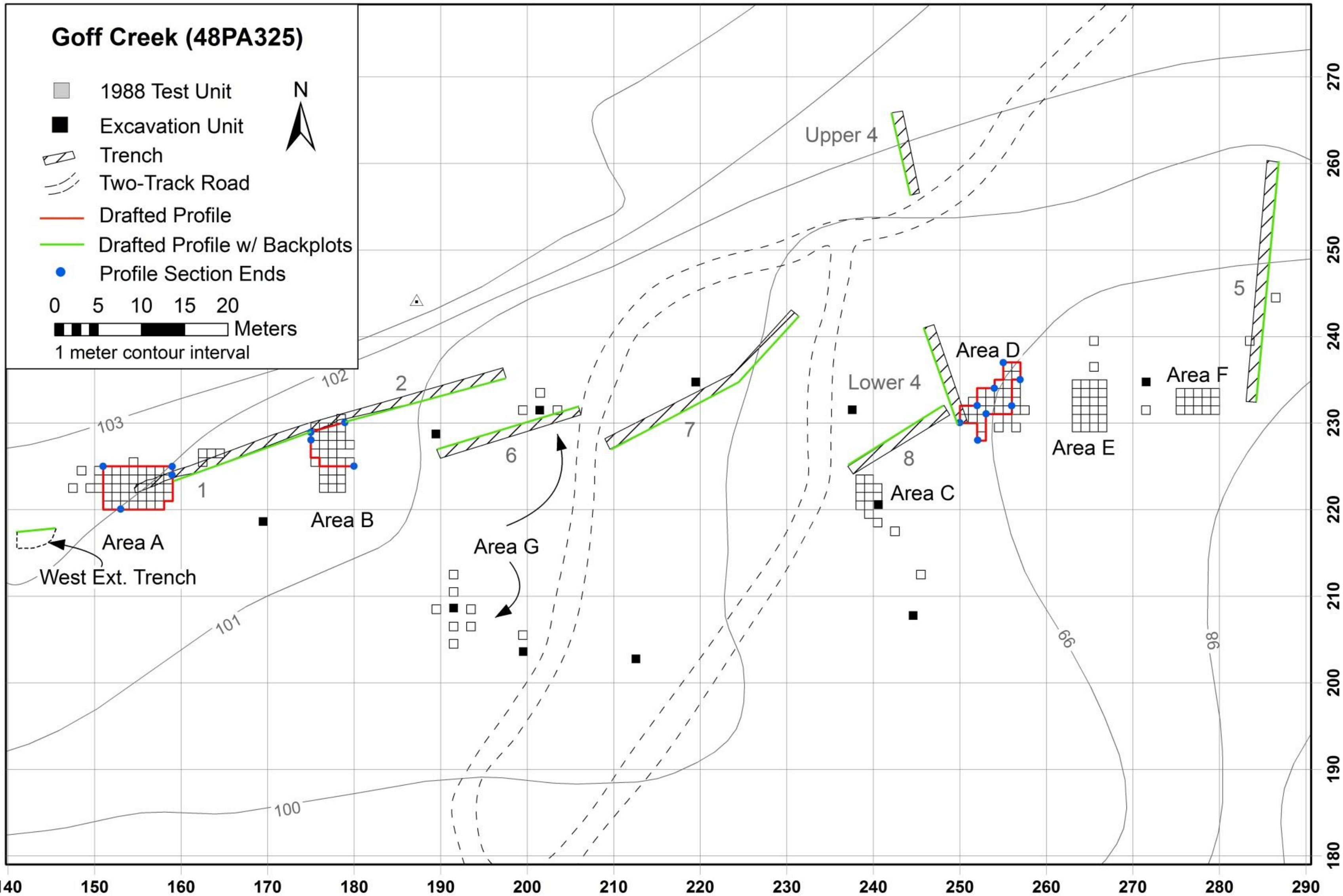

Figure 5-2 Site plan map, Goff Creek site (48PA325).

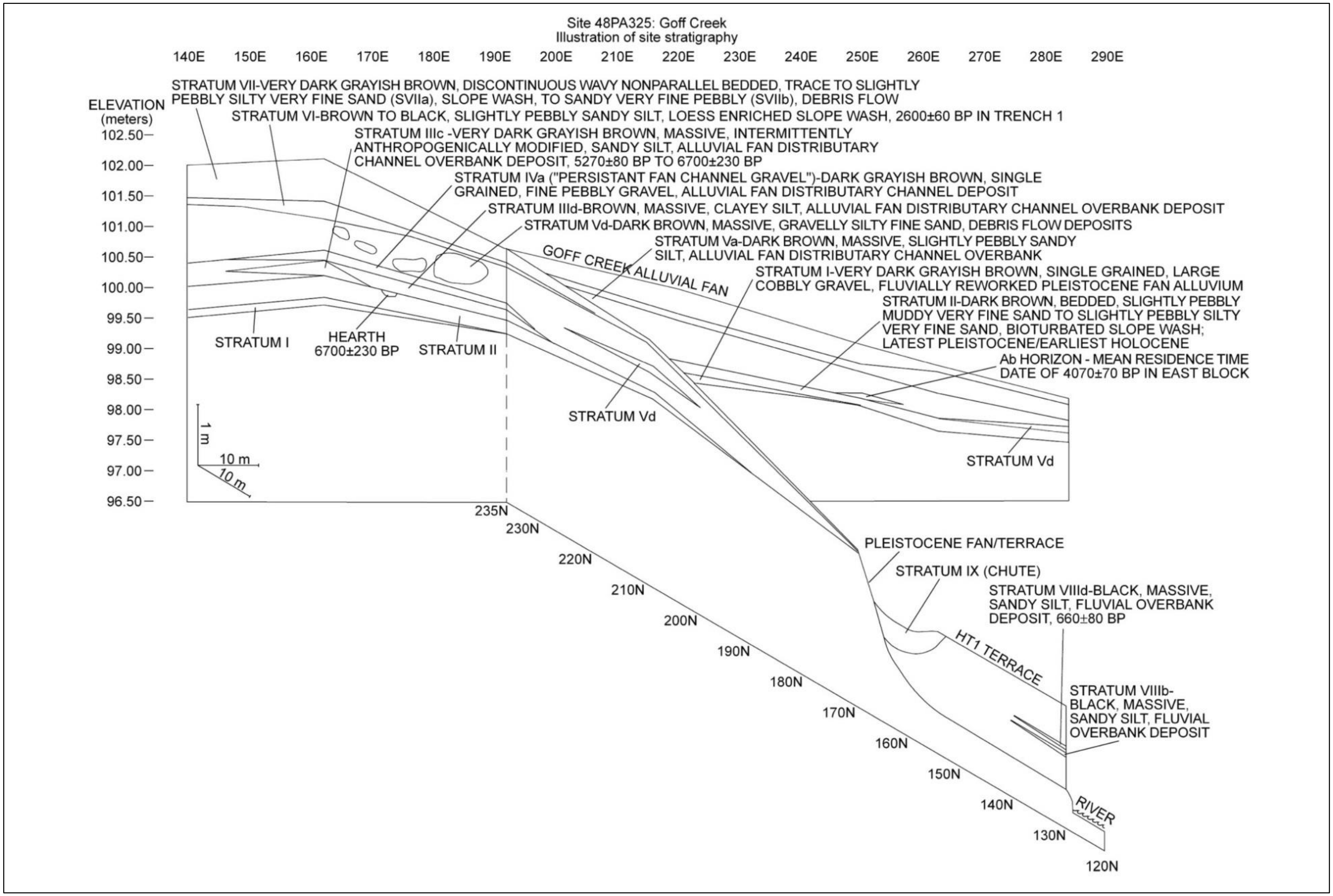

Figure 5-3 Perspective illustration of site stratigraphy (note vertical exaggeration).

Table 5-2 Strata characteristics for the Goff Creek (48PA325) site.

Stratum	Color	Structure	Modifications	Textures	Depositional Environment	Age
I	Very Dark Grayish Brown	Single Grained	Fluvially Reworked	Large Cobbly Gravel	Alluvial Fan	Holocene And Pleistocene
II	Dark Brown	Bedded		Slightly Pebbly Muddy Very Fine Sand To Slightly Pebbly Silty Very Fine Sand	Slope Wash	Early To Middle Holocene
IIa	Dark Brown	Massive	Bioturbated And Cultural Zone	Slightly Pebbly Muddy Very Fine Sand	Slope Wash	Early To Middle Holocene; Dates Ranging From 6700±230 - 5000±70 BP
IIb	Dark Brown	Massive	Cultural Zone	Slightly Pebbly Silty Very Fine Sand	Slope Wash	Early To Middle Holocene
III	Brown To Very Dark Grayish Brown	Discontinuous Even Parallel Bedded		Sandy Silt To Clayey Silt	Alluvial Fan Overbank And Rill	Middle Holocene
IIIa	Brown To Dark Brown	Massive	Cultural Zone	Sandy Silt	Alluvial Fan Overbank	Middle Holocene 5270±80 BP (~IIIa/IIIb/IIIc)
IIIb	Brown	Massive	Cultural Zone	Sandy Silt	Alluvial Fan Overbank	Middle Holocene 5270±80 BP (~IIIa/IIIb/IIIc))
IIIc	Very Dark Grayish Brown	Massive	Intermittently Anthropogenically Modified; Cultural Zone	Sandy Silt	Alluvial Fan Overbank	Middle Holocene; Date Of 5270±80 BP From ~Iiia/Iiib/Iiic
IIId	Brown	Massive		Clayey Silt	Alluvial Fan Overbank	Middle Holocene
IIIe	Brown	Single Grain		Pebbly Fine Sand	Alluvial Fan Rill	Middle Holocene

Table 5-2 Strata characteristics for the Goff Creek (48PA325) site.

Stratum	Color	Structure	Modifications	Textures	Depositional Environment	Age
IV	Dark Grayish Brown	Single Grained To Massive		Fine Pebbly Gravel To Fine Sand	Alluvial Fan Overbank	Middle Holocene
IVa	Dark Grayish Brown	Single Grained		Fine Pebbly Gravel	Alluvial Fan Distributary Channel	Middle Holocene
IVb	Dark Grayish Brown	Massive		Fine Sand	Alluvial Fan Distributary Channel	Middle Holocene
V	Brown To Dark Brown	Massive To Wavy Discontinuous Nonparallel Bedded		Trace Pebbly Sandy Silt To Fine Pebbly Gravel	Alluvial Fan Distributary Channel, Overbank, Sheet Wash, And Debris Flow	Middle To Late Holocene
Va	Dark Brown	Massive		Slightly Pebbly Sandy Silt	Alluvial Fan Overbank	Middle To Late Holocene; less than 4070±70 BP (Area D)
Vb	Brown	Massive		Sandy Very Fine Pebbly Gravel	Alluvial Fan Distributary Channel	Middle To Late Holocene
Vc	Brown	Massive		Fine Pebbly Gravel	Alluvial Fan Distributary Channel	Middle To Late Holocene
Vd	Dark Brown	Massive		Gravelly Silty Fine Sand	Debris Flow	Middle To Late Holocene
Ve	Very Dark Grayish Brown	Massive		Trace Pebbly Sandy Silt	Sheet Wash	Middle To Late Holocene
VI	Brown To Black	Massive	Loess Enriched	Slightly Pebbly Sandy Silt	Slope Wash	Early-Late Holocene
VIa	Brown	Massive	Loess Enriched	Trace Pebbly Sandy Silt	Slope Wash	Early-Late Holocene
VIb	Black	Massive	Loess Enriched	Trace Pebbly Sandy Silt	Slope Wash	Early-Late Holocene; 2600±60 BP (Trench 1)

Table 5-2 Strata characteristics for the Goff Creek (48PA325) site.

Stratum	Color	Structure	Modifications	Textures	Depositional Environment	Age
VII	Very Dark Grayish Brown	Discontinuous Wavy Nonparallel Bedded		Trace To Slightly Pebbly Silty Very Fine Sand (Sviia) To Sandy Very Fine Pebbly (Sviib)	Slope Wash (Sviia) Debris Flow (Sviib)	Early-Late Holocene
VIIa	Very Dark Grayish Brown	Massive	Loess Enriched And Cultural Zone	Trace To Slightly Pebbly Silty Very Fine Sand	Slope Wash	Late Holocene; 920±70 BP (Area D)
VIIb	Very Dark Grayish Brown	Massive		Sandy Very Fine Pebbly Gravel	Debris Flow	Late Holocene
VIII	Dark Grayish Brown To Black	Parallel Even Bedded		Silty Very Fine Sand To Sandy Silt	Fluvial Overbank And Channel	Late Holocene
VIIIa	Dark Grayish Brown	Single Grained	Fining Upwards	Silty Very Fine Sand	Fluvial Channel	Late Holocene
VIIIb	Black	Massive	Cultural Zone	Sandy Silt	Fluvial Overbank	Late Holocene
VIIIc	Dark Grayish Brown	Massive		Sandy Silt	Fluvial Overbank	Late Holocene
VIIId	Black	Massive	Cultural Zone	Sandy Silt	Fluvial Overbank	Late Holocene; 660±80 BP (Cutbank)
VIIIe	Dark Grayish Brown	Massive		Sandy Silt	Fluvial Overbank	Late Holocene
VIIIf	Very Dark Grayish Brown	Massive		Sandy Silt	Fluvial Overbank	Late Holocene

Area B, Areas C-F and Associated Test Units, and Ht1 Terrace. A single profile is documented along the scarp of the Holy City terrace next to the river and is outlined under the HT1 Terrace heading below. Selected strata sheets, soil horizon profile descriptions, and drawn profiles are presented in the body of the text. Additional data are included in Appendix A. The stratigraphic relationships are illustrated in Figure 5-3.

Area A

Holocene-age sediments containing archaeological materials were first documented from test unit 10 in Area A during the summer of 1994 (Eakin et al. 1996). Excavation of trench 1 in 1995 revealed deep archaeological deposits in this area. In 1996, the Area A block was excavated near the west end of backfilled trench 1. Area A walls were profiled and are illustrated in Figures 5-4 and 5-5 and Appendix A. A short trench was excavated off the west end of Area A in 1996 and labeled as west extension trench (Figure 5-6).

The oldest deposit in the west area is Stratum I, which is a very dark grayish brown, single grained, large cobbly gravel (Table 5-2). This sediment is thought to be fluvially reworked Pleistocene- to Holocene-age fan alluvium. A clay enriched soil Bt horizon (see below) has developed in the upper portion of this sediment. This deposit is predominantly cobbly and relatively well sorted under Area A, but coarsens to a bouldery texture and is less well sorted to the east and south.

Stratum I is in gradational contact with Stratum II. The latter is a dark brown, bedded, slightly pebbly muddy very fine grained sand to slightly pebbly silty very fine grained sand. This unit is thought to be a bioturbated slope wash deposit. Cody Complex (~9100 BP) and Ruby Valley (8780±260 to 9410±140 BP; Davis et al. 1989) projectile points were recovered from Stratum II within cultural zones predominated by Early Archaic remains including Early Archaic diagnostic projectile points and correlative radiocarbon dates. The truncated bases of several hearths were found within Stratum II in Area B including ones dated to 6150±80 BP and 6700±230 BP (Table 5-3). A mean residence time radiocarbon date of 4070±70 BP was procured from a buried Ab horizon formed into the upper contact of Stratum II from Area D (Table 5-3).

Stratum II is divided into two beds. The lowest, Stratum IIa, is a slightly pebbly, silty fine grained sand and the upper, IIb, is a slightly pebbly muddy very fine grained sand (Table 5-2). Overall, Stratum II averages about 50 cm thick (20 in). Pedogenesis has also modified Stratum IIa, producing Bt or Bw horizon characteristics (see below).

Stratum III disconformably overlies Stratum II. This unit is composed of a set of brown to very dark grayish brown, discontinuous even parallel bedded, pebbly fine sand to clayey silt deposits (Table 5-2). Five conformable units occur. The lowest is Stratum IIIa, which is a brown to dark brown, sandy silt.

It is overlain by Stratum IIIb, a brown, massive, sandy silt. Stratum IIIc is a very dark grayish brown, massive, intermittently anthropogenically modified, sandy silt. It overlies Stratum IIb with a sharp contact. A date of 5270±80 BP was procured from this unit within Area A (Table 5-3). The uppermost units are Stratum IIId, a brown, massive, clayey silt overbank deposit, and Stratum IIIe, a brown, single grained, pebbly fine grained sand.

Stratum IV overlies Stratum III with a sharp to scour contact. It is a dark grayish brown, single grained to massive, fine pebbly gravel to fine grained sand (Table 5-2). Portions of Stratum IIId were eroded by the channel that emplaced Stratum IV. Two distinct beds are present in Stratum IV. The first, IVa, is a single grained, fine pebbly gravel, and the second, IVb, is massive, fine grained sand.

Stratum V conformably overlies Stratum IV. Overall it is a brown to dark brown, massive to wavy discontinuous nonparallel bedded, trace pebbly sandy silt to fine pebbly gravel (Table 5-2). The different beds that compose this unit are: (a) Stratum Va, which is alluvial fan distributary channel overbank sediment composed of dark brown, massive, slightly pebbly sandy silt; (b) Stratum Vb, which is alluvial fan distributary channel gravel composed of brown, massive, sandy very fine pebbly gravel; (c) Stratum Vc, which is alluvial fan distributary channel gravel composed of brown, massive, fine pebbly gravel; (d) Stratum Vd, which is debris flow deposits of dark brown, massive, gravelly silty fine sand; and (e) Stratum Ve, which is sheet wash deposits composed of very dark grayish brown, massive, trace pebbly sandy silt.

Stratum VI overlies Stratum V throughout much of the site. Its contact with Stratum V is conformable. Stratum VI is a brown to black, slightly pebbly sandy silt. Stratum VI varies in organic content with VIa having some weak humus enrichment and VIb having more pronounced organic enrichment (Table 5-2). Stratum VIb dates to 2600±60 BP (mean residence time date) in trench 1 (Table 5-3).

The uppermost deposit on the fan is Stratum VII. It consists of a very dark grayish brown, discontinuous wavy nonparallel bedded, trace to slightly pebbly silty very fine grained sand (Stratum VIIa) to sandy very fine pebbly (Stratum VIIb) deposit (Table 5-2). A date of 920±70 BP was procured from Stratum VIIb in Area D (Table 5-3). An organic surface soil is formed into this unit.

Stratum VIII forms the HT1 alluvial terrace. It is immediately underlain by Pleistocene- to Holocene-age alluvial gravel. This deposit is a dark grayish brown to black, parallel even bedded, silty very fine grained sand to sandy silt. It contains several archaeological occupation zones (Table 5-2). The upper one dates to 660±80 BP (Table 5-3). Stratum IX is inset into Stratum VIII. No Stratum IX exposures were available and thus it is not described.

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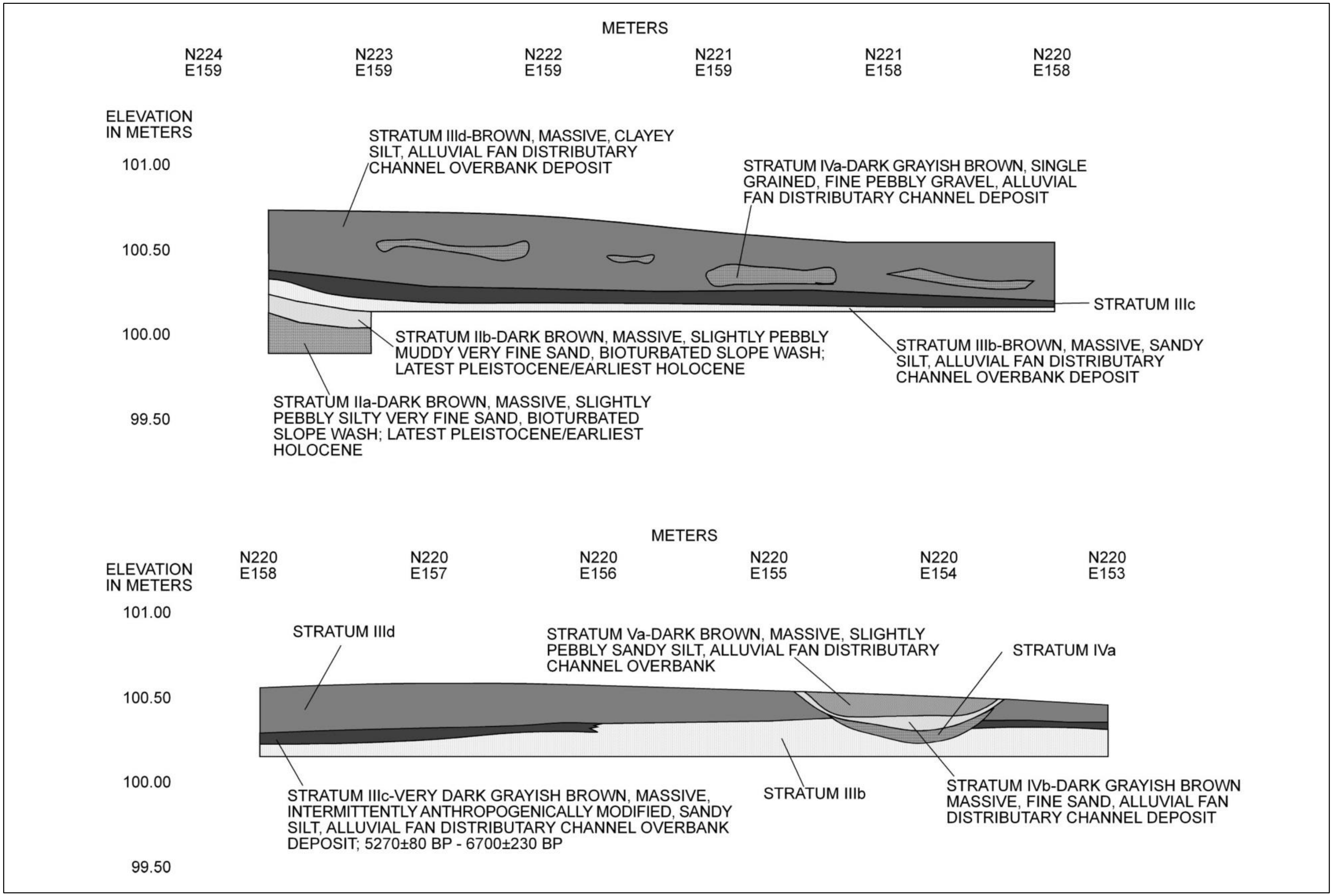


Figure 5-4 Illustrated profiles from Area A, Block A.

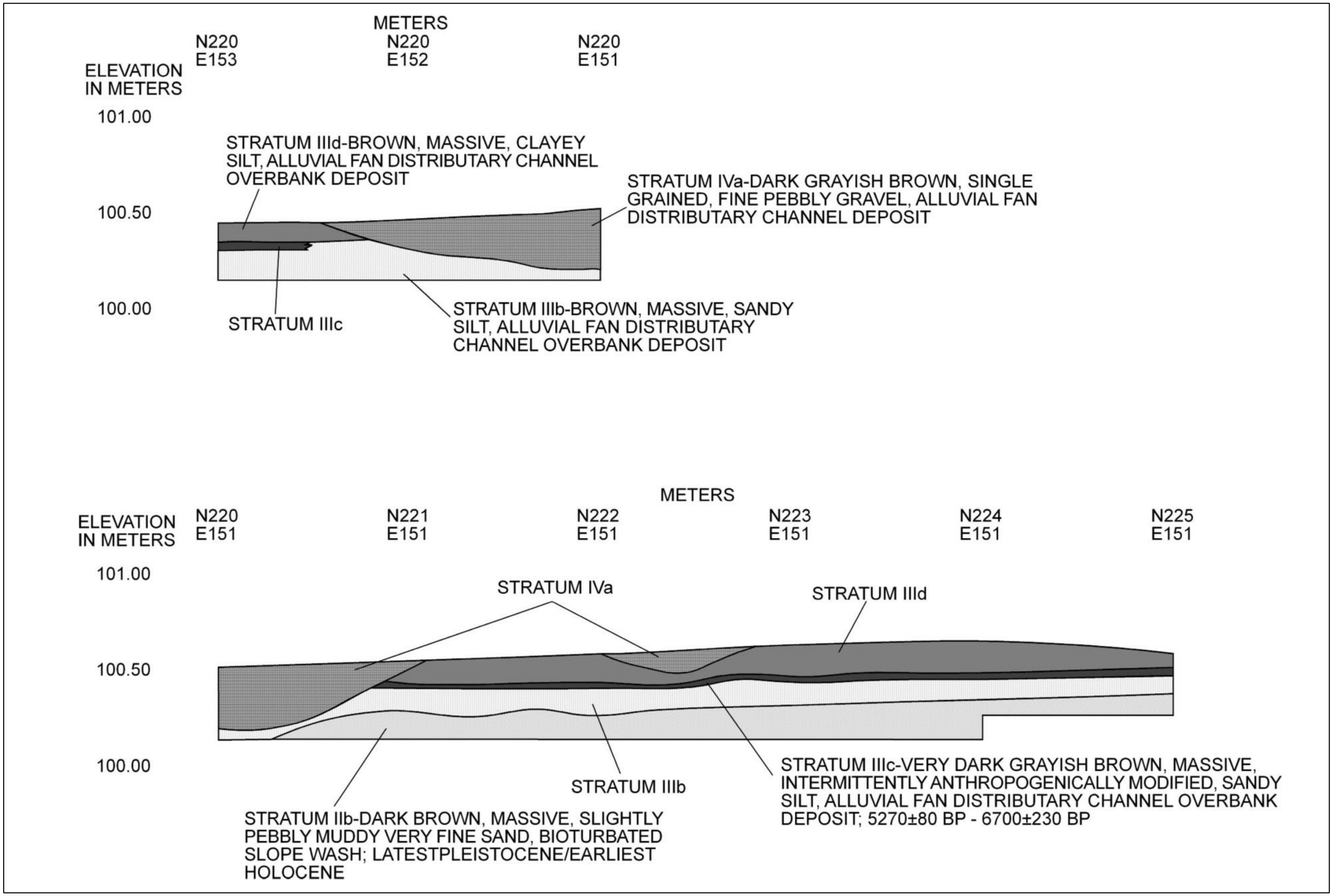


Figure 5-5 Illustrated profiles from Area A, Block A.

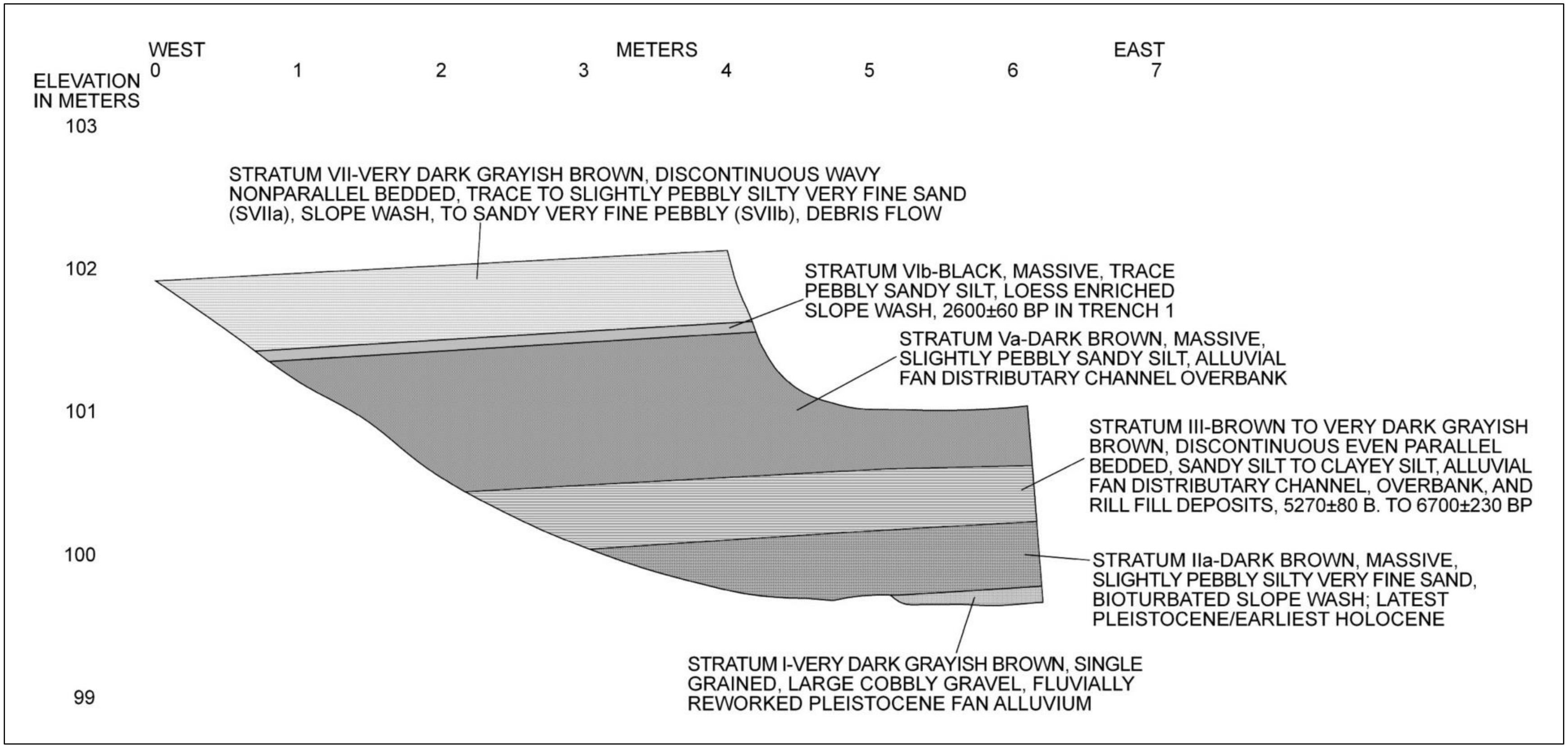


Figure 5-6 Illustrated profile from the west extension trench in Area A.

Table 5-3 Radiocarbon dates from the Goff Creek (48PA325) site.

Beta #	Strat	Provenience	CL	C14 Age BP	C13/C12 o/oo	Calibrated Years BP 2σ	Material
406661	II/VI	Blk F, N233 E278, F.21 98.01-97.96 m	L	130±30	-25.9	9-45 [.16], 57-151 [.44], 173-275 [.40]	Charred material
97535	VIId	Organic lens in cut bank	?	660±80	-25.0	527-728	Charred material
97537	VIIa	Blk D, N232 E255, F.16, 98.82-98.66 m	U	920±70	-25.0	697-938 [.99], 946-952 [.01]	Charred material
87105	VIb	Trench 1/2 Join, ~100.75 m	U	2600±60	-25.0	2490-2643 [.33], 2654-2667 [.01], 2676-2849 [.66]	Organic sediment
97540	Va	Blk D, N231 E254, SE quad, 98.24-98.21 m	L	4070±70	-25.0	4420-4729 [.82], 4734-4743 [.01], 4747-4820 [.17]	Organic sediment
406662	I	Blk F, N231 E278, F.23 97.67-97.53 m	L	4310±30	-22.9	4835-4893 [.77], 4898-4960 [.23]	Charred material
97538	IIa	Blk D, N235 E256, F.17, 98.07-97.97 m	L	5000±70	-25.0	5609-5898	Organic sediment
87106	IIIc	Trench 1 in Block A, Akb3	U	5270±80	-25.0	5906-6218 [.96], 6236-6273 [.04]	Organic sediment
97539	IIb	Blk B, N224 E176, F.5, 98.84-99.78 m	L	5700±80	-25.0	6316-6660	Organic sediment
406660	IIIc	Blk A, N223 E154, F.1 100.37 m	U	5730±30	-26.4	6445-6573 [.83], 6579-6632 [.17]	Charred material
87107	IIb/IIIc	Blk B, N229 E176, F.14 99.93-99.67 m	L	6150±80	-25.0	6804-6813 [.01], 6849-7251 [.99]	Organic sediment
97534	IIb	Blk B, N222 E176, F.3 99.83-99.71 m	L	6700±230	-25.0	7032-7040 [.01], 7156-8014 [.99]	Charred material

Area B

Sediments were first documented in Area B from backhoe trenches 1 and 2 during the fall of 1995. A buried hearth was found in the south wall of the west end of trench 2 (Figures 5-7 and 5-8). In 1996, a trench was excavated to join the original trenches 1 and 2 (Trench 1-2 Join; Figures 5-9 through 5-13). Area B was excavated south of the backhoe trenches to explore the cultural deposits within Strata II and III at this location.

Stratigraphic relationships in Area B are very similar to those in Area A. Stratum I, cobbly and bouldery fluvial gravel, underlies this entire area. Stratum II is found throughout the length of trench 1-2 join, and trench 2. Stratum III, an alluvial fan overbank deposit, also occurs over the entire area. The distinct bedding found in Strata II and III in Area A becomes more difficult to distinguish in Area B, and thus it is more difficult to assign cultural material to particular beds. A single Cody Complex (~9100 BP) projectile point was found in Stratum II in Area B. Both Strata II and III contain Early Archaic cultural materials. The Cody and Early Archaic materials could not be separated stratigraphically, but the Cody point occurs within a distinct activity area of lithic debitage. As in Block A, Stratum IV channel gravel caps Stratum III. Overlying deposits include Stratum V, which at this location is an 80-cm (32-in) thick sequence of trace pebbly sandy silt to fine pebbly gravel that includes channel and debris flow structures. This unit is conformably overlain by Stratum VI, the brown to black, slightly pebbly sandy silt. Stratum VIb is dated to 2600±60 BP in trench 1 (Table 5-3). A carbonaceous soil is formed into Stratum VI and into the top of Stratum V (see below). The uppermost sedimentary unit is Stratum VII. As in Area A, it consists of a trace to slightly pebbly silty very fine grained sand (Stratum VIIa) to sandy very fine pebbly (Stratum VIIb) deposit. It also contains debris flow structures.

The soil sequence in Area B is similar to that described for Area A, where a surface soil and three buried soils are present. A mollic A horizon is present in the surface soil. Below is the buried organic Ab horizon present in Stratum VI that dates to 2600±60 BP. This soil grades into a weaker humic Ab horizon, which is formed into the upper portion of Stratum V. Still lower in the stratigraphic sequence is the Bt horizon that formed into Stratum II. This clay enriched zone is not as developed in Area B as in Area A. The deepest soil horizon is the well-developed Bt horizon that is formed in Stratum I fluvial gravel.

A surface soil and three buried soils are present in Area A. The surface soil consists of a mollic A horizon, which is about 20 cm (8 in) thick and extends over most of the fan area. This zone is formed in Stratum VII fan deposits. Field documentation indicates that this zone is thick enough and dark enough to qualify as a mollic horizon (epipedon). Late Prehistoric and Late Archaic cultural material occurs in this mollic zone.

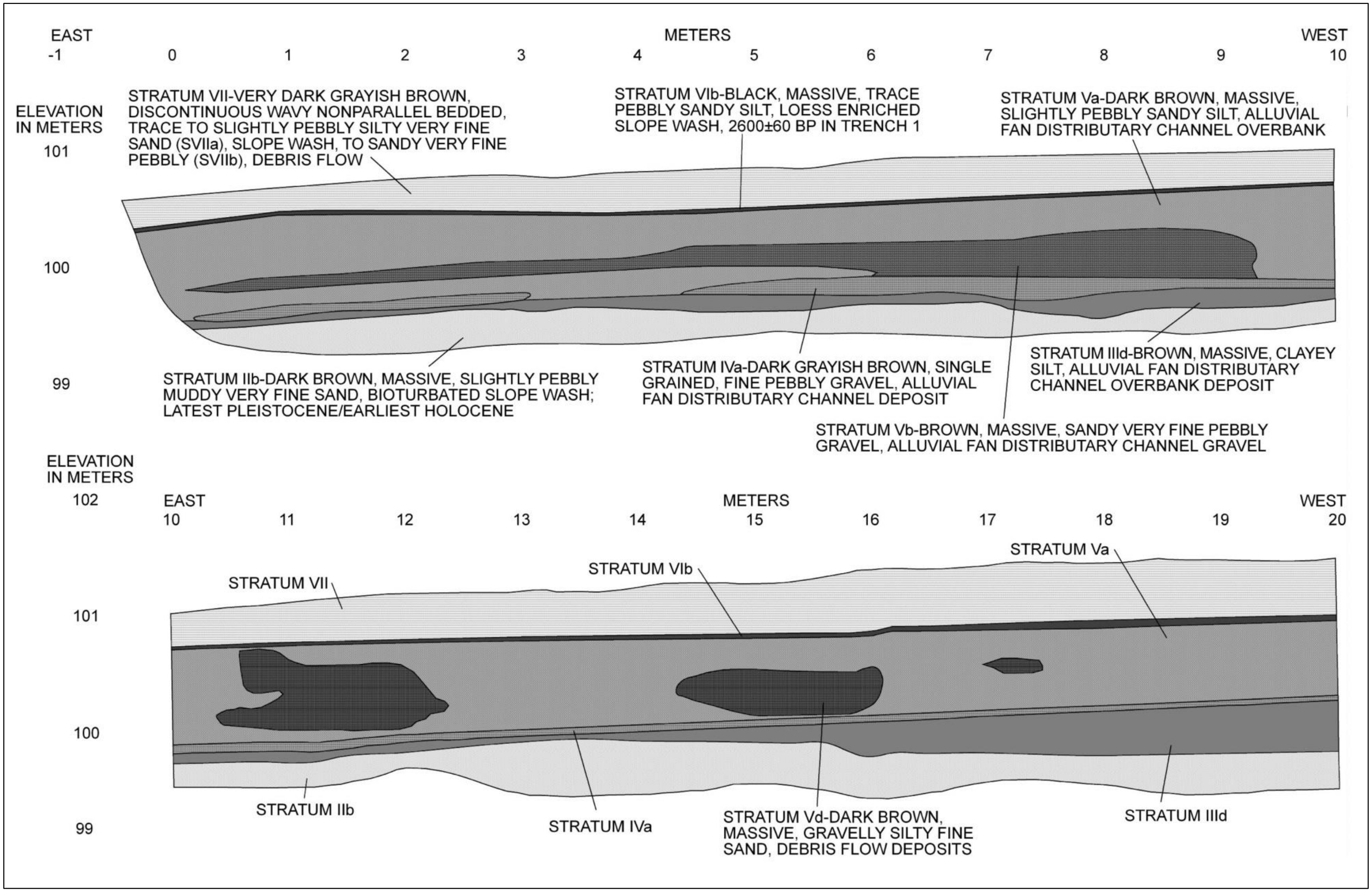


Figure 5-7 Illustrated profile of Trench 2, Area B.

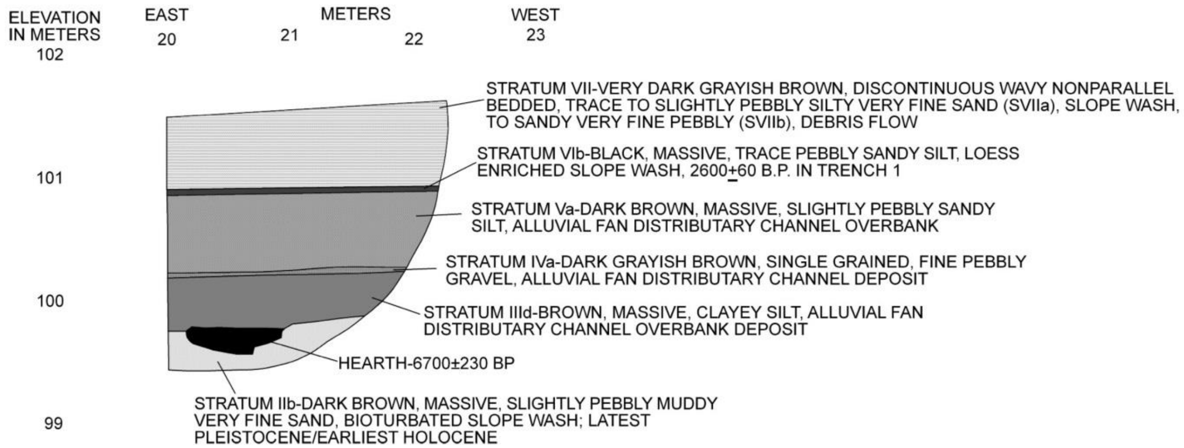


Figure 5-8 Illustrated profile of Trench 2, area B.

A buried organic soil is also present over nearly the entire site. It consists of both anthropogenic and mollic organic material (A1) formed into Stratum VIb and in places extends into the top of Stratum V (A2). The A1 is much darker than the A2. In Area A, this soil is buried about 70 cm (28 in) deep but it becomes progressively more shallowly buried eastward. This Ab horizon dates to 2600±60 BP in the western portion of the site where it is associated with a Late Archaic occupation in Area D (Table 5-3).

The deepest soil in Area A is a buried Bt horizon that is formed in Stratum IIa. This zone has a loam texture and contains 2-5% pebbles that increase in volume downward to the contact with Stratum I channel gravel. This zone appears to have some pedogenic clay development. Thin illuvial clay coatings are present on pebbles. As well, the lower portion of this Bt horizon has moderately developed angular blocky structure. Stratum II occurs under both Areas A and B, but the Bt soil development characteristics are most prominent in Area A. Illuvial calcium carbonate (stage I to I+) has accumulated in the upper portion of this zone, but it is thought to post-date the clay development. Hearth basins excavated into the Bt horizon within Area B date to 6700±230 BP (N222/E176) and 6150±80 BP (Trench 1-2 join and Trench 2) thus, the soil formed before these occupations (Table 5-3).

The lowest soil documented is a well-developed, clay enriched Bt horizon that is formed in the upper portion of Stratum I, the Pleistocene- to Holocene-age fluvial gravel. This soil is present wherever Stratum I is encountered. The Bt is well developed, with moderately thick clay skins.

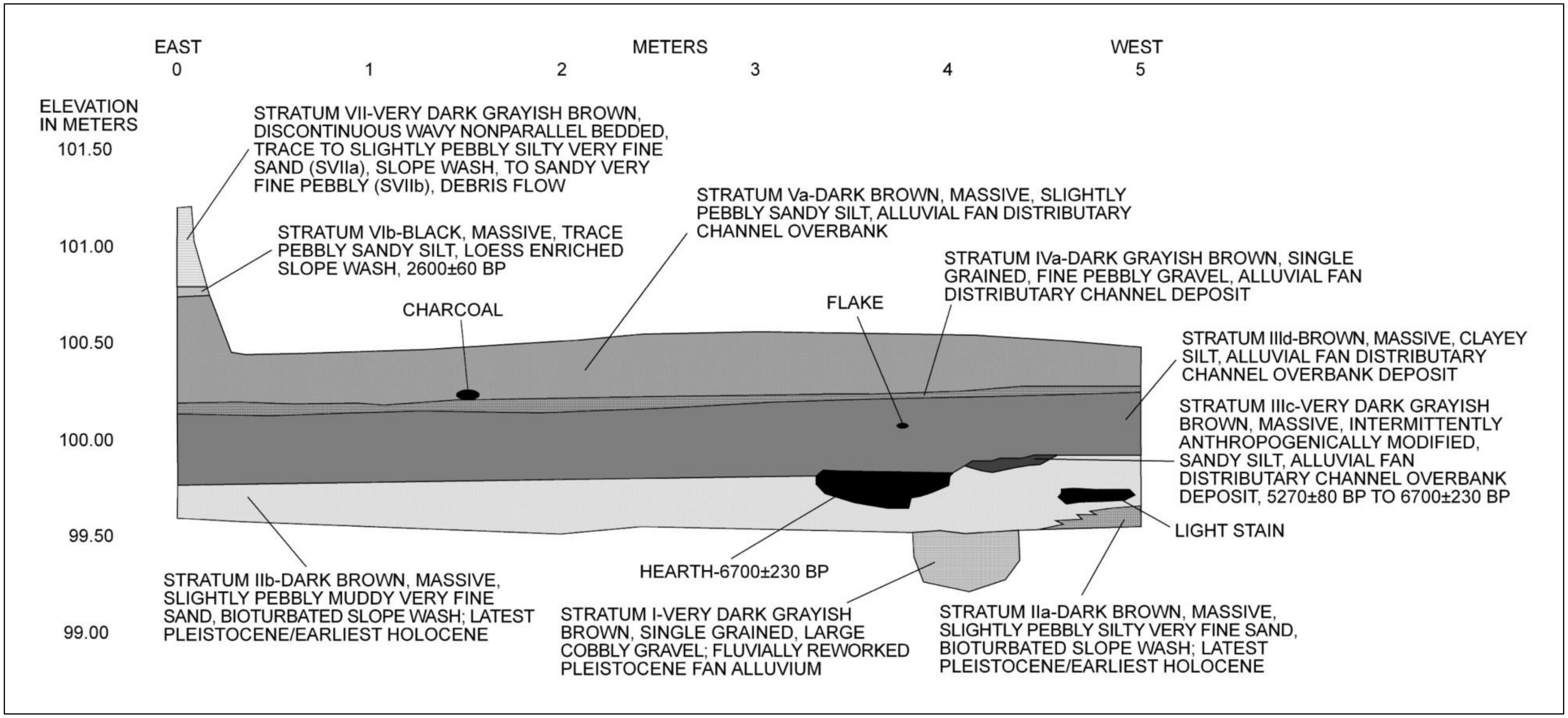


Figure 5-9 Illustrated profile of Trench 1-2 Join, Area B.

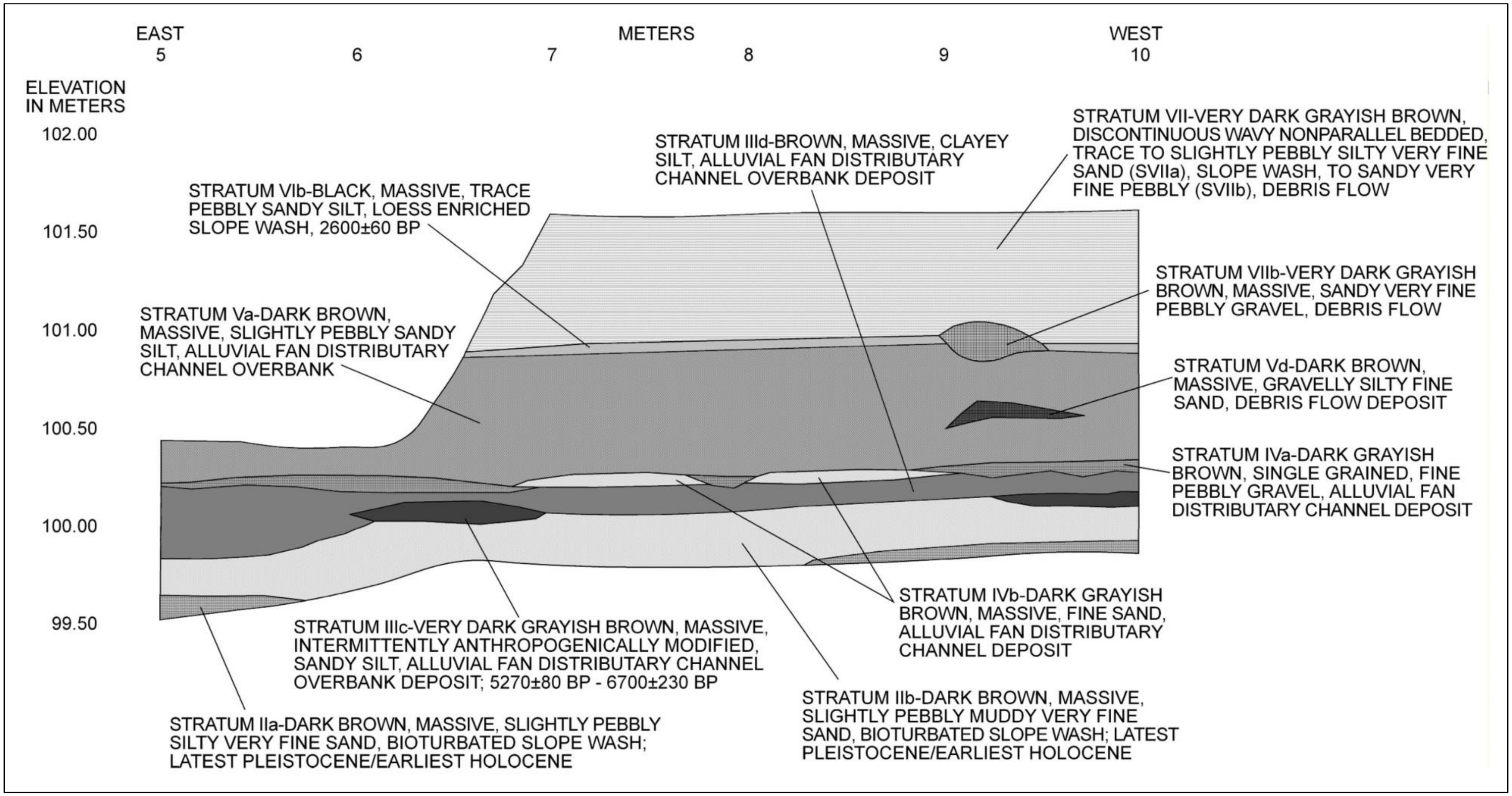


Figure 5-10 Illustrated Profile of Trench 1-2 Join, Area B.

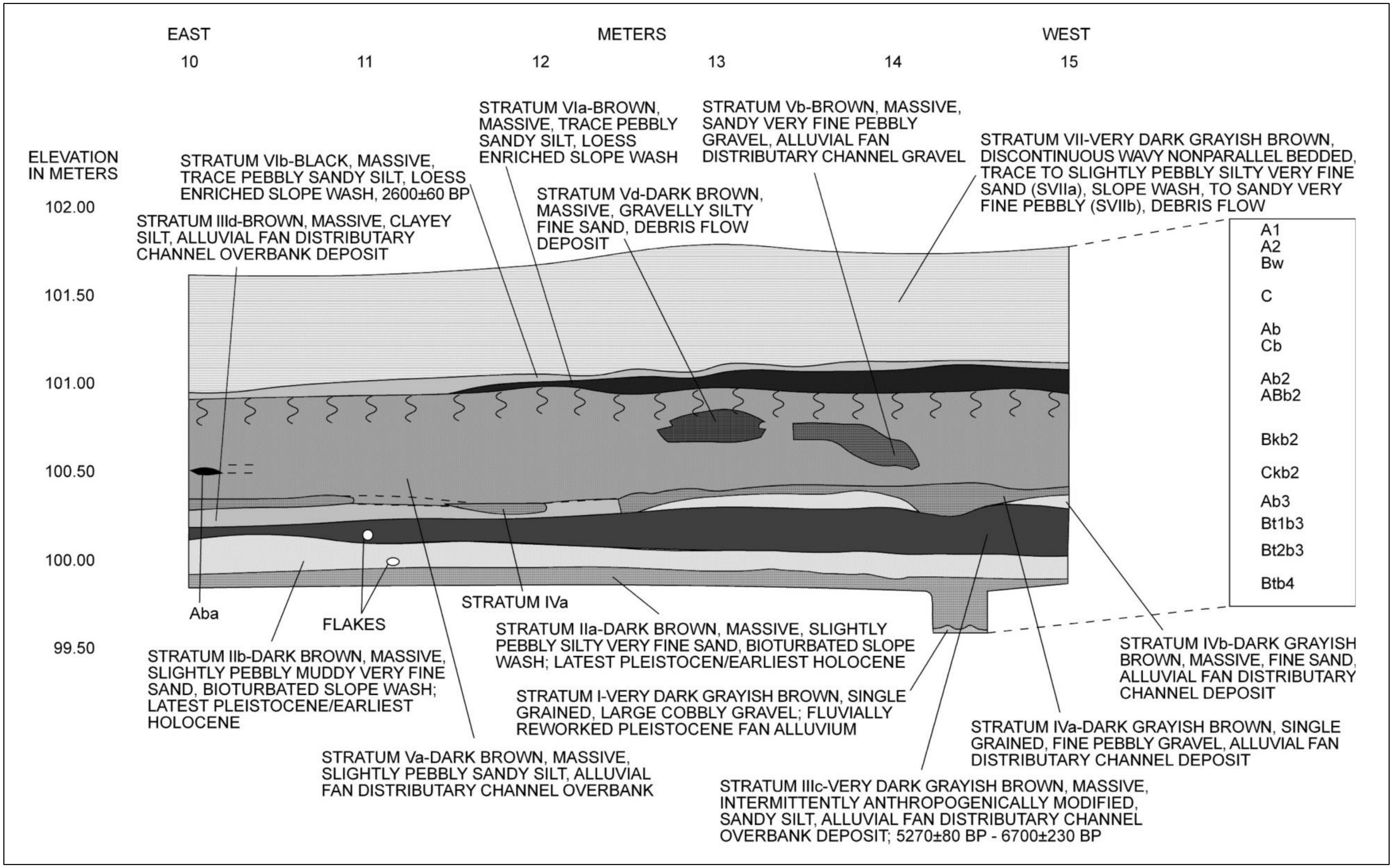


Figure 5-11 Illustrated profile of Trench 1-2 Join, Area B.

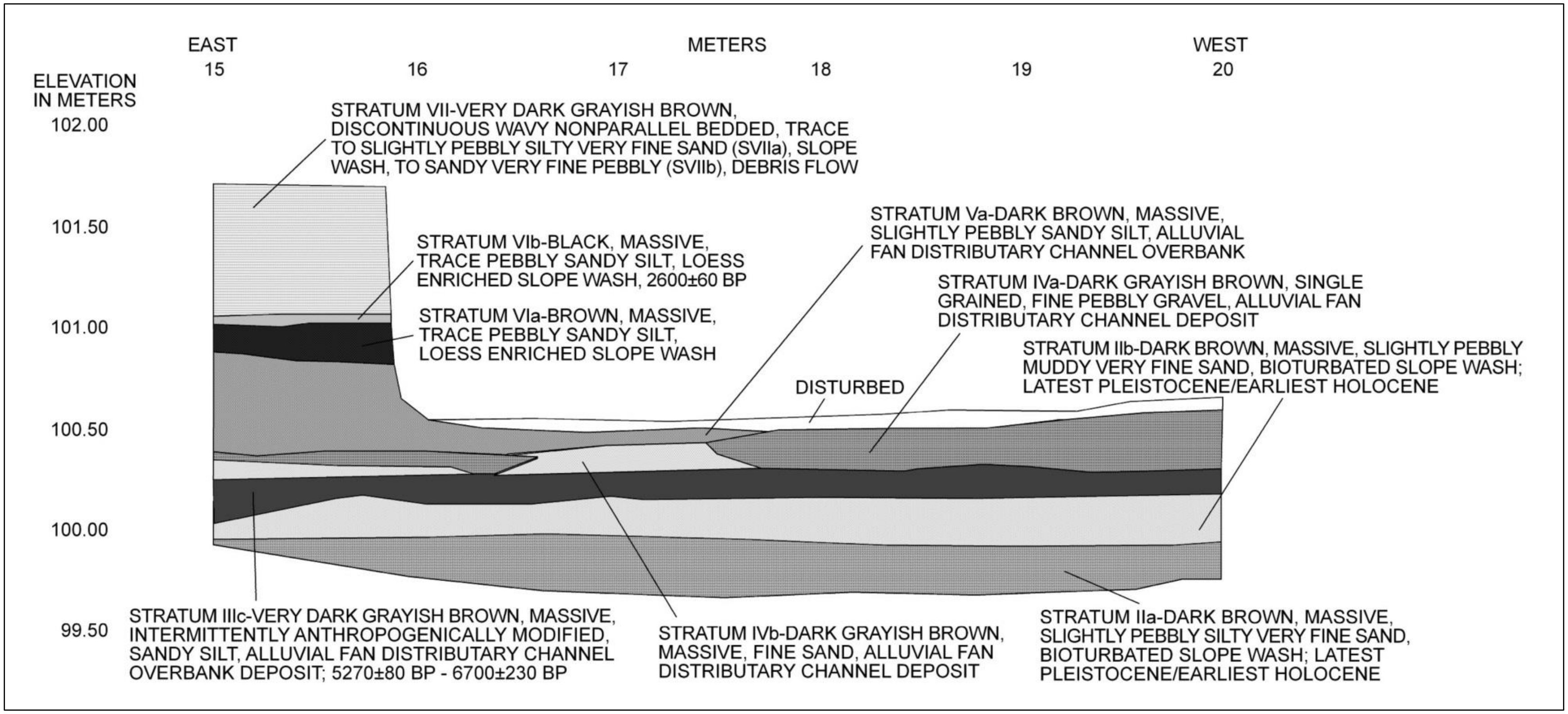


Figure 5-12 Illustrated profile of Trench 1-2 Join, Area B.

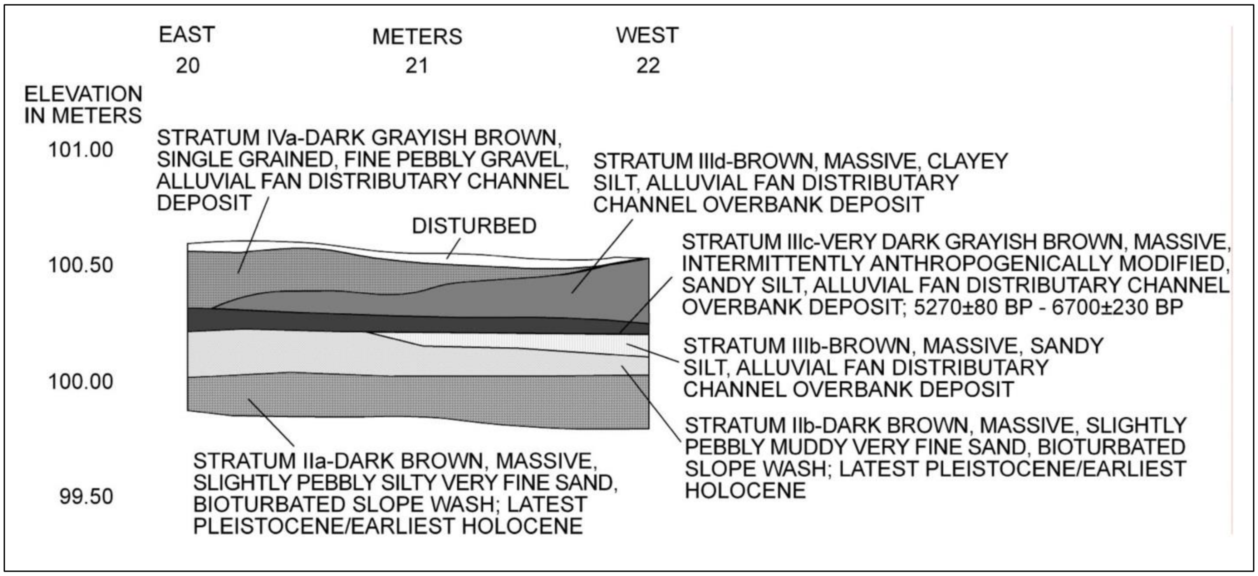


Figure 5-13 Illustrated profile of Trench 1-2Join, Area B.

Areas C - F and Associated Test Units

Sediments were first documented in Block D (Figure 5-14), Block C (Figure 5-15) and Area E (Figure 5-16) in 1995. Several shallow blocks were excavated to explore Late Prehistoric and Late Archaic components in the eastern portion of the site in 1996. Backhoe trenches were excavated in the late fall of 1996, including trenches 3-7 (Figures 5-17 and 5-18). Block D, was excavated deeper in 1997 to explore Early Archaic and possible Paleoindian deposits in this portion of the site.

As with the rest of the site, the oldest deposit is along the eastern margin is Stratum I. However, this deposit is more bouldery and less well sorted than in Areas A and B, and clasts range upward in size to medium boulders (102.4 cm; 39.9 in). Similar, unburied, bouldery zones are found immediately downstream from the mouths of several tributaries to the North Fork. Apparently they are lag deposits resulting from the fluvial winnowing of cobbly matrix from preexisting bouldery fan deposits. Stratum I is in gradational contact with the overlying Stratum II, which is comprised of dark brown, slightly pebbly muddy very fine grained sand to slightly pebbly silty very fine grained sand. Both Paleoindian and Early Archaic cultural materials are present in Stratum II, and a hearth in this area produced a date of 5000±70 BP (Table 5-3). In terms of pebble content, this sediment is most similar to what is designated as Stratum IIa in the west and central portions of the site. Stratum II is overlain by Stratum Va, an alluvial fan sheet wash deposit. Strata III-IV pinch out to the west of Area D. Overlying deposits appear to correlate to Stratum VIa, which dates to 2600±60 BP further to the west. Late Archaic cultural materials are present in VIa. Stratum VII overlies Stratum VI. It is composed of alluvial fan, slope wash, and debris flow deposits. Late Archaic and Late Prehistoric artifacts are present in this zone and charcoal recovered in association with the cultural material produced a date of 920±70 BP (Table 5-3).

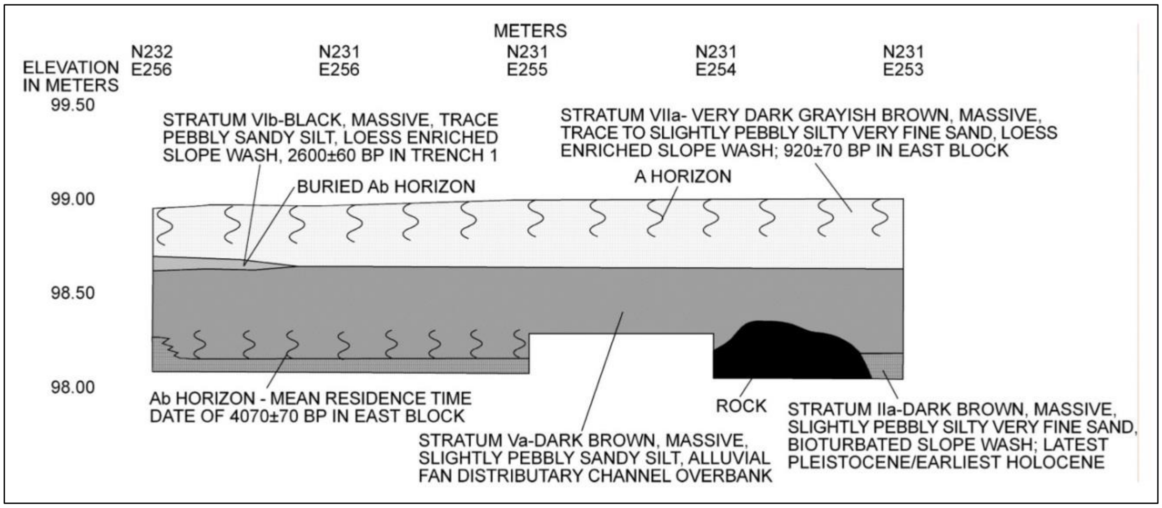


Figure 5-14 Illustrated profile of Block D, Area D.

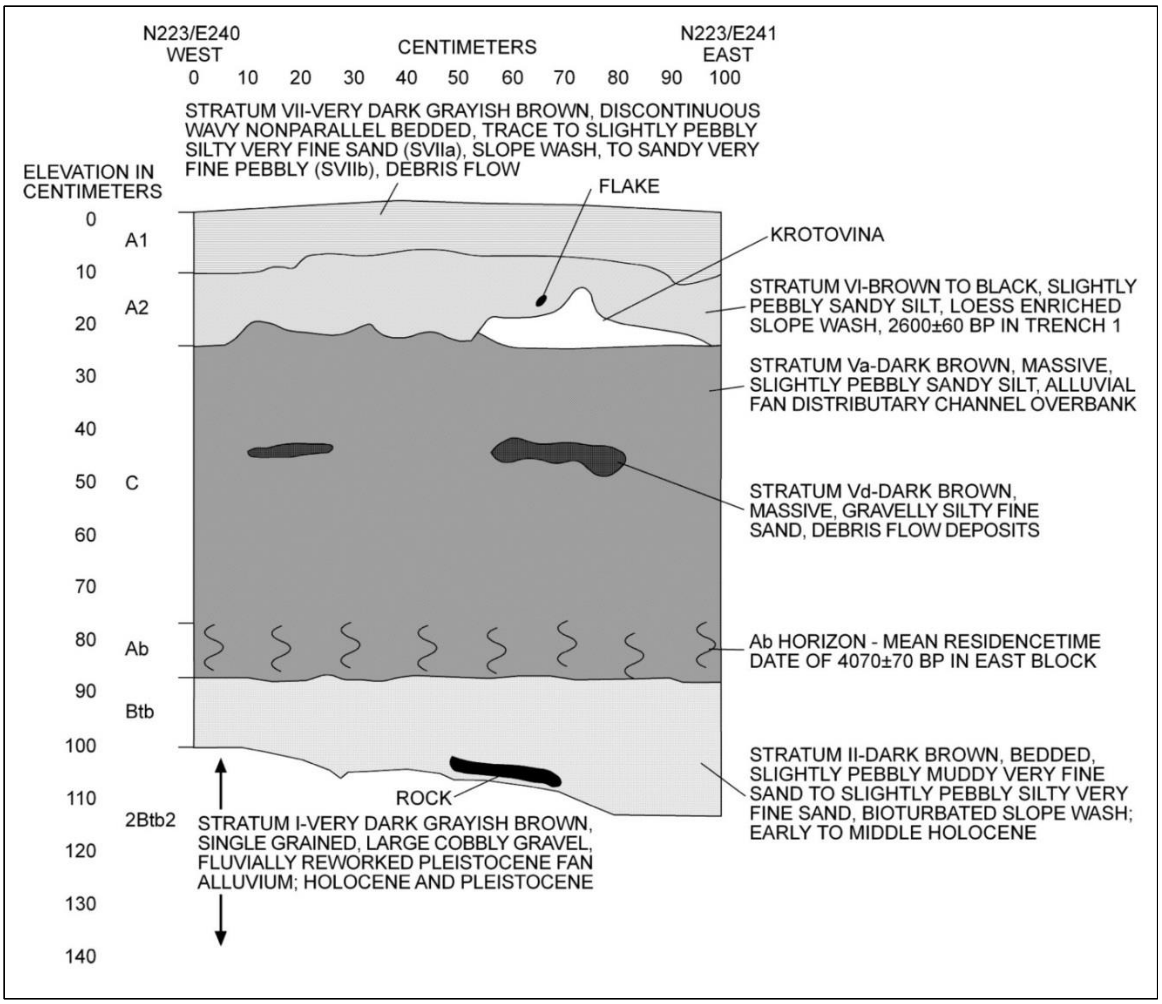


Figure 5-15 Illustrated profile of unit N223 E240, Block C.

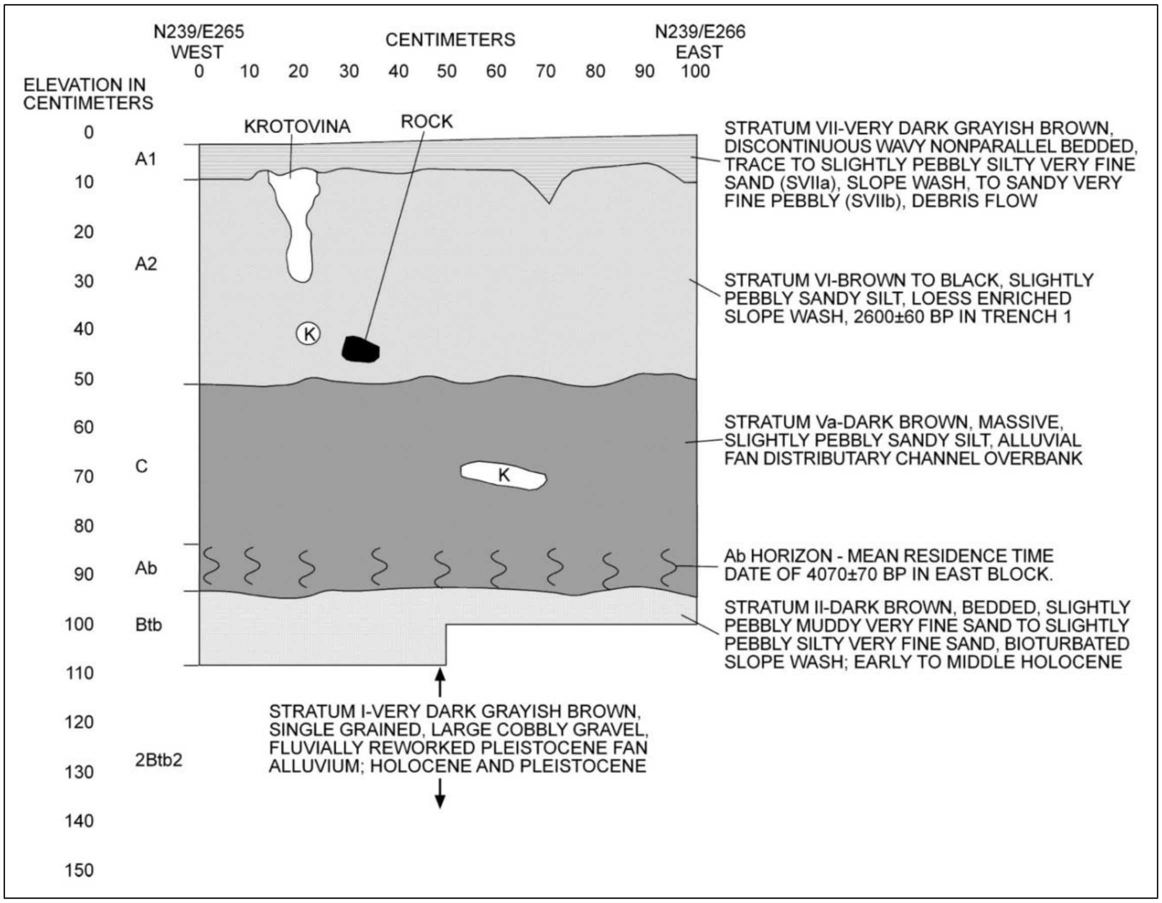


Figure 5-16 Illustrated profile of unit N239 E265, Area E.

From oldest (deepest) to youngest, four soils are present in the eastern part of the site. As in other areas of this site, a well-developed clay enriched Bt horizon is formed into the upper portion of Stratum I, the Pleistocene- to Holocene-age gravel. As well, there appears to be some Bt clay enrichment in Stratum II. In Area D, a weak, humic Ab horizon is formed into the surface of Stratum II. A bulk sample of organics in this soil produced a mean residence time date of 4070±70 BP (Table 5-3). The overlying Stratum VI also contains organics that were designated as an Ab horizon (higher in the profile) which contains LateArchaic artifacts and probably correlates to the soil which dated to 2600±60 BP in trenches 1, 2, and 1-2 Join (Table 5-3). Finally, the surface soil contains a mollic A horizon formed in Stratum VII. As mentioned, this surface A horizon is associated with Late Prehistoric cultural materials.

The Ht1 terrace is an alluvial fill terrace that is situated in the southern portion of the site (Figure 5-3) adjacent to the North Fork. The river ford to the Fish Eagle Creek trail passes through this portion of the site. The terrace tread stands at about 1.4-1.6 m (4.6-5 ft) above the summer, low water shoreline. A partially filled cutoff channel separates Ht1 from the Hf (Figure 5-3). Vegetation on the terrace consists principally of a cinquefoil (*Potentilla*) forb-grass meadow.

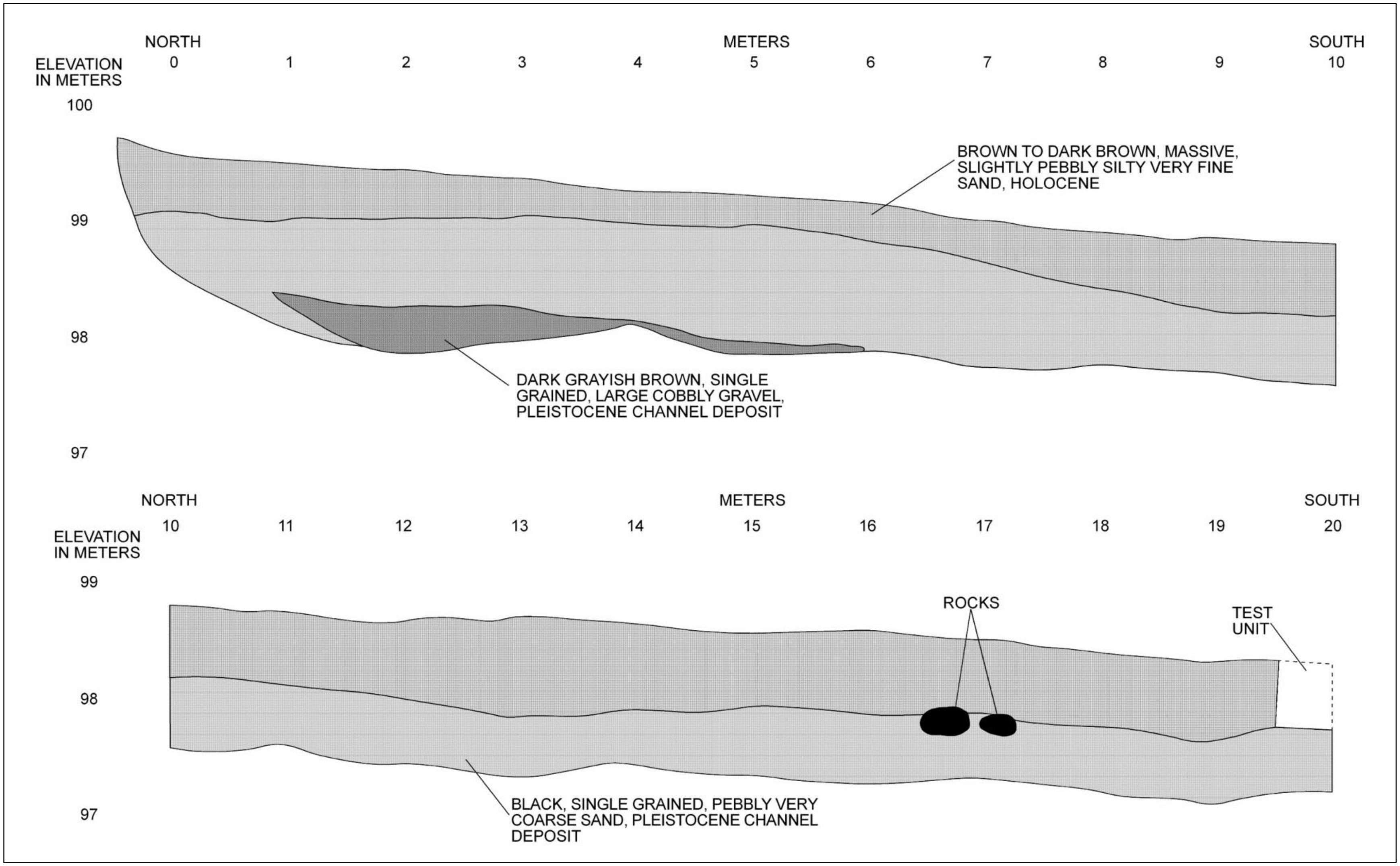


Figure 5-17 Illustrated profile of Trench 5, Area F.

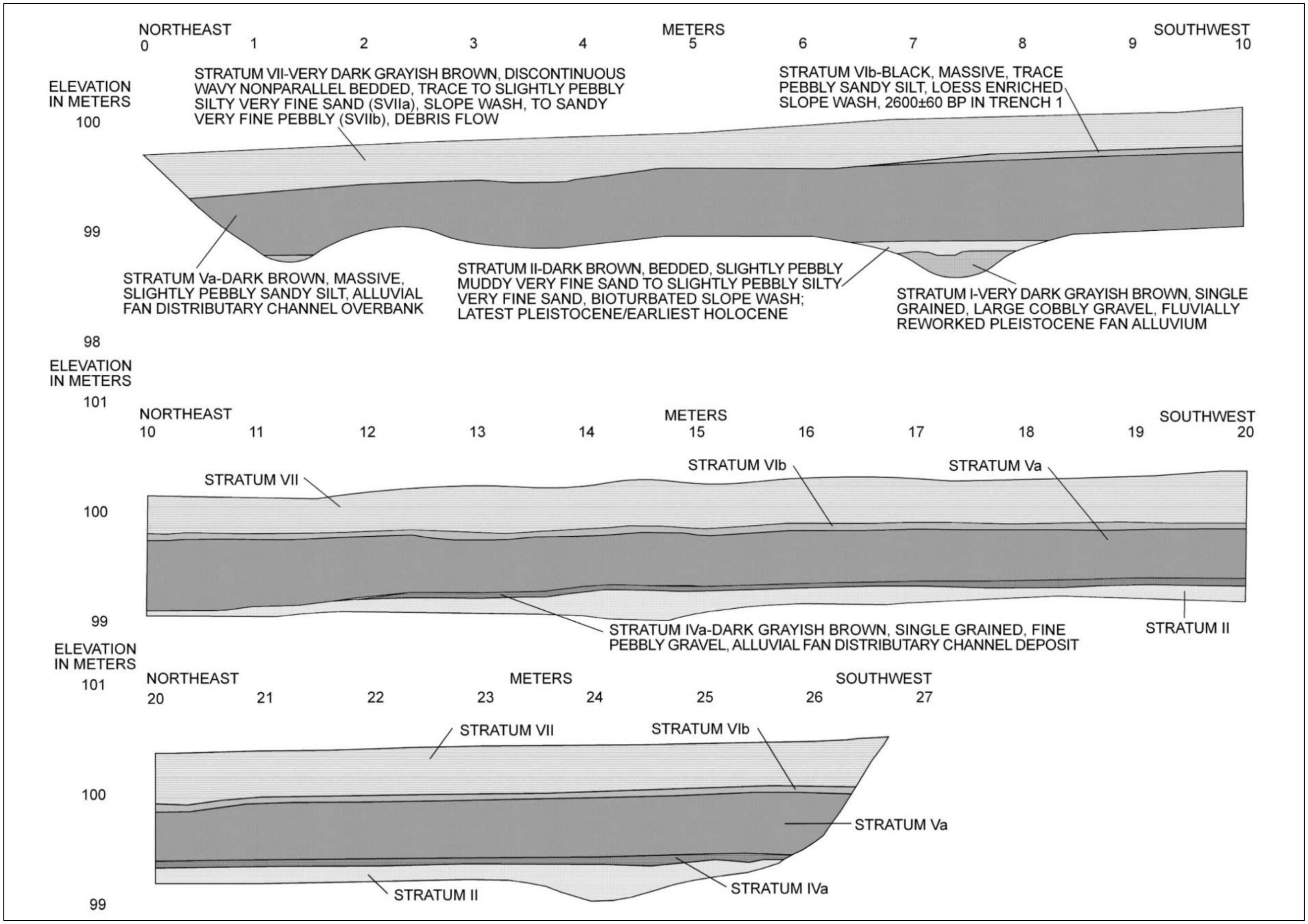


Figure 5-18 Illustrated profile of Trench 7, between Areas C and G.

HT1 deposits are documented in a profile along the cutbank. The lowest sediment is Stratum I, bouldery channel alluvium. The top of Stratum I is nearly coincident with the summer, low water shoreline. Total thickness of Stratum I is unknown. Stratum I is immediately overlain by a 1.4 m (4.6 ft) sequence of fine textured alluvium. These fine upward in what is interpreted as a channel marginal/ overbank sequence. The silty sandy lower portion is designated as Stratum VIIIa. A set of bedded, sandy silt deposits overlies the silty sand. These are designated VIIIb-VIIIf. Several of the beds, including VIIIb and VIIId, are darkened by cultural organics and contain cultural materials such as fire-cracked rock (FCR), chipped stone flakes, charcoal, and butchered medium and large mammal bone. Cultural charcoal from this terrace yield a date of 660±80 BP (Table 5-3).

Pedogenic horizonation is weak in the Ht1 profile. A thin surface A horizon is formed on stratified alluvium. As well, there are several buried A horizons that are darkened by cultural organics and contain artifacts, including FCR, chipped stone, and bone. They are labeled as Aab (anthropogenic) horizons to distinguish them from mollic A horizons such as the surface one.

Summary of Stratigraphy

Figure 5-3 illustrates west to east and north to south cross sections of the site stratigraphy. This figure illustrates the surface slope of the fan as it descends from the fan apex in the northwest to the toe on the east and the south. As well, it shows the attitude of the Pleistocene- to Holocene-age fan deposit (Stratum I) as it existed prior to burial by younger Holocene fan deposits. It also shows some of the notable stratigraphic relationships.

Stratum I underlies the entire site area. As described above (from the sections where is present), it is a very dark grayish brown, single grained, large cobbly gravel, fluvially reworked fan alluvium with small to medium size boulders observed in a few areas. Dates on overlying deposits at the site indicate that it predates Cody Complex and Barton Gulch projectile points, and is older than ~9500 BP. This unit was relatively well sorted under the western portions of Hf and present channel margin of the North Fork, where it averages a small bouldery texture. In the eastern and northern portions of Hf, Stratum I becomes less sorted and contains larger boulders.

Stratum II overlies Stratum I in most exposures. It is a poorly sorted, dark brown, bedded, slightly pebbly muddy very fine grained sand, to slightly pebbly silty very fine grained sand. It appears to be a time-transgressive unit and ranges in age from Early to Middle Holocene. The poor sorting exhibited by this unit may be a result of slope wash deposition. Alternatively, it may also be explained as having resulted from bioturbation of formerly well sorted sediments (possibly by tree tip-outs).

Stratum III, composed of bedded fluvial overbank deposits, is confined to the western portion of the site, near the apex of the Holocene fan. This unit is a brown to very dark grayish brown, discontinuous even parallel bedded, sandy silt to clayey silt. Emplacement is thought to have been as alluvial fan overbank, and rill fill formed in proximity to a distributary channel on the fan's northwest flank. A radiocarbon date from this unit places it to around 5270±80 BP (Table 5-3).

A widespread episode of fluvial channel activity occurred in the western portion of the site after the deposition of Stratum III and this channel activity cut and removed portions of Stratum III. This resulted in the emplacement of Stratum IV, a grayish brown, single grained to massive, fine pebbly gravel to fine grained sand. Stratum IVa is a dark grayish brown, single grained, fine pebbly gravel and Stratum IVb is a dark grayish brown, massive, fine sand. Each of these deposits are sufficiently well sorted to suggest deposition as bedload during a relatively long-term flood event, as opposed to a short-term flash flood. Underlying and overlying dates suggest that this flood event occurred during the late-middle Holocene.

Stratum V is widespread over the site. It is a brown to dark brown, massive to wavy discontinuous nonparallel bedded, trace pebbly sandy silt to fine pebbly gravel, alluvial fan distributary channel, overbank, sheet wash, and debris flow deposits. Several distinct beds are present, including: (1) Stratum Va, a dark brown, massive, slightly pebbly sandy silt (overbank sediment); (2) Stratum Vb, a brown, massive, sandy very fine pebbly gravel (channel gravel); (3) Stratum Vc, a brown, massive, fine pebbly gravel (channel gravel); (4) Stratum Vd, a dark brown, massive, gravelly silty fine grained sand (debris flow deposits); and (5) Stratum Ve, a very dark grayish brown, massive, trace pebbly sandy silt (sheet wash deposit).

Stratum VI is also widespread over the site. It disconformably overlies Stratum V. This unit is brown to black, massive, slightly pebbly sandy silt. It is interpreted as a loess enriched slope wash. A mean residence time date suggested that it aggraded sometime before 2600±60 BP. Stratum VI contains Late Archaic cultural material. Two beds are recognized, including Stratum VIa which is brown, massive, trace pebbly sandy silt and Stratum VIb, a black, massive, trace pebbly sandy silt. Both are interpreted as loess enriched slope wash deposits.

The surficial unit on the fan is Stratum VII. It is a very dark grayish brown, discontinuous wavy nonparallel bedded, trace to slightly pebbly silty very fine sand slope wash (Stratum VIIa), and a sandy very fine pebbly (Stratum VIIb), debris flow. The debris flow portion is confined more to the western portion of the site. Late Prehistoric cultural materials are present in this unit.

Stratum VIII occurs only on the Holocene alluvial terrace (Ht1) in the southern portion of the site, adjacent to the North Fork. It is a dark grayish brown to black, parallel even bedded, silty very fine sand to sandy silt. This unit is composed of fluvial overbank and channel marginal deposits. It contains Late Prehistoric age cultural materials that date to 660±80 BP. Rodent turbation is prevalent in Strata VI through VIII.

Summary of Soils

As mentioned above, a surface soil and several buried soils are present at the site. These include: a buried Bt/Bw soil within Stratum II that is mostly confined to the west end of the site; a buried mollic A horizon that is formed into the upper contact of Stratum II in the east end of the site; a mollic and possibly anthropogenic A horizon that is in Stratum VI; and a mollic A horizon (mollic epipedon) present throughout the site area. These soils are summarized in greater detail below.

A buried Bt/Bw horizon (Table 5-2) has developed on Stratum II at the west end of the site. It is most apparent in Area A where it is formed in slightly pebbly silty fine sand sediment and is about 50 cm (20 in) thick. Stratum II is underlain by Stratum I, which is Pleistocene- to Holocene-age fan/terrace gravel. The Stratum II Bt horizon is buried, in turn, by Stratum III alluvial fan, overbank deposits which contain distinct cultural occupation zones. The Bt/Bw horizon is slightly reddened from oxidation and slightly clay enriched. Angular blocky structure and thin clay coating on pebble surfaces are present within the lower portion of this zone. An overlying radiocarbon date yielded an age of 5270±80 BP. This soil horizon most likely formed as part of an Inceptisol, under a partial forest cover during the early Holocene.

Area D contains a buried humic Ab horizon. It is about 10 cm thick and is formed into the upper portion of Stratum II. This Ab horizon is also present in N223/E240-241 and N239/E265-66. The horizon is a very dark grayish brown, contrasting with the underlying and overlying horizons which are both dark brown. A mean residence time date yielded an age of 4070±70 BP. Usually, mean residence time dates are somewhat younger than the age of sediment emplacement, but almost always older than the overlying deposits. The Ab horizon is most likely a buried mollic A horizon. Its characteristics and context suggest that it formed in a non-forested environment.

A relatively thin, sharply bounded, organic zone overlies Stratum V in Areas A and B. It is formed in Stratum VI, a trace pebbly sandy silt. The relatively high silt content in this stratum suggests a windblown silt contribution. Underlying and overlying deposits are poorly sorted, less silty, and formed as fan/slope deposits. The organic zone is about 10 cm thick, lacks abundant archaeological materials and charcoal, and is probably of a non-cultural origin. This horizon may be a buried O horizon which formed during a short interval when a closed canopy forest occupied the area. Mean residence time radiocarbon assay produced a date of 2600±60 BP.

A surface soil is present in Stratum VII, which contains poorly sorted slope wash and debris flow deposits. This soil is expressed as an approximately 30-cm thick surface A horizon. Occasionally a Bw zone of weakly developed, subangular, blocky structure occurs from 30-40 cmbs. The A horizon ranges from very dark brown (A1) to very dark grayish brown (A2). It is likely that this soil formed under sagebrush-grass-forb vegetation.

Table 5-4 Characteristics of various soils at the Goff Creek site, 48PA325. Soils include the adjacent, overlying and underlying horizon.

Horizon	Strat	Depth	Color		Texture	Structure	Consistency			Reac-tion	Clay Films	Bound-ary	CaCo^3	Salts	% Gravel
			Dry	Moist			Dry	Moist	Wet						
Surface Soil (N239/E265-266)															
A1	VII		10YR3/2	10YR2/1	sil	3,f,gr	so	vfr	so	none	none	c,i	none	none	1-2
A2	VII		10YR3/3	10YR2/2	sil	2,m,sbk	sh	vfr	so	none	none	d,w	none	none	1-2
C	Va		10YR4/3	10YR3/3	sl	1,m,sbk	sh	vfr	ss	none	none	a,s	none	none	1-2
BURIED Ab HORIZON FROM EAST PORTION OF SITE (N239/E265-266)															
C	Va		10YR4/3	10YR3/3	sl	1,m,sbk	sh	vfr	ss	none	none	a,s	none	none	1-2
Ab	Va		10YR3.5/4	10YR3/3	scl	1,m,sbk	sh	vfr	ss	none	none	c,w	none	none	1-2
Ckb	II		10YR4/3	10YR3/2	scl	1,m,sbk	sh	vfr	ss	e	none	?	0,i,c,sf	none	1-2
LATE PALEOINDIAN AGE SOIL(WEST BLOCK, 233.5N/155E)															
Ak2b4	IIIa	178		10YR4/3	lvfs	m		vfr	so	et	none	c,w	stage I	none	2
Btk2b5	IIb	195		10YR3/3	l	m		vfr	s	et	none	d,s	0,i,f,sf	none	3
													0,m,sb		
Btb5	IIa	216		10YR3/3	l	2,f,abk		vfr	s	e	v1,n,co	a,i	0,i,f,sf	none	3
													0,m,sb		
2Btb6	I	218		10YR4/2	egcosl	sg	lo	lo	so	e	2,nk,co,pf	?	none	none	75

DEFINITIONS

HORIZON:
SCS designation
(modified by Birkeland)
DEPTH:
Lower boundary in cm
COLOR:
Munsell: Dry and Moist
TEXTURE:
Prefixes
cob-cobbly
g-gravelly
Modifiers(sand size)
vco-very coarse
co-coarse
f-fine
vf-very fine
Stems
s-sand
ls-loamy sand
sl-sandy loam
l-loam
si-silt
sil-silt loam
scl-sandy clay loam
cl-clay loam
sicl-silty clay loam
sc-sandy clay
sic-silty clay
c-clay

STRUCTURE:
Grade
m-massive
sg-single grain
1-weak
2-moderate
3-strong
Size
vf-very fine
f-fineloose, noncoherent
m-medium
c-coarse
vc-very coarse
*Type*vfi-very firm
gr-granular
cr-crumb
pl-platey
pr-prismatic
cpr-columnar
abk-angular blocky
sbk-subangular blocky
REACTION:
et-very slightly effervescent
e-slightly effervescent
es-strongly effervescent
ev-violently effervescent

CONSISTENCE:
Dry
lo-loose, noncoherent
so-weekly coherent
sh-slightly hard
h-hard
vh-very hard
eh-extremely hard
Moist
l-irregular
vfr-very friable
fr-friable
fi-firm
v1-very few
fi-extremely firm
br-very firm and brittle
Wet
so-nonsticky
ss-slightly sticky
s-sticky
vs-very sticky

BOUNDARY:
Distinctness
a-abrupt
c-clear
g-gradual
d-diffuse
Topography
s-smooth
w-wavy
b-broken
CLAY FILMS:
Frequency
1-few
2-common
3-many
4-continuous
Thickness
n-thin
mk-moderately thick
k-thick
Morphology
pf-ped faces
po-pores
br-bridges
co-coatings on grain

CARBONATES AND SALTS:
Size
0-very thin
1-fine
2-medium
3-large
Shape
r-generally rounded
I-irregularly shaped
Abundance
f-few
c-common
m-many
Distribution
d-disseminated
su-segregated
sf-filaments or threads
ss-seams
m-soft masses
sc-concretions
sb-bottoms of rocks
S#:
Stratum Number

Table 5-5 Burial context of components, Goff Creek Site (48PA325)

Stratum & Cultural Zone	Soil Texture	Deposit Type	Predicted Thickness	Thickness Of Stain, Or Cultural Level	Predicted Horizontal Scuffing	Predicted Ease Of Cleaning	Ease Of Identifying Activities	Ease Of Identifying Domestic Activity Areas	Burial Energy	Post-Burial Turbation
Stratum IIa; Early Archaic	Sandy Loam	Slope Wash	<5 cm	5-50 cm Thinner in West, Thicker In East	High	High	Low	High	Moderate	High; Probable Tree Tip-Out
Stratum IIb Early Archaic	Sandy Loam	Slope Wash	<5 cm	20-40	High	High	Low	High	Moderate	High, Probable Tree Tip-Out
Stratum IIIa, IIIb, & IIIc; Early Archaic	Silt Loam	Alluvial Fan Overbank	<5 cm	5-20 cm	High	High	Low	High	Low To Moderate	Moderate
Stratum Vii; Late Archaic/ Late Prehistoric	Sandy Loam	Slope Wash	<5 cm	30-80 cm	Moderate	Moderate	Moderate	Moderate	Moderate	High From Rodents
Stratum Viii; Late Prehistoric	Silt Loam	Fluvial Overbank	<5 cm	~5 cm	High	High	Low	High	Low	Low

Site Contextual Integrity

Site formation and destruction processes and the importance of substrate texture in determining the potential context of archaeological components are discussed above. Table 5-1 summarizes occupation churn zone thickness and predicted archaeological implications. Table 5-5 summarizes the potential contextual integrity of the components at site 48PA325, which are discussed individually below.

Stratum II: Paleoindian and Early Archaic Cultural Materials

Stratum II contains both Paleoindian and Early Archaic diagnostic projectile points as well as chipped stone debitage and some bone. This unit is a slope wash/sheet wash deposit, which may have been bioturbated. Stratum II is overlain by Middle Holocene age dates within fan and overbank deposits (Stratum III), and underlain by Pleistocene- to Holocene-age channel gravels (Stratum I). Radiocarbon dates in Stratum II range from 6700±230 BP to 5000±70 BP (Table 5-3). Early Archaic diagnostic artifacts were recovered from Stratum II in all blocks. A Cody Complex projectile point fragment was recovered in Area B and a Ruby Valley point was recovered in Area D. If the Cody Complex and Ruby Valley points are in primary context, then Stratum II(a) aggradation probably began by 9000 BP and continued (Stratum IIb) until about 5000 BP.

Stratum II is predominantly a sandy loam (silty to muddy sand), which would have formed a <5 cm thick churn zone. The actual thickness of cultural zones within Stratum II varies from 5-50 cm. Vertical dispersion is more pronounced in Area D than it is in Areas A and B. Given the predicted depositional environment, post-occupational dispersal (by slope wash, creep, and eolian transport) and burial dispersal (by slope wash deposition) are characterized as moderate. The effects of burial and post-burial processes are moderate to severe, respectively. The difference between the predicted and actual thickness of the cultural zones differs markedly and is probably the result of bioturbation, possibly tree tip-out. The vertical artifact dispersion of Stratum IIa is more pronounced than in IIb, and this may be the result of differential tree tip-out.

Stratum IIIa, IIIb, and IIIc: Early Archaic Component

Stratum IIIc contains Early Archaic diagnostic material associated with a feature that produced a date of 5270±80 BP (Tables 5-2 and 5-3). The component is best expressed in Area A where it is a 5-30 cm thick zone of staining and occupation debris. Smaller amounts of Early Archaic cultural debris are present above and below this component within Stratum III, especially in IIIa, IIIb, and IIIc. All of these strata are alluvial fan overbank deposits. Thus, they were deposited in a relatively low energy depositional environment.

Strata IIIa, IIIb, and IIIc have silt loam texture, which is predicted to have formed a <5 cm thick churn zone. As mentioned above, artifacts are less easily lost in firm substrates than in soft ones. Stratum

III would have provided a firm occupation substrate and thus has a low potential of concealing items after trampling. Since items which are not hidden in the churn zone are available for secondary refuse disposal, potential discrimination of high primary discard areas from low ones is impaired (i.e., low). Another implication of substrate texture is that the identification of domestic areas that were cleaned is enhanced. This is because many artifacts were available for domestic area cleanup by the site occupants as they were not trampled into the churn zone. Thus, there is a high potential for discriminating these zones based on the substrate texture. The effects of scuffage on the integrity of the Stratum III archaeological materials would be high, leading to lessened integrity. Post-occupational dispersal (by slope wash, creep, and eolian transport) and burial dispersal (by alluvial fan processes) are characterized as moderate, and the effects of post-burial processes are moderate as well. Stratification of the overbank deposits is well preserved, thus tree tip-out is not considered to be as severe in these cultural zones.

Stratum VII: Late Archaic and Late Prehistoric Component

Late Archaic and Late Prehistoric cultural materials occur within Stratum VII in the east end of the site. Diagnostic projectile points indicate that the Late Archaic and Late Prehistoric diagnostic materials are mixed in this area. A date of 920±70 BP was procured from a hearth in the sod zone within Area D (Table 5-3). Stratum VII is coincident with this surface soil A horizon. The zone is a sandy loam and formed as an alluvial fan overbank/slope wash deposit. Interbedded debris flows are present in the stratum within the western portion of the site. The Late Archaic and Late Prehistoric cultural deposits are about 30-80 cm thick (12-31 in) and thus are thicker than the predicted churn zone thickness of <5 cm (<2 in). This A horizon developed in a meadow environment, and thus rodent turbation could easily account for the overthickening and the mixing of artifacts of different ages.

HT1 Terrace: Late Prehistoric Occupations

Several occupation zones occur in the cutbank of the Ht1 fluvial terrace that abuts the river on the south margin of the site. These occupations are buried 60-80 cmbs and are each about 5 cm in thickness. The deposits are stratified fluvial overbank sediments, classified as well sorted silt loam. This substrate texture would have produced a thin churn zone of <5 cm. Discrimination of high vs. low primary discard would be low, but potential discrimination of cleaned domestic areas should be high for such a substrate. A radiocarbon date of 660±80 BP was procured from the uppermost of these occupations. Both occupations contain cultural organics including charcoal, chipped stone, FCR, and bone. The context of these occupations is excellent (i.e., high geoarchaeological contextual integrity) with each approximating the predicted churn zone thickness.

Geological History

The sediments documented at the site were deposited by Goff Creek and the North Fork, and some were subsequently modified by pedogenesis. Radiocarbon and cultural dating provide temporal control for the sedimentary sequence and buried soils. The changing landscape presented prehistoric inhabitants of the site with a variety of conditions depending on the era of occupation.

When the post-glacial geology of the Goff Creek fan is interpreted within the framework of the regional geological record, a tentative model for its formation emerges. Meyer et al. (1995) propose a model to account for fan and stream relationships in the Lamar Valley of Yellowstone National Park. In that area, fan formation appears to relate to periods of increased forest fire frequency, both of which increase during arid intervals. Alluvial fan formation elsewhere in the Northern and Middle Rocky mountains appears to correlate well with arid intervals, which are represented by non- or poorly-channelized debris flow deposits (Eckerle et al. 2000). On the other hand, stream incision, fan back-trimming, overbank deposits, loess, or a lack of deposition predominate during moist intervals (Eckerle et al. 2000). Fan geology is further complicated by various degrees of distributary channel migration over time, and time-transgressive facies changes away from the fan apex, and coarser-textured and higher energy deposits near the fan apex.

The oldest, unconsolidated deposits in the Goff Creek area are Pleistocene fluvial gravel deposits. Well-developed gravel terrace treads are present at 6 m, 15 m, and 23 m above the present channel of the North Fork. The first and last correlate to Pt1 and Pt2, respectively, of the sequence outlined by Eckerle and Eakin (1997) for the North Fork of the Shoshone River. These are tentatively associated with Pinedale proglacial (Pt1) and Bull Lake outwash (Pt2) events, respectively. Incision and subsequent scarp formation is thought to have developed during deglacial phases. The 15 m tread is rarely present in the canyon, but may correlate to early Wisconsin (Isotope Stage 4) glaciation.

Bouldery latest Pleistocene to earliest Holocene gravels are fluvial channel deposits that armor the present North Fork channel and underlie post-glacial sediments documented at the site. Fluvial gravel underlying the post-glacial Mummy Cave stratigraphic sequence are situated no more than 1 m above the present shoreline of the North Fork (Moss 1978). Thus, the most recent glacial channel of the river flowed at an elevation equivalent to that of the present river. Bouldery bar and swale topography at the Blackwater Pond Site (48PA328) is interpreted as fossil, terminal Pinedale braided channel morphology (Eakin et al. 1996), and is overlain by fine textured, Holocene overbank deposits yielding late Paleoindian Period dates (~8000 BP).

Bouldery gravel deposits with clasts over 1.5 m in diameter underlie the Goff Creek alluvial fan. Both clast-supported, channel gravel and matrix-supported debris flow fabrics and structures are present. Goff Creek channel incised 1-3 m with the deepest incision occurring at its confluence with the river.

Abandoned, fan distributary channels flank and roughly parallel the present channel and exhibit similar incision depths as the modern channel. Highway construction excavations across the present channel revealed a 3 m deep sequence of debris flows that suggest channel plugging and channel diversion. No fining upward sequence was observed in the limited depth of observation within the fan. The generally coarse size of these deposits indicates high energy discharge. Stratigraphic relationships suggest a Pleistocene age for some of the fan, although Holocene-age archaeological materials are buried by coarse-textured fan sediments at other locations in the North Fork canyon, and thus Holocene deposition on parts of the fan cannot be ruled out.

The bouldery Stratum I deposits (Figure 5-3) predominate on the surface of the central axis of the fan. The downstream, lateral aspect of the fan, including most of the site area, is underlain by a gravel platform formed from this bouldery sediment. This gravel platform slopes gently away from the fan apex. Texture is mostly small bouldery gravel, although some large boulders are present along the southern margin of the platform. The tread of this now buried gravel surface stands as much as 2.5 m above the river, averaging about 2 m above. In other portions of the canyon, the average elevation of the inferred, early-deglacial channel level (~14,000 BP) is ~1.5 m above the summer low water shoreline (Eckerle and Eakin 1997). This gravel probably formed a fan/terrace platform, which graded to the terminal North Fork channel.

A relatively well developed, clay enriched, B horizon is formed into the top of the Pleistocene gravel platform. This Bt horizon indicates that an unknown increment of time elapsed between deposition of the gravel fan/terrace and its subsequent burial by the post-glacial fan. The oldest date within the overlying fan deposit is inferred from the presence of Cody Complex and Ruby Valley projectile points that are older than 9000 BP. If the gravel fan/terrace was abandoned as part of deglacial fluvial incision beginning perhaps at ~15,000 BP, then several thousand years of surface stability may have been available for this soil to form.

The site area includes most of the Goff Creek alluvial fan and adjacent Ht1 overbank terrace (Figure 5-2). A thick sequence of finer-textured sediments overlies the bouldery gravel and form the upper sequence of the fan as well as the terrace. Post-glacial, medium and fine textured, fan sediments extend from the fan apex southward to the edge of the buried Pt0 gravel terrace platform (Figure 5-3). Sediment types include: (1) poorly sorted sheet wash/slope wash sediments; (2) very poorly sorted, debris flow deposits; (3) well sorted gravelly channel deposits; and (4) bedded, well sorted, alluvial fan overbank sediment.

Stratum II overlies Stratum I throughout a large portion of the site where it is the basal, post-glacial deposit. It consists of poorly sorted, slightly pebbly silty to muddy, very fine grained sand. The textural characteristics suggest either a slope wash origin, or less-likely bioturbated sheet wash deposits.

A slightly oxidized Bw horizon grading to very slightly clay enriched Bt soil horizon are formed into this unit, especially in the western portion of the site. The oxidation suggests formation under a forest overstory. Several Paleoindian points including Cody Complex and Ruby Valley (Alder Complex) types (~9400-9000 BP) were recovered from this deposit in Area B suggesting that the deposit began to aggrade before 9000 BP. A hearth within Stratum II of Area B dates to 6700±230 BP (Table 5-3) and indicates that the unit encompasses slightly more than 2000 years of site history.

Deposition of Stratum II was followed by a period of surface stability and pedogenesis (Bt/Bw horizon development), possibly in early through early-middle Holocene time. Concurrently, Goff Creek might have been incised within a channel to some depth below the fan surface resulting in a depositional hiatus. This period of fan inactivity might have provided the North Fork an opportunity to shift northward and trim back the fan toe. Subsequently, a mollic Ab horizon formed into the top of Stratum II in Area D. It appears to have developed sometime before 4070±70 BP, the beginning the Neoglacial era in regional paleoenvironmental records. Its presence suggests short-term fan stability and possible meadow vegetation. The fact that Stratum II dates to before 5700±80 BP in the western portion of the site, and has a soil that dates to 4070±70 BP in the eastern part of the site, suggests that in the east, Stratum II style of aggradation may have been ongoing, when in the western portion of the site the depositional regime may have undergone changes that resulted in the deposition of Strata III and IV.

Alluvial fan overbank sediments of Stratum III conformably overlie Stratum II in the western portion of the site. Stratum III consists of bedded, well sorted, silts and fine grained sands. Cultural occupation zones in this unit (notably in IIIa-IIIc) contain Early Archaic cultural material including a dated hearth (5270±80 BP). Stratum III appears to have aggraded when the Goff Creek channel was still entrenched into the fan, which provided an opportunity for flood waters to overtop the bank and overbank beds to aggrade. However, the shift from the previously mentioned soil formation to renewed aggradation suggests that the channel was not as deeply incised as before, and that middle Holocene fan building was being initiated.

Stratum III is overlain by Stratum IV, a channel deposit composed of fine pebbly gravel. Stratum IV formed sometime after 5270±80 BP as braided stream channels flowed over this portion of the site. No cut and fill features suggestive of deep channel incision were noted. However, this channel activity did scour and truncate the upper contact of Stratum III. No archaeological materials are associated with this unit. Stratum IV sediments are similar to those thought to form during spring run-off. The characteristics of this unit suggest that Goff Creek was beginning to flow upon the alluvial fan surface.

A thick sequence of interbedded channel, debris flow, and sheet wash deposits overlie the channel gravel (Stratum IV) and are designated Stratum V. This sequence fines laterally to the east, where the bulk of the deposit is composed of slope wash and sheet wash.

Stratum VI occurs across most of the alluvial fan at the site. The upper part is organic-rich and the entire thickness is sandy silt interpreted as loess or loess enriched slope wash. The upper organic zone consists of a relatively thin and sharply bounded A1b soil horizon (Stratum VI) overlying a weak A2b and Bwb horizon developed into the upper portion of Stratum V in the west. The soil thickens and becomes more diffuse in the east. A radiocarbon date of 2600±60 BP was procured from the western portion of the site. Late Archaic Period archaeological materials are associated with Stratum VI in the east. Mollic soil development and archaeological organic deposition are responsible for the organic stain (A2b). Stratum VI aggraded and the mollic soil formed during the middle Neoglacial era. Increased hydraulic competency may have incised Goff Creek at this time so that fan deposits ceased aggrading and the mollic loess enriched soil formed.

Stratum VII is the uppermost unit and is composed of interbedded sheet wash and debris flow sediments. In the upstream portion of the site, the latter consists of sandy very fine pebbly sediment. This material becomes finer to the east, where it is slightly pebbly silty very fine grained sand. Radiocarbon assay of a near-surface hearth sample from the east portion of the site produced a date of 920±70 BP. Late Archaic and Late Prehistoric archaeological diagnostics are found in Stratum VII, which also includes a mollic A horizon. The mixed Late Archaic and Late Prehistoric artifacts are found together in Stratum VII in the eastern portion of the site suggest that the 2600-year-old Stratum VI may be incorporated into Stratum VII in the west. Rodent burrows are common on the site surface and thus Stratum VII is considered to be partially turbated.

The youngest unit on the site is Stratum VIII. It forms the Ht1 terrace, which is situated between the fan and the present channel of the North Fork. Stratum VIII consists of bedded, fining upward, overbank deposits, that grade from sand to sandy silt. Several thin, discrete, occupation zones are present in this sequence. The upper one is at 50 cmbs (20 inbs) and dates to 660±60 BP. No soil horizonation is present in Stratum VIII. A partly refilled cut-chute channel (Stratum IX) is incised into Ht1, but was not examined or dated.

Paleoenvironmental Reconstruction

An understanding of the sequence of paleoenvironmental changes in the North Fork canyon is helpful in order to discuss how humans exploited and adapted to local conditions. Regional paleoenvironmental data are summarized earlier in this report. Geological and archaeological data from site 48PA325 and its surrounding area will be compared to the regional and local paleoenvironmental record, after a review of a few key studies.

The presentation of paleoclimate proxy data is discussed within the context of a post-glacial model of temperature and precipitation change. A macrophysical climate model (MCM; ‘Archaeoclimatic

Model'; Bryson and Bryson 2000; Bryson 2005) is the basis for temperature and precipitation predictions. Climate in the sense used in the MCM refers to how weather conditions change over time as a result of shift in the earth-ocean-atmosphere boundary conditions. These boundary conditions determine the position of the major circulation features at any one time. Energy inputs control the boundary conditions. Variation in energy input is largely the result in solar interception variance (Milankovitch cycles; J Imbrie and Imbrie (1980) and changes in the earth's albedo, primarily as a result of the sporadic addition of volcanic tephra to the atmosphere (Bryson 1991). The MCM utilizes these factors, along with location-specific range of historical weather variation to predict the variance of monthly temperature and precipitation on a site specific basis.

Macrophysical climate modeled monthly temperature and precipitation values can be used to create Thornthwaite annual water budgets (1948; Thornthwaite and Mather 1957). Thornthwaite (1948) used water budget values to help derive a Moisture Index (MI) that approximates the moisture available for plant growth (effective precipitation), which he then used to classify world climates. Changes in effective precipitation are useful for evaluating vegetation community change and productivity.

Modeled water budgets were used to evaluate vegetation community shifts and productivity in prehistoric resources over time for site regions in the Green River Basin (Eckerle and Taddie 2002; Eckerle et al. 2003). Byers et al. (2004) found a correlation between modeled effective precipitation and large vs. small game procurement with more emphasis on big game procurement after the shift from drier Middle Holocene to moister Late Holocene climate. In the North Fork of the Shoshone River valley, we utilize modeled monthly precipitation and temperature for the Wapiti, Wyoming vicinity (R. U. Bryson, written communication 2004) to calculate changes in MI and effective precipitation at 200 year intervals for the North Fork of the Shoshone River valley (Figure 5-19). The modeled Moisture Index is discussed, where applicable along with the proxy paleoenvironmental data, below. In general terms, temporal changes in MI indicate that effective precipitation was highest in the Early Holocene (Anathermal) and Late Holocene (Metathermal) and lowest during the Middle Holocene (Altithermal).

Several recent paleoenvironmental studies provide proxy data for conditions in the study area. These are described below and include: (1) pollen investigations in the Greater Yellowstone Ecosystem (Whitlock 1993; Whitlock and Bartlein 1993; Whitlock and Millspaugh 1994); (2) forest fire influenced alluvial fans and terraces along the Lamar River (Meyer et al. 1995); (3) analysis of small mammal remains from Lamar Cave (Hadly 1996); and (4) modeling of climate in the Greater Yellowstone Ecosystem (Bryson and Bryson 2000).

Whitlock and Bartlein (1993) hypothesize that two present-day, seasonal, precipitation regimes dominate the Greater Yellowstone Ecosystem: a winter-wet/summer-dry regime in the south and west, and a summer-wet/winter-dry regime in the north and east. These precipitation regimes result from

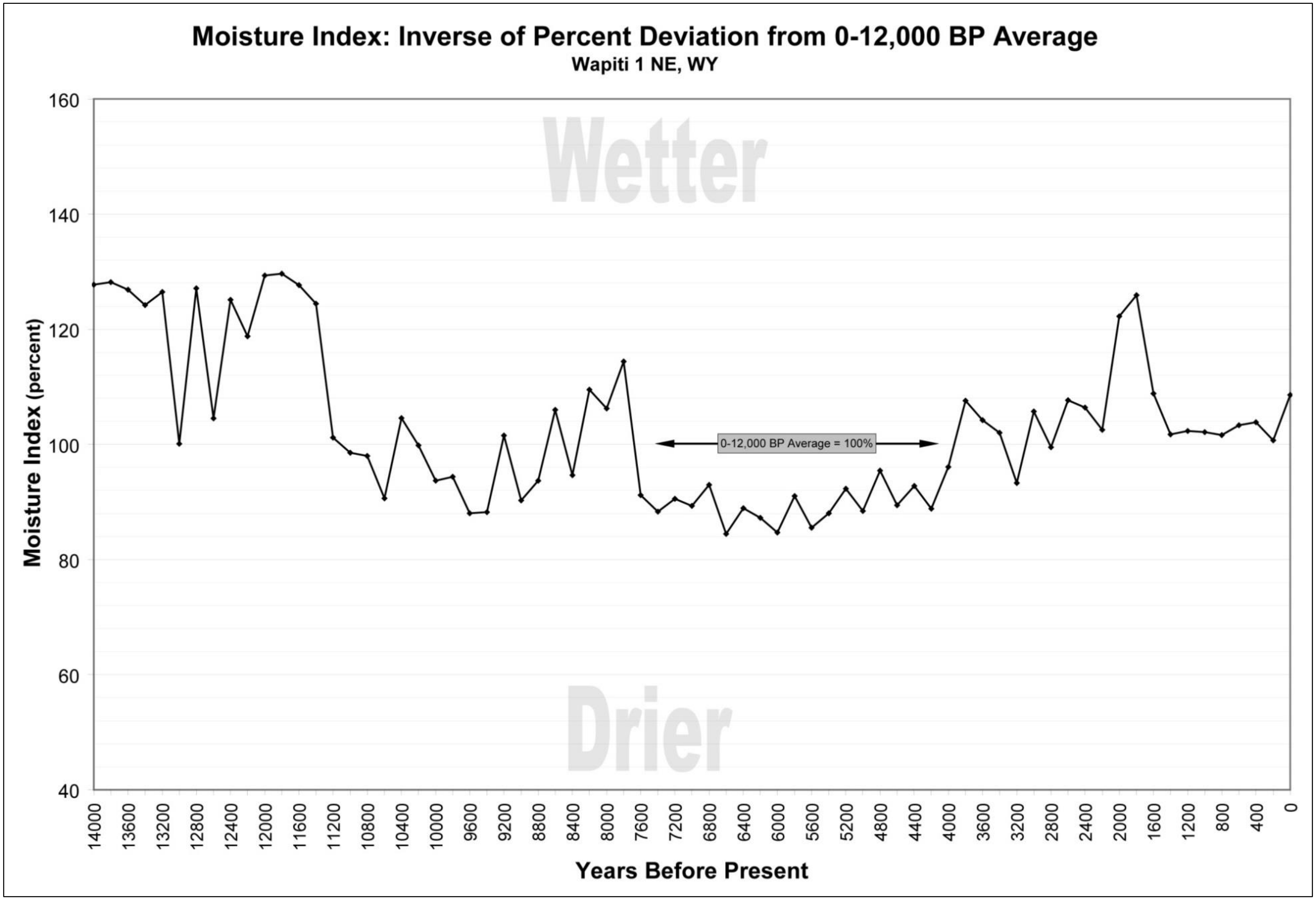


Figure 5-19 Modeled moisture index for the Late Pleistocene and Holocene at Wapiti, Wyoming.

orographic interception of atmospheric circulation and resultant effect on local climate. The analysis of pollen data suggests that each regime has maintained a unique and individual paleoclimatic trajectory since the last (Pinedale) glaciation (Whitlock 1993; Whitlock and Millspaugh 1994). Their studies suggest that the winter-wet/summer-dry regime experienced maximum, post-glacial, aridity during the early Holocene and again during a Neoglacial episode. Conversely, the summer-wet/winter-dry regime did not attain maximum post-glacial aridity until the late Holocene and did not seem to have undergone Neoglacial conditions. The Bryson's Archaeoclimatic analysis of post-glacial paleoclimate of the Greater Yellowstone Ecosystem indicates more diversity than suggested by Whitlock and Bartlein (1993), especially for the summer-wet/winter-dry regime. For example, according to the Bryson model, drier than present conditions prevailed during the early Holocene, while the middle Holocene was wetter at the Lamar Ranger Station and Tower Falls. At Mystic Lake, generally dry conditions are modeled for the late Holocene, preceded by a peak in precipitation at 3500-2500 BP, drier but still moist conditions during the middle Holocene, and wet early Holocene conditions. Archaeoclimatic modeling fits better with the Whitlock information for the winter-wet/summer-dry regime.

Meyer et al. (1995) investigated alluvial fans and terraces along the Lamar River in northern Yellowstone National Park. They suggest that fan aggradation coincides with arid periods and consequent wildfires, whereas floodplain aggradation is confined to more mesic intervals. Fire activity and fan deposition is documented at 9600-9150 BP, 9000-8600 BP, 7950-7200 BP, 5700-5100 BP, and continuously from 4800 BP to present, with a minor peak at 4650 and more pronounced peaks at 2150, 1200, and 900 BP. Floodplain aggradation is suggested to have prevailed from 8550-7700 BP, 7150-5700 BP, 3150-2550 BP, 2100-1300 BP, and 850-200 BP (Meyer et al. 1995; Figure 7). Unfortunately, the model does not account for the ages of deposits removed during channel incision events. This is especially troubling for the lengthy period from 5700-3200 BP during which debris flow activity was depressed compared to the late Holocene and for which no overbank deposits are documented. The fact that this period coincides with the early and middle Neoglacial periods, an interval that was relatively moist in other parts of the Middle Rocky Mountains suggests that some sediment could have been removed from the alluvial system.

Another important Greater Yellowstone Ecosystem paleoenvironmental record is documented by the changing rodent species in Lamar Cave (Hadly 1996). Hadly reports dates in calendar years, which are converted to radiocarbon years (BP) in the following discussion. This record only covers the last 3200 years (cal.) but is very detailed. More mesic than present conditions are documented from 3200-1200 BP (cal.). Xeric indicator species are more common through the Medieval Warm Period (1000-650 BP (cal.)), "Little Altithermal"), followed by more mesic species during the Little Ice Age (700-100 BP (cal.)).

Regionally, Pinedale deglaciation culminated at about 14,000 BP (Porter et al. 1983). Although the North Fork was not glaciated below Pahaska, fluctuation in ice wasting would have affected the lower river canyon. Pollen data from the Greater Yellowstone Ecosystem spanning 14,000-11,500 BP indicate temperatures were 5-6° C cooler and the tree line was 600 m (1969 ft) lower than present (Whitlock and Millspaugh 1994). The predicted lowering of tree line in the North Fork drainage would have resulted in subalpine conifer (whitebark pine-subalpine fir) forest, similar to that which presently grows at 2539 m (8330 ft) in and around the Goff Creek Site (1939 m; 6362 ft). Thus, several thousand years prior to Clovis time, resident animals at the site would have included pica, hoary marmot, and ptarmigan. Big game range would have been available only during the summer, with the possible exception of the conifer-loving and deep snow adapted mastodon (Haynes 1990). The above conditions probably prevailed at the site during Stratum I aggradation and stabilization.

A significant reactivation of cirque and valley glaciers occurred in the Absaroka Range and Two Ocean Plateau sometime after 13,140±200 BP (Richmond and Pierce 1972). Winter precipitation increased between 11,500 and 10,500 BP as subalpine forest replaced alpine meadow on the Yellowstone Plateau (Whitlock and Millspaugh 1994). The two events may have resulted from cool and moist conditions coinciding with the Younger Dryas. Locally, spruce and perhaps lodgepole pine might have replaced the former subalpine forest at the site location. A much longer snow-free season would have resulted, although big game winter habitat would probably have remained minimal. Some local habitat was probably suitable for mastodon, and some of the drier settings in the North Fork valley may have been suitable for mammoth. Both species have been found at similar altitudes and environments on the Wasatch Plateau (Miller 1987; Gillette and Madsen 1993). The B horizon was probably forming into Stratum II sediments at the Goff Creek Site at this time.

By the beginning of the Holocene (10,000 BP), lodgepole pine had spread throughout the Yellowstone Plateau. Wetter-than-present conditions prevailed from 9500 BP until 5000 BP in the present-day, summer-wet/winter-dry northern portion of the Yellowstone Plateau (Whitlock and Bartlein 1993). Such mesic conditions would have supported pine, juniper, and birch. Conditions were drier in the summer-dry/winter-wet, southern portion of the Yellowstone Plateau between 9500-5000 BP where Douglas fir was more common (Whitlock and Millspaugh 1994). Lodgepole forest was probably common in the site area at this time. Big game winter range at the site would still have been restricted, but carrying capacities in non-forested portions of the canyon (i.e., down canyon from the site) would have been higher than at present. The suspected forest Bw/Bt soil which formed into Stratum IIa might have continued to form during the earlier portion of this time period. Since tree tip-outs are common in lodgepole forests, Stratum II may have been turbated as a result of their presence.

Deposition of overbank sediments (Stratum III) was occurring by 5270±80 BP and their presence suggests that the stream incised but not as deeply as to precluded overbank deposition. The fan was experiencing a fine-textured phase of progradation at this time. Stream flow may have been reduced in competency as a result of a drier climate. Figure 5-19 illustrates that modeled Moisture Index was depressed from 7600-4200 BP suggesting reduced effective precipitation. As there are no signs of long term soil saturation (gleying) it appears that these overbank deposits formed in a well-drained fan floodplain setting rather than a saturated floodplain. The moisture regime at the site would have been ideal for sagebrush, forbs, and grasses. Early Archaic people utilized the site repeatedly during this time. Shortly after 5270±80 BP, Goff Creek distributary channel deposits buried Stratum III and the Early Archaic occupations. The resultant deposit (Stratum IV) suggests that Goff Creek was no longer channelized and that anastomosing, distributary channel style deposition had been renewed. This is part of a coarse-textured fan progradation phase. Several possible causes can be postulated: (1) the North Fork meandered to the south, thus decreasing the gradient on the fan leading to plugging of distributary channels, and (2) increased bedload deposition resulting from high energy flood events.

Sediments indicative of somewhat increased energy, as reflected in a larger maximum clast size, from Strata IV and V. They were deposited after the final occupation in Stratum IIIc at around 5270±80 BP and are thought to have aggraded after 5000 BP. These deposits seem to be the result of desiccated upstream slope conditions and high sediment availability. Within Strata IV and V, convectional storm-triggered debris flow sediments dominate. This is consistent with Whitlock and Bartlein's (1993) conclusions, which indicate that Holocene drying at summer wet/winter-dry locations became pronounced at around this time. It is also consistent with the modeled effective moisture which remained depressed until 3800 BP. The Goff Creek alluvial fan record shows that debris flow and sheet wash aggradation peaked at this time. A xeric, sub-climax sagebrush community is inferred for the site based on the paleoenvironmental model and the local stratigraphic record. When viewed from a regional perspective the Goff Creek Site, situated within a mountain setting, would have still been a good campsite and resource procurement location at this time, compared to dry basin-interior locations.

Stratum VI dates to 2600±60 BP. It is a slope wash and debris flow deposit. The buried A horizon formed in it indicates development during a minor period of surface stability on the fan. Late Archaic groups used the site at this time. Regionally, moist conditions prevailed during most of the interval from 3800-2000 BP although several reversals to dry conditions occurred locally. Fan stability and A horizon formation might be the result of mesic conditions and hillslope stabilization within the Goff Creek drainage basin. More moist conditions would have supported a sagebrush meadow/conifer forest similar to the present day site vegetation.

Stratum VII sediments are very similar to those of Stratum V, but are thinner overall. The sediments yielded a date of 920±70 BP, which coincides with the dry period (900-600 BP; Medieval Warm Period/"Little Altithermal") that preceded the Little Ice Age (500-150 BP). The presence of debris flow deposits associated with Stratum VII in the west portion of the site tend to support arid conditions. Vegetation and resource availability during this interval were probably similar to conditions when Stratum V was aggrading (5000-3000 BP).

A Mollisol formed after deposition of Stratum VII. This was the result of Little Ice Age conditions favoring increased grass growth on the site. The vegetation during the Little Ice Age was probably dominated by grass and sagebrush. Hadly (1996) found small mammal indicator species responded to a mesic Little Ice Age.

Archaeological Implications

The discussions of site-specific, local, and regional paleoclimatic data in this report relate to archaeological research issues in this section. Changing environmental conditions probably affected prehistoric food resource distribution and ultimately human subsistence; these factors are discussed below. Following this is a discussion of site formation and destruction processes.

Resource Availability and Human Adaptation

As discussed above, climate of the North Fork drainage and Goff Creek Site has changed over the last 14,000 years since the end of the Ice Age. These climatic changes caused variations in resource availability, subsistence options, and perhaps settlement pattern for prehistoric hunting-gathering groups occupying the region.

Regional Climatic Variability and Prehistoric Adaptations

Early in the history of Northwest Plains archaeology, investigators considered temporal climate trends to affect broad regions. Thus, Mulloy (1958) utilizes the Altithermal hypothesis (Antevs 1955) to justify a Northwest Plains, region-wide cultural “hiatus.” Leopold and Miller’s (1954) study of alluvial terrace history in eastern Wyoming is used to bolster claims for region-wide drying during the Altithermal. Reeves (1969) argues that despite arid conditions, complete abandonment of the Northwestern Plains did not occur. Frison (1978) notes that foothill and mountain environments, like the North Fork canyon, would have provided refuges for hunters and gatherers during these drier climatic episodes.

Albanese and Wilson (1974) observe that some alluvial terrace sequences are not what one would expect using the Leopold and Miller (1954) model and suggest that this might be the result of intraregional climate differences. Similarly, Davis et al. (1986) note anomalous pollen sequences from sites on the Snake River Plain and suggest that they might be due to different rates of climate change at different elevations, as predicted from the Milankovitch model.

In the 1980s, construction of a general circulation model (GCM) greatly enhanced understanding of regional climatic shifts (COHMAP Project Members 1988; Kutzbach 1987; Thompson et al. 1993). Whitlock and Bartlein (1993) formulated a model of intraregional climatic variation, in part, to explain pollen data that was difficult to accommodate under the GCM. Whitlock and Bartlein's model has important archaeological implications. If the two regional seasonal precipitation regimes (i.e., winter-wet/summer-dry vs. summer-wet/winter-dry) have had different paleoclimatic trajectories, then how might this have affected regional human ecology?

A great deal of archaeological discussion has centered on the emergence of Archaic adaptations. The “Desert Culture” (Jennings and Norbeck 1955) apparently emerged early (ca. 10,000 BP) in the history of human occupation of the region (Madsen 1982). Archaic subsistence patterns were common west of the project region, while subsistence focused on big game hunting on the Northwestern Plains (Frison 1991). An early onset of xeric conditions in the west would have favored the adoption of an Archaic lifeway there, while more mesic conditions on the Northwestern Plains apparently continued to make a big game hunting adaptation viable (Eckerle 1989). When increased aridity resulted in a marked reduction of big game populations, then Archaic lifeways would have become an adaptive advantage (Eckerle 1997). Thus, the spread of Archaic subsistence patterns in the region may be partly in response to climatic change.

Figure 2-5 illustrates the distribution of summer-wet/winter-wet regimes in Wyoming. According to the Whitlock and Bartlein (1993) hypothesis, the winter-wet area, which occurs primarily in the Wind River, Gros Ventre, and Wyoming ranges, and southern Yellowstone Plateau, should contain evidence for the earlier onset of Archaic lifeways at about 10,000 BP. Conversely, the summer-wet area, primarily the eastern Powder River Basin, and Black Hills, as well as most of the Montana plains, would not have experienced environmental conditions conducive to an Archaic adaptation until much later (after ~5000 BP). As indicated on the map, the remaining areas of Wyoming, which compose the majority of the state, are predicted to have reached maximum post-glacial aridity within the traditional period associated with the Altithermal interval (7500-5000 BP) (Eckerle et al. 1995) and therefore would exhibit an intermediate inception of an Archaic lifeway.

The model presented above oversimplifies regional paleoclimatic variability. No systematic attempt is made to test it here. However, it has implications for archaeological interpretation. Reviewing the temporal and geographic distributions of bison kills support this model. There are no classic Paleoindian bison kills in the winter-wet area, where an early onset of post-glacial drying occurred. On the other hand, the area predicted to have experienced maximal aridity during the traditional dates for the Altithermal (7500-5000 BP) contains early Paleoindian (Casper, Finley, Horner, Hanson Sites) through late Paleoindian (Jimmy Allen, Haskett Sites) bison kill sites. Within the summer-wet area, where Holocene drying is not predicted to have begun until after 5000 BP, communal bison kills extend into the

Early Archaic Period, as late as 6000 BP (e.g., Hawken Cultural Complex).

The geographic location of Archaic sites suggests complementary patterns. Archaic site characteristics, such as ground stone and storage pits, begin to show up in the non-modal climate regime in the late Paleoindian era, including Medicine Lodge Creek sites, Bighorn Canyon sites, and the Betty Green Site (Frison 1991). Evidence for a true Archaic adaptation in the summer-wet zone is not present until the Middle Plains Archaic (see Kornfeld and Reher 1990) with the occupation of the McKean Site. To date, there is a paucity of early Holocene, winter-wet sites that provide suitable context for evaluating the presence of Archaic lifeways.

Given these observations, groups who occupied the western Bighorn Basin/Absaroka Mountain interface are expected to have begun switching from a big game hunting emphasis to an Archaic lifeway at about 8000-7000 BP. Earlier occupations are present in some Bighorn Mountain rockshelters, but the earliest evidence for an Archaic lifestyle is in the latest Paleoindian era (Frison and Grey 1980). Evidence for the adoption of an Archaic lifestyle in the North Fork consists of ground stone in Level 30 of the Mummy Cave sequence, and dating to 2470±150 BP (Husted and Edgar 2002). Interestingly, bison were nearly absent from the entire Mummy Cave sequence while mountain sheep dominate the faunal assemblage with mule deer a distant second (McCracken et al. 1978). Cody Complex and Barton Gulch points are found at Goff Creek indicating some use of the canyon by ~9400 BP. This date corresponds to the earliest occupations in Mummy Cave. Geological processes might have destroyed some evidence of Paleoindian occupations. However, as the record now stands, it appears that use of the canyon was minimal until the Archaic.

Summary

Geoarchaeological investigations at 48PA325 document the geomorphology, geology, and pedology of the confluence area of Goff Creek and the North Fork of the Shoshone River. The river canyon consists of the active channel, a series of stepped terraces (Pt1-Pt3), and footslope deposits along the canyon margin. Channel gravels form the present channel, underlie the lower terrace (Ht1), and form the Goff Creek gravel fan-terrace. Terrace heights are 1.8 m (6 ft) for Ht1 and 3 m (10 ft) for the Pleistocene gravel fan-terrace bench. Overbank deposits veneer Ht1. Bedded fan sediments form the PHf alluvial fan. A comparison of modern channel bars suggests that the gravel of the Pleistocene terraces was deposited under significantly higher flow regimes than exist at present and probably formed during periods of deglacial outwash during the Pleistocene.

The basal Pleistocene- to Holocene-age fan deposit (Stratum I) is a clast-supported cobbly to bouldery gravel. It was deposited sometime before 9000 BP, possibly during Pinedale deglaciation at around 14,000 BP. The river canyon was probably a raw gravel outwash surface at this time with very little vegetation.

Stratum II overlies the gravel, and is a poorly sorted slope wash/sheet wash deposit, probably emplaced by alluvial fan style deposition. No absolute dates are available for this unit. Turbated Paleoindian and Early Archaic age artifacts were recovered from it. Although the inception of deposition is not well dated, Stratum II continued to aggrade until about ~5500 BP. A soil formed into the up-fan portion of this deposit implies coniferous forest cover during the earlier portion of this time span. The presence of trees may have caused some of the cultural material buried in Stratum II to be turbated by tree tip-out.

Stratum III consists of a set of bedded, alluvial fan overbank sediments, which contain Early Archaic occupations dating to around 5270±80 BP. These occupations have good integrity. Minimal turbation in these deposits suggests the site was not forested and tree tip-out was not important at this time.

Channel gravel (Stratum IV) overlies the overbank deposits. This gravel does not seem to have been associated with any entrenched channel and it apparently formed when Goff Creek flowed across the surface of the fan. The gravel is well washed suggesting that it was deposited as part of a spring runoff event. No archaeological materials were recovered from Stratum IV.

Slope wash, debris flow, and interbedded channel deposits form the overlying sedimentary unit, Stratum V, which is a classic alluvial fan deposit. It fines down-fan where it is composed mostly of slope wash. Stratum V may have formed mostly from episodes of intense rainfall during an otherwise dry climatic regime. The site substrate and climatic conditions would have been ideal to support xeric shrub vegetation when Stratum V was forming. Archaeological materials including Early Archaic diagnostics were recovered from Stratum V in the eastern portion of the site. This suggests that Strata IV and V aggraded rapidly after ~5000 BP.

The fan appears to have stabilized from ~5000 to ~2000 BP. During this time a thin veneer of loess influenced slope wash (Stratum VI) was deposited on the site. A carbonaceous soil overprints this unit and extends into the top of Stratum V.

In the eastern portion of the site, Late Archaic and Late Prehistoric cultural materials are associated with Stratum VII, which is a slope wash and debris flow deposit that forms the uppermost depositional unit at the site. Like Stratum V, it was probably deposited as a result of increased aridity and slope instability, in conjunction with episodes of intense slope saturation. Late Prehistoric cultural remains including a hearth date of 920±70 BP were associated with Stratum VII. This date correlates to the Medieval Warm Period or “Little Altithermal” era of increased aridity described earlier in this report. A well developed, mollic surface soil (Mollisol) is formed into Stratum VII. It formed as a result of increased moisture during the Little Ice Age (500-150 BP).

The Ht1 fluvial terrace abuts the trimmed-back fan to the south. This terrace is underlain by Holocene reworked Pleistocene gravel. Bedded, medium to fine textured overbank sediments form the Ht1 terrace. Several occupations were observed in the terrace cutbank, and one produced a date of 660±60 BP. These occupations are predicted to have excellent integrity.

The geological and soils data suggest that the environment varied over the span of human occupation at Goff Creek, and by inference in the North Fork of the Shoshone River. Modeled water budget and effective precipitation suggest similar variations. Drier than present conditions seem to have begun possibly before 7000 BP and peaked at ~6000 BP and again at ~900 BP. Conditions were apparently more moist than present in the early Holocene prior to 7500 BP, possibly during the middle Neoglacial from 5000-2000 BP, and finally during the Little Ice Age at around 500-150 BP. The site data gives some support to the Whitlock and Bartlein (1993) hypothesis, which states that the timing of the maximum Holocene drying varied from early (>10,000 BP) at locations that have a present day winter-wet regime to later (<5000 BP) at locations which have a summer-wet precipitation regime. Geological evidence from Goff Creek suggests that the maximum Holocene aridity occurred around 7000-5000 BP. This would seem to fit as the North Fork canyon has a seasonally non-modal modern precipitation regime, similar to large portions of central Wyoming. The Whitlock and Bartlein (1993) hypothesis provides a climatic model to examine the timing of adaptive shifts across the Basin-Plateau throughout the Rocky Mountains and onto the Northwestern Plains. It helps explain the maintenance of a Pleistocene big game hunting adaptation into the Holocene on the Plains, whereas an Archaic-style adaptation spread west from the winter-wet Basin-Plateau early in the Holocene. The contrasting subsistence evidence of the Horner Site and the earliest levels from Mummy Cave clearly exhibit the steepness of this climatic/ecological gradient on a transect across Yellowstone Plateau/Absaroka Mountains into the Bighorn Basin.

CHAPTER 6
RESULTS OF EXCAVATION: AREA A

Michael Page, Carmen Clayton, Dale Wedel and Brian Waitkus

Area A consists of Block A, two isolated units west of Block A, and four contiguous units east of Block A. Excavation Block A, the westernmost excavation block at Goff Creek, encompasses a 51m^2 area located approximately 10 m south of the highway. One unit was only partially excavated because it contained a support for the excavation structure which prevented digging the complete unit. Another 14 units were only partially excavated because they were located along Backhoe Trench 1. The excavation of Block A was initiated following the discovery of a buried Early Archaic cultural component in the west end of Backhoe Trench 1 in the fall of 1995. In the spring of 1996, approximately 1.5 m of overburden (strata VII, VI, V and IV) above the cultural level in Block A was mechanically stripped (Figure 6-1), and excavations were conducted in May, June and July of that year.

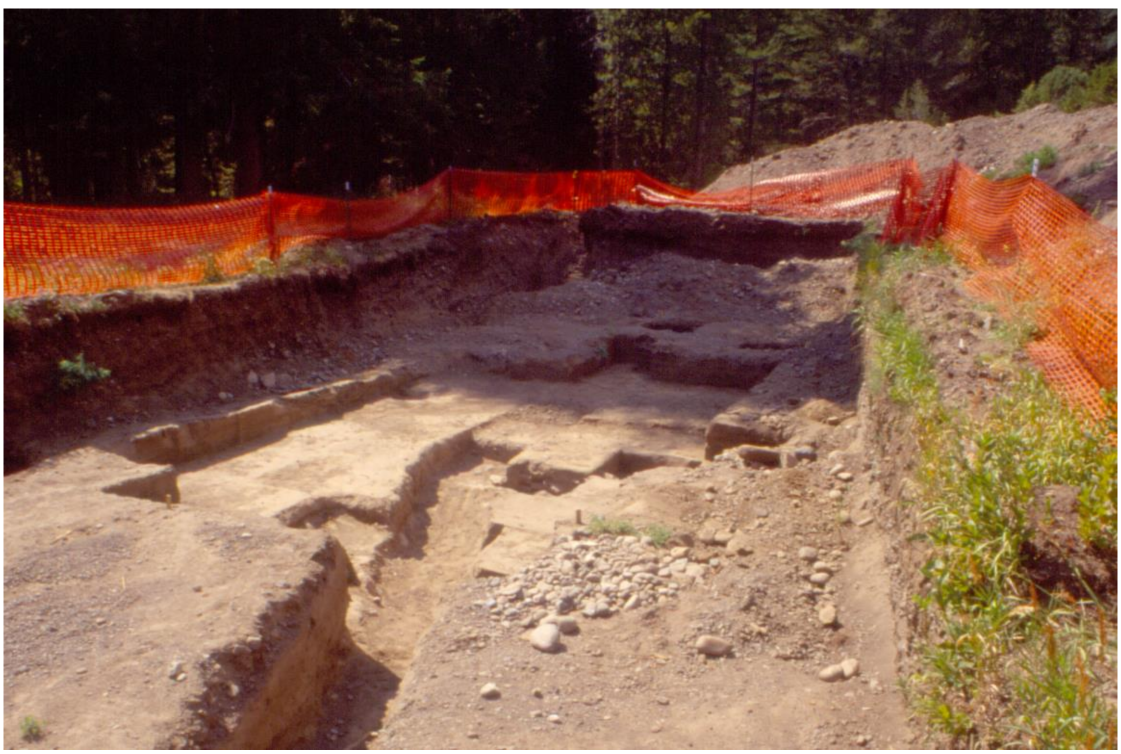
Most of the units were excavated to an elevation of 100.2 m to 100.1 m (~180-190 cmbs) (Figures 6-2 through 6-6). The four units to the east of the main block each had seven levels excavated, reaching 99.9 m. Six units located along the backhoe trench in the main block had nine or ten levels excavated, reaching 99.9 m to 99.7 m (~210-230 cmbs). A total of 50,270 lithic artifacts, 7,641 bones, and two features were excavated from Area A.

Stratigraphy

The vertical distribution of artifacts indicates three cultural levels in Area A (Figures 6-2 through 6-7). Cultural Level 1 was not well defined and was only sampled in 12 units that were excavated to its depth, primarily in the northeastern portion of the block. Cultural Level 1 varied between 10 and 28 cm in thickness and occurred near the bottom of Stratum IIb and within Stratum IIa between 100.0 m and 99.7 m (~200-230 cmbs). Sediments consisted of slightly pebbly mud slopewash alluvium. No radiocarbon dates are available for Cultural Level 1 in Block A, but a small fragment of what appears to be a side-notched dart point was recovered, suggesting the presence of an Early Archaic-aged component. Both Paleoindian and Early Archaic-aged artifacts were recovered from the same stratigraphic contexts in Area B, about 20 meters to the east. It is therefore possible that Cultural Level 1 represents a palimpsest of multiple occupations. Approximately 15-20 cm of sediment that was nearly sterile of cultural material capped Cultural Level 1.

The two upper components, Cultural Levels 2a and 2b are dispersed through Strata IIIb and IIIc and the upper 10 cm of Stratum IIb between 100.40 and 100.15 m (~160-185 cmbs) in elevation (Figures 6-2 through 6-7). The sediments consisted of fine sand and silt alluvium deposited during overbank flood events and mud flows. The thin A Horizon formed into Strata IIIc and IIIb indicates a prolonged hiatus in

View to the southeast



View to the southwest

Figure 6-1 Photographs of Excavation Block A from Site 48PA325.

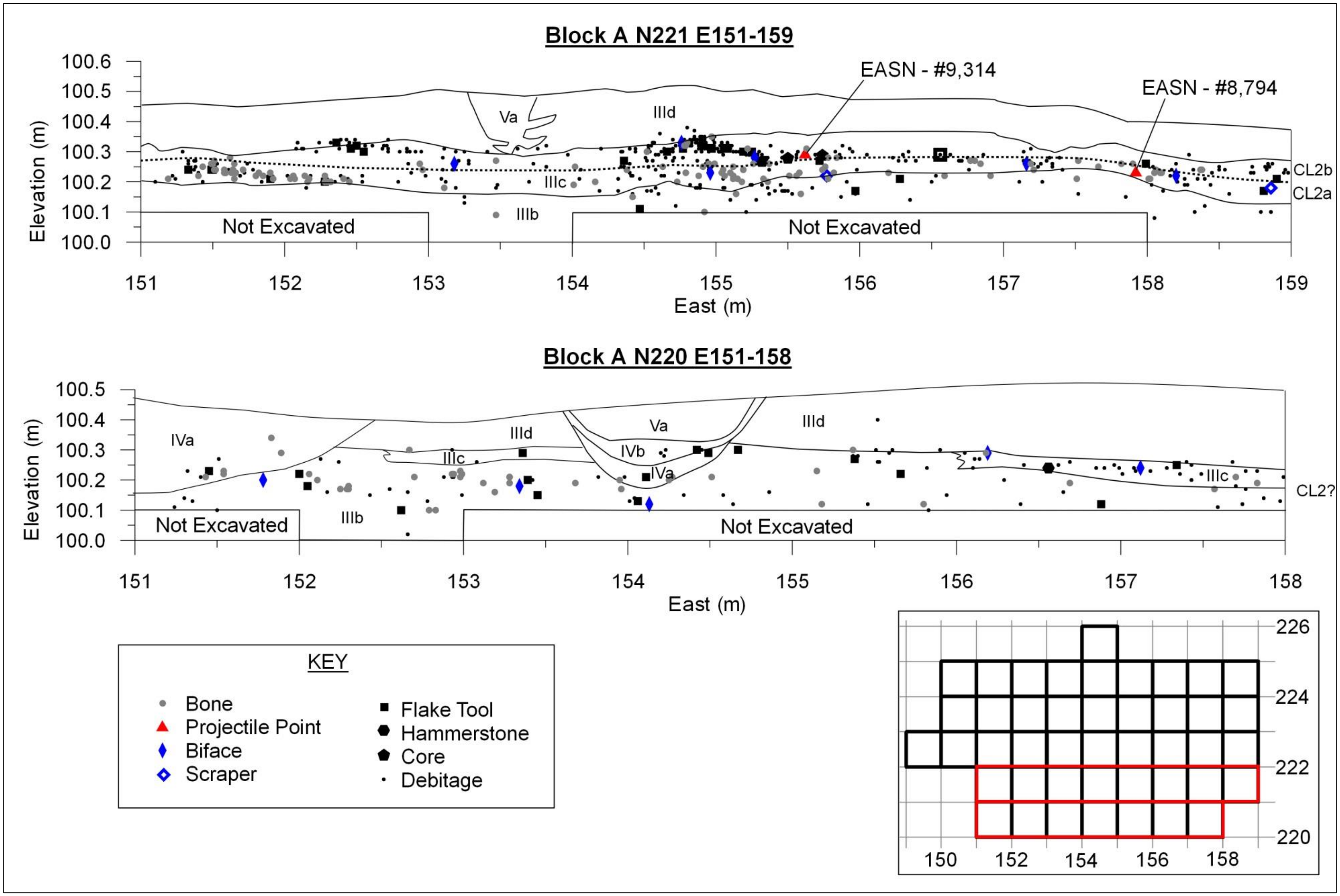


Figure 6-2 Backplots of point plotted artifacts from Block A N220 and N221.

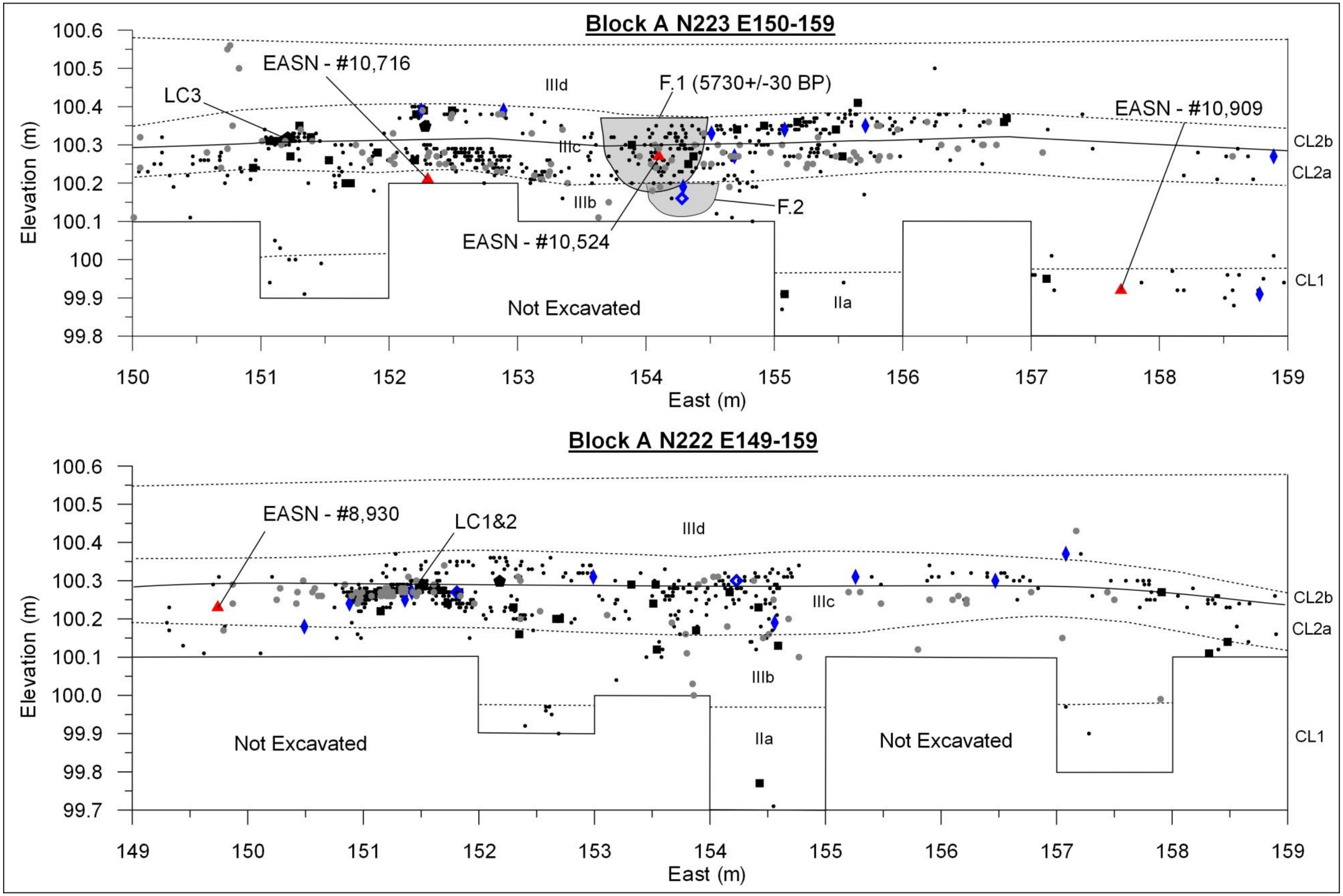


Figure 6-3 Backplots of point plotted artifacts from Block A N222 and N223 (See Figures 6-2 and 6-4 for key).

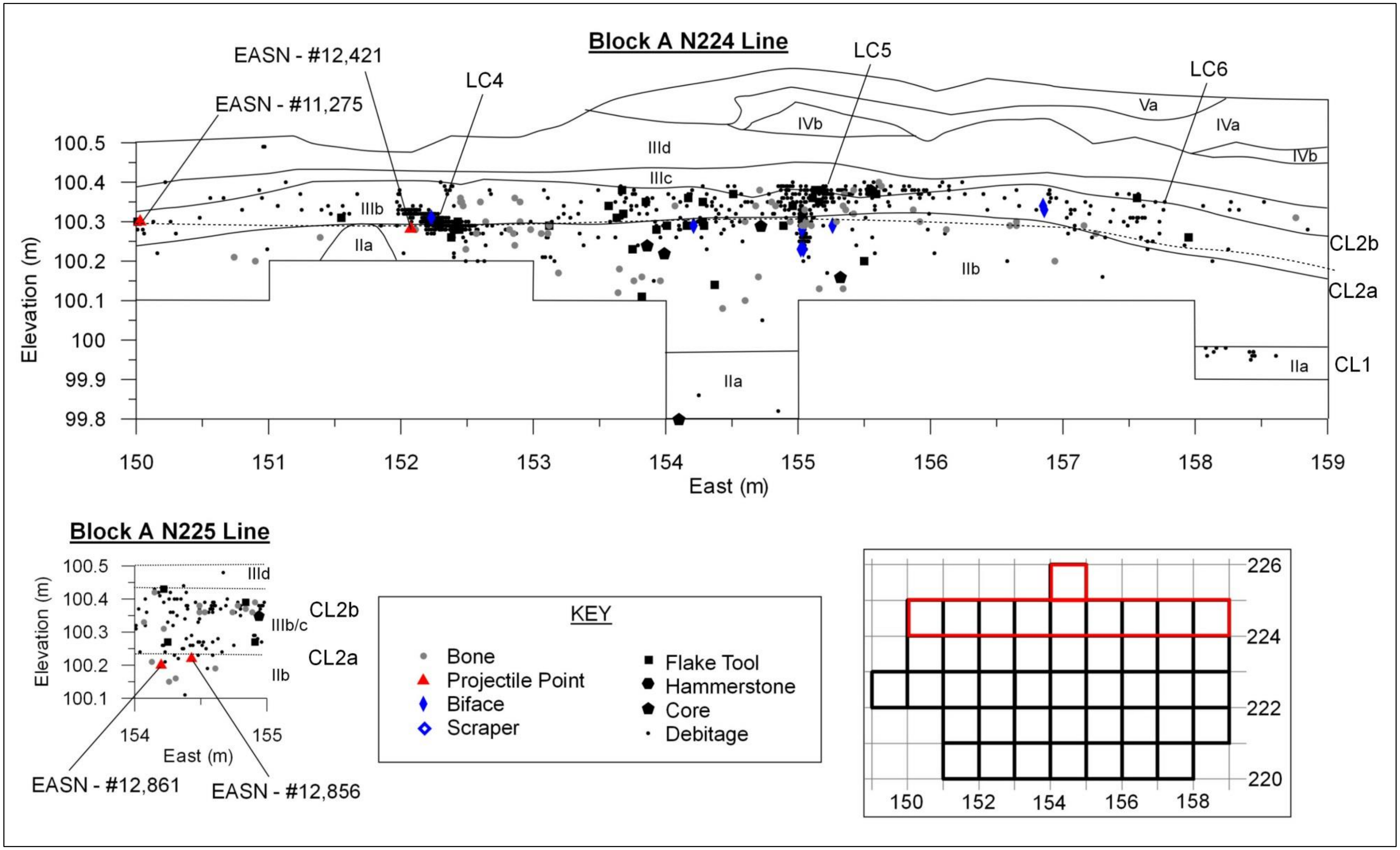


Figure 6-4 Backplots of point plotted artifacts from Block A N224 and N225.

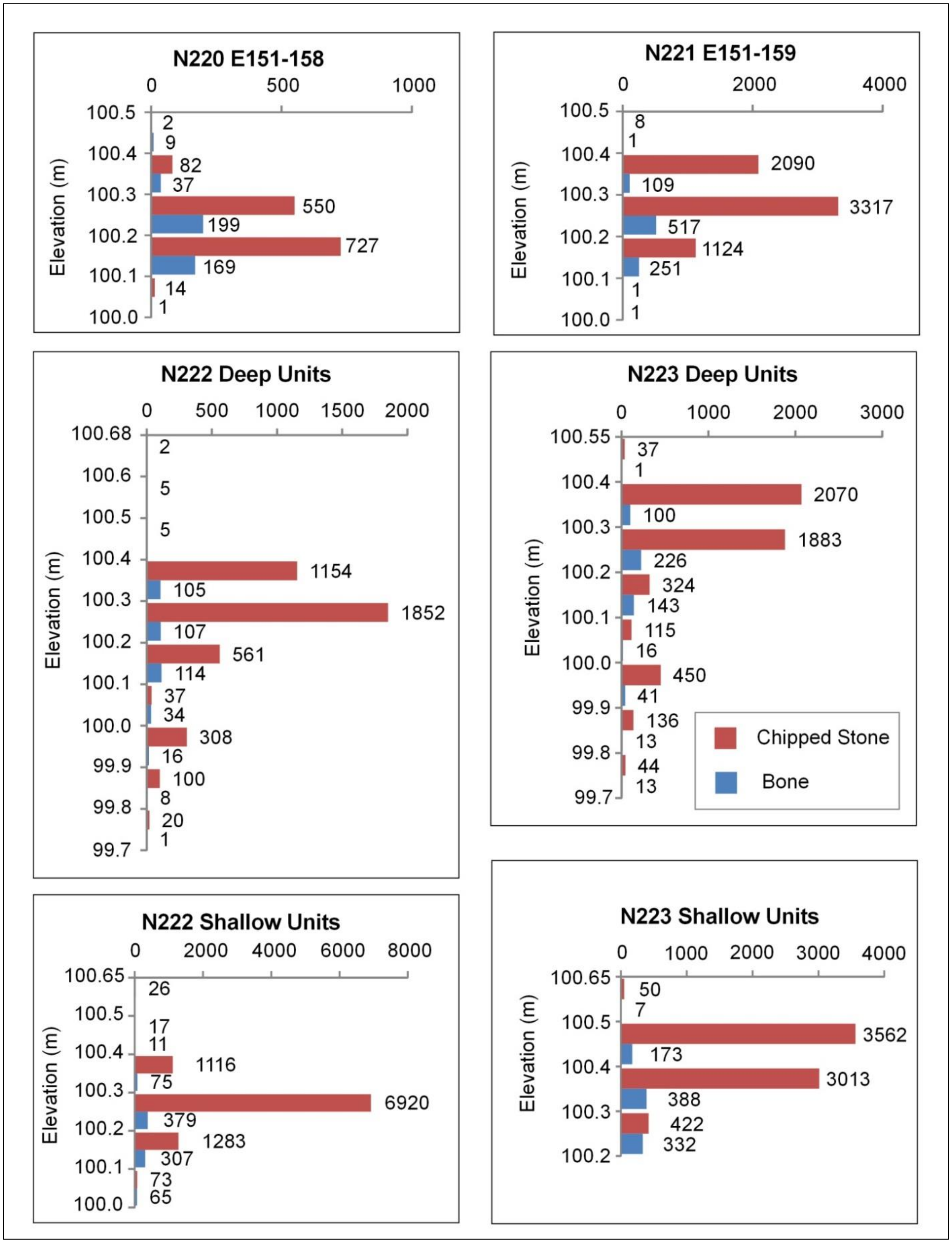


Figure 6-5 Graphs showing the vertical distribution of chipped stone and bone artifacts in Block A, N220-N223.

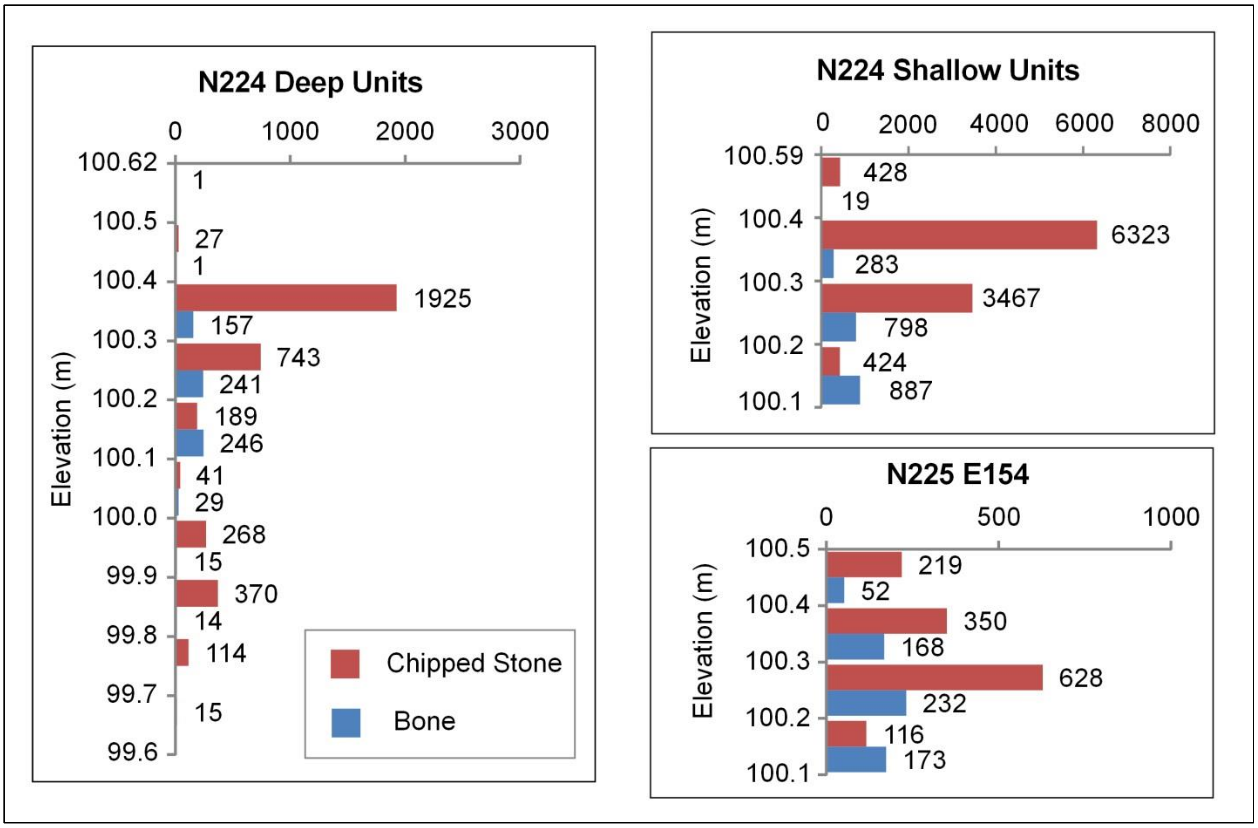


Figure 6-6 Graphs showing the vertical distribution of chipped stone and bone artifacts in Block A, N224-N225.

deposition. During this time, when the cultural deposits were shallowly buried, post-depositional disturbances such as tree falls, rodent burrowing and stream channel incision mixed the artifacts from the two levels. However, in places, such as the N221 transect of Block A (Figure 6-2); the boundary between the two cultural levels is clear. Cultural Level 2a, the earlier of the two components, was about 5 cm thick and occurred between about 100.25 and 100.20 m in elevation (~175-180 cmbs [Figures 6-2 through 6-4]). Feature 2 is directly associated with this lower component. Cultural Level 2a was overlain by about 5 cm of fine-grained sediment that contained relatively few artifacts. The upper component, Cultural Level 2b, was about 10 cm thick and found between 100.45 and 100.35 m in elevation (~155-165 cmbs). Feature 1 is clearly associated with this component.

Cultural Levels 2a and 2b could not be consistently isolated throughout the block due to mixing. Moreover, the apparent boundaries between Cultural Levels 2a and 2b, identified primarily by artifact backplots (Figures 6-2 through 6-4) and histograms of point plotted artifacts (Figure 6-7), did not coincide with the 10-cm thick excavation levels. Consequently, at least one excavation level from each unit of Block A contained a mixture of artifacts from both cultural levels. The evidence shows that both Cultural Level 2a and 2b date to the Early Archaic. Despite the degree of mixing and the resulting

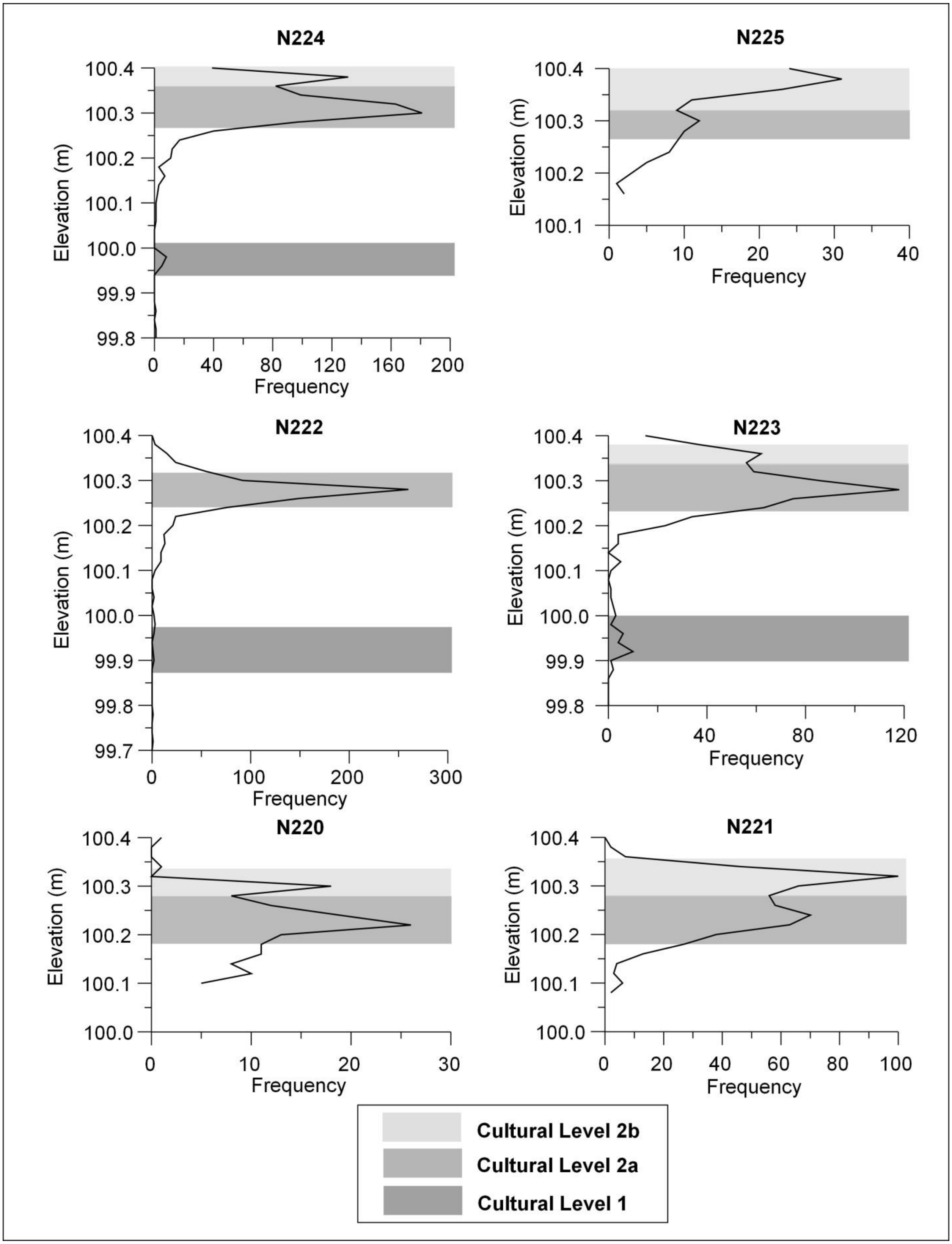


Figure 6-7 Frequency of point plotted artifacts by depth in Block A.

uncertainty in assigning artifacts from certain contexts to particular components, the data are sufficient to allow the segregation of the cultural levels. However, a large number of artifacts from the mixed deposits cannot be assigned to either cultural level and are therefore presented separately following the discussions of Cultural Levels 2a and 2b.

Cultural Level 1

Cultural Level 1 is a sparse scatter of lithics and bone that was documented in nine units within Block A and two units northwest of Block A adjacent to Trench 1 (Figures 6-3 through 6-6). The entire assemblage consists of 2,644 pieces of chipped stone, including 15 tools and 306 pieces of bone. No features were identified, and no radiocarbon dates were obtained. One temporally diagnostic artifact, an Early Plains Archaic side-notched dart point was recovered.

Lithic Raw Material Utilization

A total of 2,644 lithic artifacts and 15 tools were recovered from the nine square meters of Block A that were excavated into Cultural Level 1, resulting in an average of about 184 artifacts per square meter. The majority of the debitage is composed of local chert (65.6%), with silicified wood (23.7%), obsidian and/or ignimbrite (5.3%), miscellaneous quartzite (3.9%), Morrison quartzite (1.3%), and miscellaneous material. The miscellaneous materials, including non-local chert, and coarse grained quartzite, account for only 0.2 percent of the lithic assemblage (Table 6-1). It is likely that much of the silicified wood was acquired locally, judging from the similar proportions of the material in the tool and debitage assemblages. Based on these figures, it is apparent that 89.3 percent of the assemblage is composed of raw material that occurs locally or could occur within a few kilometers of the site. Obsidian, non-local chert, Morrison quartzite, and miscellaneous quartzite were probably not locally procured and constitute 10.5 percent of the assemblage. Comparison of raw material frequencies of tools reveals that 73.3 percent of the formal tools in the component are made from locally available materials and 26.7 percent are made of non-local materials.

Debitage

Lithic analysis reveals that flake fragments (53.4%) are the most common artifact type, with broken flakes (31.3%), debris (6.6%), and complete flakes (8.7%) composing the rest of the sample. Thus, the tool maintenance/manufacture category comprises over 99 percent of the assemblage. Of the complete flakes (n=159), only four exhibit evidence of a cortex and represent less than one percent of the total debitage assemblage. The overall assemblage then indicates that on-site primary lithic reduction is not the main activity reflected by the assemblage. It appears that most debitage within Cultural Level 1 was produced from finished or nearly finished tools. This is generally supported by the small size of the

Table 6-1 Area A, Cultural Level 1 chipped stone artifacts by raw material type.

MATERIAL TYPE	ARTIFACT TYPE							
	Projectile Point	**Biface**	**Retouched Flake**	**Utilized Flake**	**Tools Total**	**Core**	**Debitage**	**Total**
Local Chert	**1**	**1**	**1**	**4**	**7**	**1**	**1,726**	**1,734**
% of artifact	50%	25%	50%	57%	47%	50%	66%	66%
% of material	0.1%	0.1%	0.1%	0.2%	0.4%	0.1%	99.5%	
Silicified Wood		**2**		**2**	**4**	**1**	**621**	**626**
% of artifact		50%		29%	27%	50%	24%	24%
% of material		0.3%		0.3%	0.6%	0.2%	99.2%	
Obsidian	**1**				**1**		**138**	**139**
% of artifact	50%				7%		5%	5%
% of material	0.7%				0.7%		99.3%	
Misc. QTZ		**1**		**1**	**2**		**102**	**104**
% of artifact		25%		14%	13%		4%	4%
% of material		1.0%		1.0%	1.9%		98.1%	
Morrison QTZ			**1**		**1**		**34**	**35**
% of artifact			50%		7%		1%	1%
% of material			2.9%		2.9%		97.1%	
Miscellaneous							**6**	**6**
% of artifact							<.1%	<.1%
% of material							100.0%	
Total	**2**	**4**	**2**	**7**	**15**	**2**	**2,627**	**2,644**

artifacts in the assemblage; over 70 percent of the assemblage is less than one-quarter inch in maximum dimension. Sullivan and Rozen (1985) found that high percentages of broken and non-cortical flakes indicate tool manufacture and maintenance rather than core reduction. Accordingly, only two cores were recovered, one discoidal core made of local chert and a polyhedral core fragment made from silicified wood. Generally speaking, the Cultural Level 1 lithic assemblage indicates stone working activities in the excavation block focused on repair and maintenance of tools and weaponry derived of toolstone from both local and non-local sources.

Projectile Points

Two projectile points were found in Block A Cultural Level 1 (Table 6-1, Figure 6-8). The

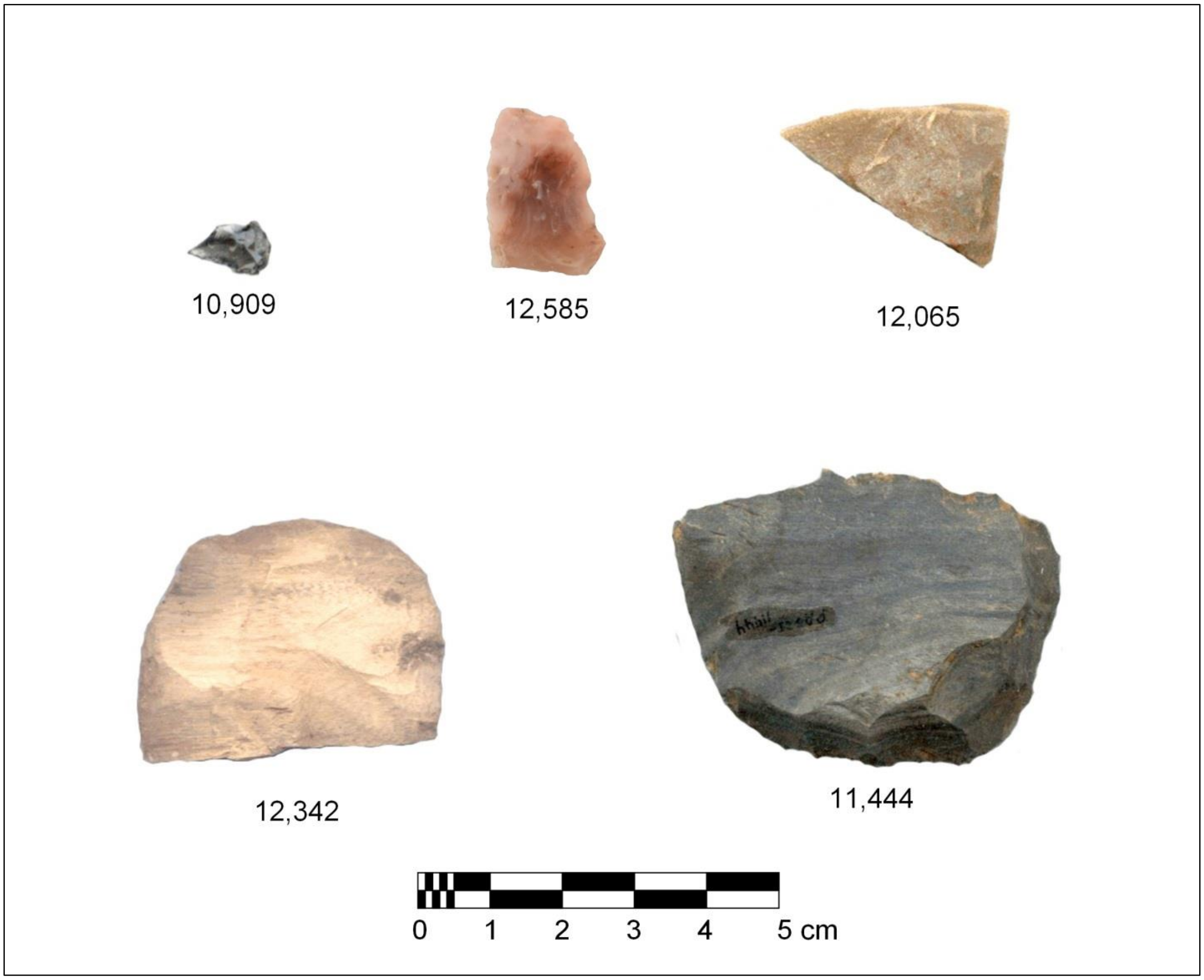


Figure 6-8 Photographs of projectile point and biface fragments recovered from Area A Cultural Level 1.

projectile points were found between 100.1 m and 99.9 m, depending on the unit. Projectile point #10,909 is a small obsidian fragment that appears to be the basal corner of a side-notched Early Plains Archaic projectile point. It has a bend break and exhibits light grinding. Similar side-notched dart points have been dated at other sites in the region to circa 8000-5000 BP. Projectile point #12,585 is a midsection fragment. The absence of the base precludes identification to type, but it is probably from a dart given its size. It was made from a white / clear Eocene chert (local chert) which has been partially heated to a pink color. Impact fractures are present on the distal and one lateral edge, and a bend break is present on the proximal end.

Bifaces

The four bifaces recovered from Cultural Level 1 in Area A were categorized using the five-stage scheme defined by Frison and Bradley (1980:31-39). Biface #10,442 is a Stage V biface fragment made of Eocene chert reddened by heat (local chert). It exhibits no use wear. Biface fragments #11,444 and #12,342 are Stage II and III respectively. They are made from silicified wood and exhibit use wear typical of scraping semi-hard materials (Appendix B). The final fragment, #12,065, is Stage III and made from gray Ten Sleep orthoquartzite (miscellaneous quartzite). It exhibits use wear typical of cutting semi-hard materials (Appendix B).

Expedient Flake Tools

Of the one retouched and six utilized flakes, five were made of local cherts (PA325-10,156, 10,907, 11,173, 12,501, and 12,573), one of silicified wood (PA10903), and one of miscellaneous gray orthoquartzite (PA325-11,161). All exhibited use wear from cutting or scraping soft to semi-hard materials (Appendix B).

Faunal Remains

A total of 260 bone and 46 pieces of tooth enamel were recovered from Block A Cultural Level 1 (Table 6-2). Of these, the majority is comprised of unidentifiable bone fragments. Six fragments of medium artiodactyl (bighorn sheep or deer) bone were found. Three artiodactyl bones exhibited green bone spiral fractures. Only three of the unidentified specimens showed evidence of dry breaks. A total of 180 specimens showed evidence of burning, all of which were unidentifiable. None of the specimens showed evidence of gnawing or cut marks.

The sparse faunal assemblage from this component is composed of highly fractured and burned bone which is suggestive of intensive processing. The comparatively high number of unidentified specimens might indicate that long bones were crushed in order to retrieve additional nutrients through boiling.

Table 6-2 Faunal remains from Area A Cultural Level 1.

Species	**Element**	**Break**	**Burned**	**NISP**
Unidentified	bone fragment		X	175
Unidentified	bone fragment			77
Unidentified	long bone	dry		3
Unidentified	tooth fragment		X	3
Unidentified	tooth fragment			42
medium artiodactyl	incisor	green		1
medium artiodactyl	innominate	dry		1
medium artiodactyl	long bone	dry	X	2
medium artiodactyl	long bone	green		1
medium artiodactyl	metacarpal	green		1
Total				306

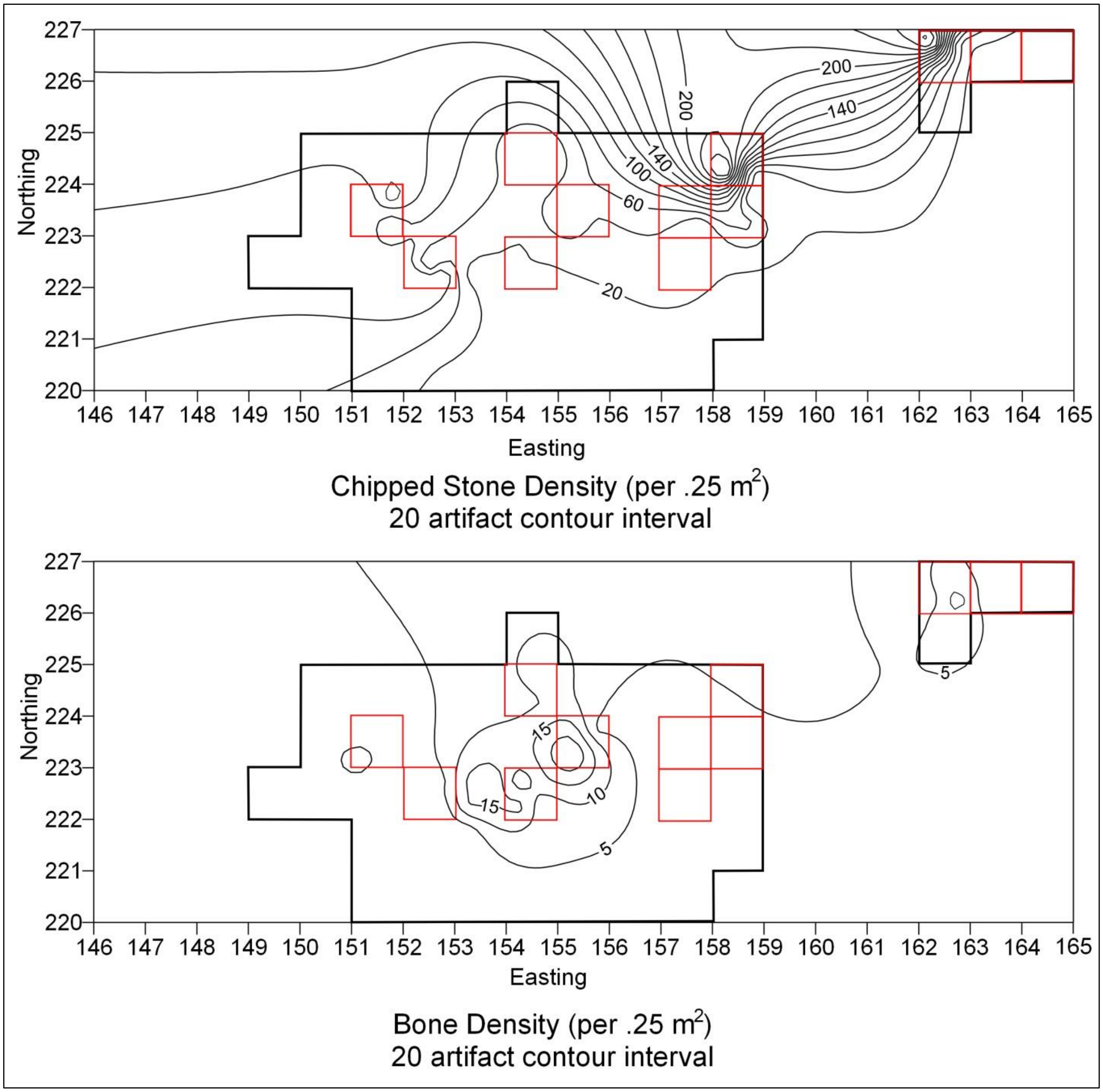


Figure 6-9 Map showing the interpolated artifact densities for Area A Cultural Level 1.

Spatial Analysis

Cultural Level 1 consists of a light scatter of artifacts that was situated near the bottom of Stratum IIb and the upper part of Stratum IIa. Of the 2,949 artifacts recovered from Cultural Level 1, 82 were point plotted, while the remainder was recovered from 1/8 inch screen. Of the 12 units that sampled Cultural Level 1, nine were partially excavated by Backhoe Trench 1 and the material therein was not recovered. The debitage density contours and more subtly the bone density contours suggest one or possibly two activity areas centered around N224 E158 and N226 E162 (Figure 6-9).

Nine of the 12 units contained between one and three tools. Units N222 E152, N225 E162, and

N226 E164 contained no tools. The four bifaces are scattered fairly evenly across the 12 units. Nine of the 15 tools, including the projectile point fragments located in N223 E157 and N226 E162, are within the inferred activity areas. No rocks or features were present to further define activity areas in Cultural Level 1.

Cultural Level 2a

One 10 cm thick excavation level from each unit contained a mixture of artifacts from Cultural Levels 2a and 2b. Consequently, the artifacts recovered from mixed contexts have been excluded from the tabulations of Cultural Levels 2a and 2b. A summary of the intermingled artifacts is provided following the discussions of Cultural Level 2a and 2b.

Cultural Level 2a contained multiple concentrations of chipped stone and bone in direct association with a hearth (Feature 2). Artifact density was particularly high, with 26,779 pieces of chipped stone (including 185 tools), 5,349 faunal specimens, four bone tools and one metate. Cultural material was found in every unit of Block A except the easternmost unit, N226 E165. Spatial analysis revealed several clearly defined activity areas adjacent to, but also away from an unlined hearth. The evidence shows that at least one bighorn sheep, a deer and several smaller animals were butchered and/or intensively processed for the extraction of marrow and bone grease. Other subsistence activities are also suggested by a small macrobotanical assemblage, but the clear focus of the occupation appears to have been bighorn sheep procurement and processing. No radiocarbon dates are available for this cultural level, but it predates the overlying Cultural Level 2b that is dated to 5730±30 BP (Beta-406660).

Lithic Raw Material Utilization

Overall, the chipped stone assemblage from Cultural Level 2 contains 11 categories of raw materials, consisting of a variety of local and exotic stone (Table 6-3). Locally available Eocene chert dominates the assemblage, comprising over 80 percent of the chipped stone assemblage. The next most abundant material is silicified wood, at 13.8 percent. Both of these material types are available in the immediate vicinity of Goff Creek. Exotic raw materials such as obsidian/ignimbrite (3.7%), Madison and Phosphoria cherts (i.e. non-local chert [0.5%]), miscellaneous quartzite (0.7%), and Morrison quartzite (0.4%) comprise only a small proportion of the Cultural Level 2 assemblage. The remaining categories - coarse grained quartzite, basalt/igneous, unidentified chert, quartz crystal, and porcellanite – contribute less than 0.01percent each to the chipped stone assemblage. Thus more than 90 percent of the toolstone was of locally available material.

The tools show a slightly different pattern. Locally available chert and silicified wood dominates the tool assemblage, at 88.1 percent, or just slightly less than the assemblage overall. In contrast, obsidian/ignimbrite and Phosphoria chert account for 6.5 and 2.7 percent of the chipped stone tools, but

Table 6-3 Area A, Cultural Level 2a chipped stone artifacts by raw material type.

MATERIAL TYPE	ARTIFACT TYPE										
	Projectile Point	**Biface**	**Drill**	**Scraper**	**Retouched Flake**	**Utilized Flake**	**Tools Total**	**Core**	**Tested Cobble**	**Debitage**	**Total**
Local Chert	**8**	**37**	**1**	**3**	**48**	**40**	**137**	**4**	**1**	**21,483**	**21,625**
% of artifact	66.7	77.1	100	60.0	72.7	75.5	74.1	66.7	25.0	80.8	80.8
% of material	<.01	0.2	<.01	<.01	0.2	0.2	0.6	<.01	<.01	99.3	
Silic. Wood	**1**	**6**		**1**	**12**	**6**	**26**	**2**	**3**	**3,673**	**3,704**
% of artifact	8.3	12.5		20.0	18.2	11.3	14.1	33.3	75.0	13.8	13.8
% of material	<.01	0.2		<.01	0.3	0.2	0.7	0.1	0.1	99.2	
Obsidian	**1**	**4**			**2**	**5**	**12**			**972**	**984**
% of artifact	8.3	8.3			3.0	9.4	6.5			3.7	3.7
% of material	0.1	0.4			0.2	0.5	1.2			98.8	
Non-Local Chert		**1**		**1**	**3**		**5**			**128**	**133**
% of artifact		2.1		20.0	4.5		2.7			0.5	0.5
% of material		0.8		0.8	2.3		3.8			96.2	
Misc. Qtz					**1**		**1**			**198**	**199**
% of artifact					1.5		0.5			0.7	0.7
% of material					0.5		0.5			99.5	
Morrison Qtz	**2**					**1**	**3**			**97**	**100**
% of artifact	16.7					1.9	1.6			0.4	0.4
% of material	2.0					1.0	3.0			97.0	
Basalt						**1**	**1**			**15**	**16**
% of artifact						1.9	0.5			0.1	0.1
% of material						6.3	6.3			93.8	
Miscellaneous										**18**	**18**
% of artifact										0.1	0.1
% of material										100	
Total	**12**	**48**	**1**	**5**	**66**	**53**	**185**	**6**	**4**	**26,584**	**26,779**

only 3.7 and 0.5 percent of the debitage, respectively. A similar high proportion of tools are Morrison quartzite, which accounts for 1.6 percent of the tools, but only 0.4 percent of the debitage. The higher proportion of tools made from exotic raw materials likely reflects the exhaustion and replacement of tools that arrived at Goff Creek in the toolkits of the site's inhabitants. Some of these material types, such as Phosphoria chert and Morrison Quartzite were likely procured to the east in the Bighorn Basin. On the

other hand, the obsidian and perhaps the basalt, probably originated to the west in Yellowstone Plateau.

Debitage

Lithic analysis reveals that flake fragments (52%) are the most common artifact type with broken flakes (30.3%), debris (7.6%), and complete flakes (10.2%) composing the rest of the sample. Thus the tool maintenance/manufacture category comprises almost 90 percent of the assemblage. Of the complete flakes (n=2,207), only 11.5 percent exhibit evidence of a cortex. The overall assemblage then indicates that on-site primary lithic reduction was not the main activity indicated by the assemblage. It appears that much of the debitage within Cultural Level 2 was produced from the maintenance of finished or nearly finished tools. This is generally supported by the small size of the original assemblage; over 73 percent of the assemblage is less than one-quarter inch in maximum dimension. Sullivan and Rozen (1985) found that high percentages of broken and non-cortical flakes indicate tool manufacture and maintenance rather than core reduction. However, the presence of six cores and four tested cobbles, as well as several lithic concentrations, clearly show that raw material procurement and early stage core reduction did take place during the Cultural Level 2a occupation.

Cultural Level 2a produced six cores (Table 6-3). All were made of local raw material, with four being Eocene chert and two being silicified wood. Of the Eocene chert specimens, one is described as milky Eocene geode chert, one as green Eocene chert, and two as dark green Eocene chert. The milky Eocene geode chert specimen (PA325-9,274) is a fragment of a discoidal type core and measures 51.6 mm x 36.2 mm x 25.7 mm. The first of the cores described as green Eocene chert (PA325-9,288) is wedge shaped, being pyramidal in form. It measures 29.5 mm x 46.7 mm x 45.6 mm. The first dark green specimen (PA325-9,581) is a polyhedral fragment measuring 59.3 mm x 42.9 mm x 30.2 mm. The second dark green specimen (PA325-9,921) is a polyhedral fragment measuring 73.5 mm x 39.8 mm x 32.4 mm. The first of the silicified wood cores (PA325-12,201) is grey in color, polyhedral in shape, and measures 64.1 mm x 39.0 mm x 29.0 mm.

Projectile Points

Thirteen complete or partial projectile points were recovered from the Cultural Level 2a. Two partial points refit to form a complete point, so that 12 individual projectile points are actually represented (Tables 6-3 and 6-4, Figure 6-10, Appendix B). Most of the projectile points were made out of locally occurring materials. The most common is Eocene chert, accounting for 8 of the 12 specimens. Locally occurring silicified wood was used in the manufacture of one projectile point. Two projectile points were made from Morrison orthoquartzite, which outcrops in the Bighorn Basin east of the site. Obsidian, available in Yellowstone National Park and a variety of other places, was used in the manufacture of one projectile point (Table 6-4).

Table 6-4 Projectile Points recovered from Area A Cultural Level 2a.

Catalog#	Block	Unit	Elevation (m)	Material	Portion	Point Type	Haft Type	Prox. Shld. Angle (°)	Max. Length (mm)	Base Width (mm)	Base Length (mm)	Haft Width (mm)	Max. Thickness (mm)	Notch Depth (mm)	Notch Width (mm)	Haft Grinding	Fracture Type
8794	A	N221 E157	100.23	EC	CO	PH	SN		36		7.4	10.7	4.1	2.1	5.2	X	TA
8930	A	N222 E149	100.23	EC	CO	PH	SN	177	40	15.7	8.7	9.5	3.8	2.9	3.7	X	-
9733	A	N222 E153	100.2-100.1	EC	BA		CN	124	6.4	15.8		11.5	4.2			X	BND
10290	A	N222 E151	100.3-100.2	EC	ER		CN	129	7.6				3.7	3		X	BND
10524	A	N223 E154	100.27	SW	NC		SN	148	26	19.1	10.2	14.9	3.9	2.3	4.7	X	BND
10716	A	N223 E152	100.21	MOQ	CO	PH	SN	148	27	17.6	8.2	11.6	5.9	2.8	4.5	X	-
10892	A	N223 E157	100.3-100.2	OB	ER				9.6				4.5				IMP
11275	A	N224 E150	100.3	EC	CO	BW	CN	129	34	18.9	8.2	12.4	4.2	3.2	5.2	X	-
11291	A	N224 E150	100.3-100.2	EC	ER		CN	137	11				4			X	BUR
12439	A	N224 E152	100.3-100.2	MOQ	BA	BW	SN	146	18	17.6		11.7	3.6	3		X	BND
12856	A	N225 E154	100.22	EC	CO	PH	SN	146	25	14.7	8.2	10.7	4.7	2.2	4.5	X	-
12861	A	N225 E154	100.2	EC	NC	BW	CN	135	22	12.9	8.1	7.7	3.8	2.7	5.9	X	BND

Material: EC-Eocene Chert; SW-Silicified Wood; MOQ-Morrison Quartzite; OB-obsidian. Portion: CO-Complete; NC-nearly complete; BA-base; ER-ear/lateral base fragment. Point Type: PH-Pahaska; BW-Blackwater. Haft Type: SN-side-notched; CN-corner-notched. Fracture Pattern: BND-bend break; BUR-burinated; TA-thermally altered.

Some stylistic variation is apparent in the projectile points from Area A Cultural Level 2. Half of the points that are complete enough to be assigned to a named type conform to the Blackwater "side-notched" type defined from the small Cultural Layer 16 assemblage at Mummy Cave (Husted and Edgar 2002:45). Blackwater points have deep, wide notches placed near the base with slightly pointed ears. The proximal shoulder angle varies between 129°-146°, which straddles the corner/side notch demarcation, but most of the points would be typed as corner-notched if the 141° proximal shoulder angle is used to delineate corner from side notching. Bases are typically ground. The small type assemblage from Mummy Cave exhibited only straight to slightly convex bases, but two of the specimens from Cultural Level 2a have markedly concave bases, but otherwise closely conform to the type as described by Husted and Edgar (2002).

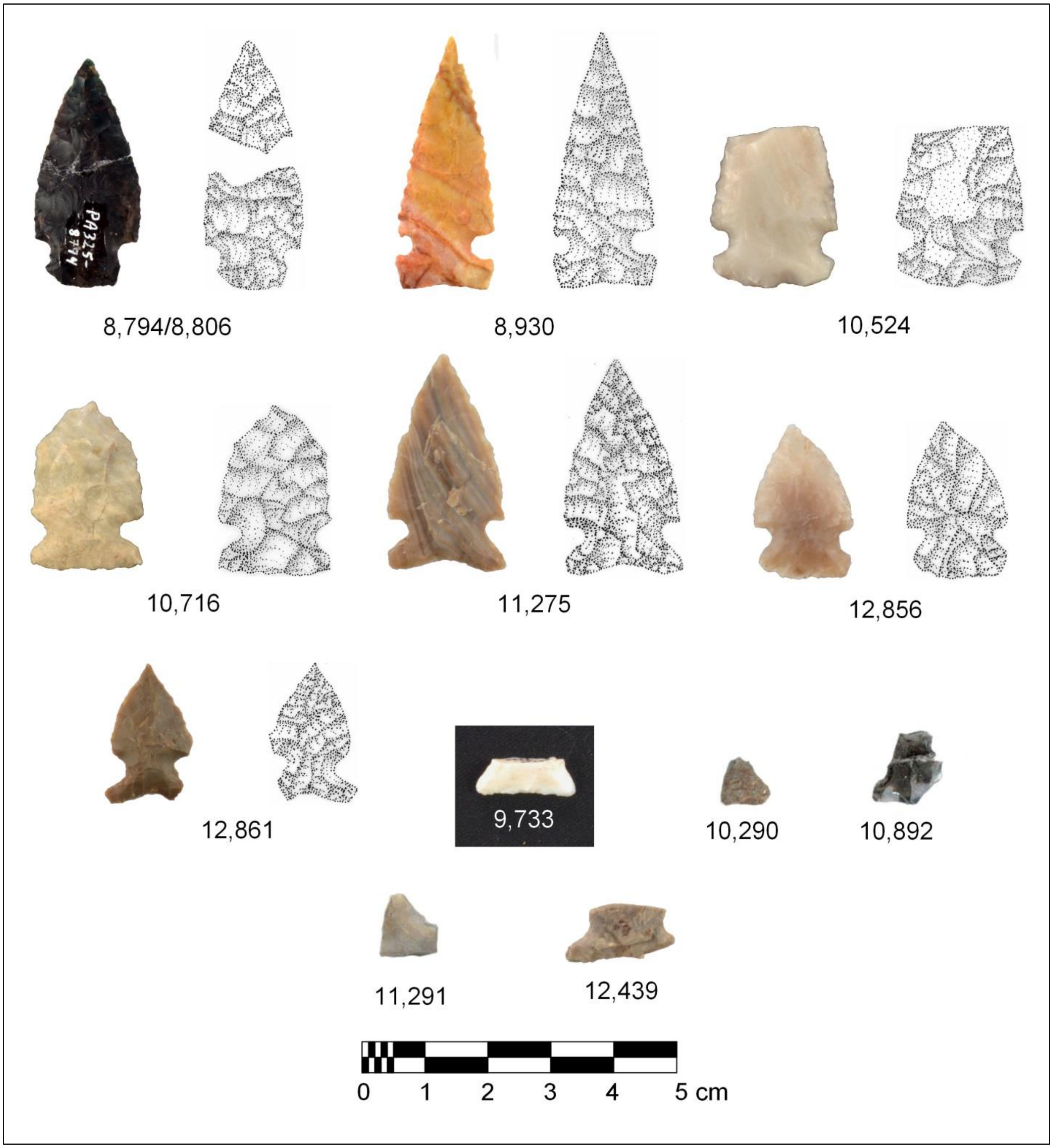


Figure 6-10 Photographs and illustrations of projectile points recovered from Area A Cultural Level 2a.

Four points are classifiable as Pahaska side-notched (Husted and Edgar 2002:45-47,183-185), also known as Northern side-notched, Bitterroot and Early Plains Archaic (Francis and Widman 1999:145-149). This style is characterized by fairly wide and deep side-notches (proximal shoulder angle >141°), straight to slightly concave bases that are typically lightly ground (Husted and Edgar 2002:47).

Pahaska points were the most common type present in Cultural Layers 17-19 at Mummy Cave, but were also found in the Layer 16 alongside Blackwater type points (Husted and Edgar 2002). The presence of both Pahaska and Blackwater point types does not necessarily indicate that there were multiple components present in Cultural Level 2a.

Pahaska points were also very common in the assemblages from Trappers Point. Francis and Widman (1999:145-146) note that while corner and side-notched styles are generally considered as discrete types, the projectile point sample from Trappers Point suggests that the two "types" may actually form a continuum with no real line of demarcation. However, like Mummy Cave, corner-notched dart types were more prevalent than side-notched forms in the earlier cultural levels at Trappers Point, and steadily decrease in frequency in the later levels (Francis and Widman 1999).

Bifaces

Forty-eight bifaces were recovered from Area A Cultural Level 2a, of which four are complete (Table 6-5, Appendix B, Figure 6-11). A variety of raw materials were used in the manufacture of the bifaces, but locally available Eocene chert and silicified wood were the most prevalent types of stone (Tables 6-3 and 6-5) Four obsidian biface fragments were also found. The bifaces were categorized using five manufacturing stages defined by Frison and Bradley (1980:31-39). No stage I bifaces were recovered from Cultural Level 2. The low proportion of decortification flakes in the debitage assemblage and absence of stage I bifaces indicates that procurement and initial reduction of bifaces occurred outside the activity areas sampled in Block A. Most (59%) of the bifaces, including one specimen made of obsidian, were stage II or stage III. A high proportion (76.9%) of these bifaces showed evidence of use-wear indicative of cutting (38.5%), or scraping (38.5%) hard (26.9%), semi-hard (38.5%) and soft (11.5%) materials. Many of the stage IV bifaces, such as #8,502, #8,838 and #11,423, shown in Figure 6-11 were well-made knives, all but two of which showed evidence of cutting hard (8.3%), semi-hard (50%) or soft (33.3%) materials. One stage IV biface fragment had no evidence of use-wear and may have been broken during manufacture. The six stage V bifaces are all small fragments, at least some of which are probably from projectile points. Two of the stage V specimens show evidence of use wear, which may indicate they were from a broken knife. Other use-wear studies have revealed that projectile points were often used to perform cutting and scraping tasks (Ahler 1971).

Three refitting biface fragments, PA325-12,609, PA325-12,647, and PA325-12,648 are of special interest (Figure 6-12). The pieces, manufactured from a brown Eocene chert, were recovered from a concentration of flint knapping debris. The biface tip, PA325-12,609, was broken off first when the piece was in reduction Stage II. Measuring 42.4 mm long, 44.3 mm wide, and 14.7 mm thick, it was not further modified or used. The remaining piece was further reduced and broken again while in reduction Stage II,

Figure 6-11 Photographs and illustrations of bifaces from Area A Cultural Level 2a.

Figure 6-12 Photograph and illustration of refitted biface found in Block A Cultural Level 2a.

resulting in two pieces which were not further modified. The midsection, PA325-12,647, measures 35.0 mm in length, 43.8 mm in width, and 8.812.6 mm in thickness and was subsequently used to scrape a hard material. The base, PA325-12,648, was used to scrape a semi-hard material. It is 28.6 mm long, 44.4 mm wide and 8.8 mm thick.

Expedient Flake Tools

Sixty-six retouched flakes were recovered from the Area A Cultural Level 2a (Table 6-3, Appendix B). The great majority (90.9%) of these specimens were manufactured from locally occurring raw materials. Sources from the Bighorn Basin were used in lesser quantities, with three made from Phosphoria chert, one made from Tensleep quartzite, and only two retouched flakes manufactured from obsidian derived from sources to the west. Use-wear analysis indicates that these tools were used to cut (15.2%), scrape and/or plane (75.8%) a variety of semi-hard (65.2%), hard (24.2%) or soft (9.1%)

Table 6-5 Attributes of bifaces recovered from Area A, Cultural Level 2a.

Catalog #	Unit	Elevation (m)	Portion	Material	Stage	Max. Length (mm)	Max Width (mm)	Max. Thickness (mm)	Use1	Mat. Worked	Use 2	Mat. Worked 2
7911	N220 E151	100.2	CO	EC	III	44.5	31.6	9.5				
8425	N220 E153	100.18	UN	EC	IV	35.8	25.4	6	C	S	C	S
8467	N220 E154	100.12	CO	EC	III	52.3	32.8	10.6	S	SH		
8502	N220 E157	100.24	UN	EC	IV	35	21.1	5.2	C	SH	C	SH
8673	N221 E153	100.26	UN	OB	III	22.2	41.2	8.4	C	SH		
8788	N221 E157	100.26	UN	EC	III	42.9	23.5	9.1	S	H		
8838	N221 E158	100.22	CO	EC	IV	37.2	15.2	4.7	C	SH	C	SH
8890	N221 E158	100.2-100.1	DS	EC	IV	11	8.5	2.5	C	SH	C	SH
8912	N222 E147	100.19	PR	SW	III	27.2	22.5	5.7	C	S		
8984	N222 E150	100.24	LT	EC	II	77	33	21.5				
9069	N221 E154	100.23	UN	EC	III	47.9	23.6	12.2	S	H		
9092	N221 E154	100.2-100.1	UN	OB	IV	15.9	8.1	4.1	C	S		
9118	N222 E155	100.31	UN	EC	III	54.9	14	10.5	C	SH		
9163	N222 E158	100.3-100.2	UN	EC	V	8.7	5.8	2.8				
9268	N221 E155	100.28	UN	PC	3	34.8	15	9				
9390	N222 E152	100.31	UN	EC	3	20.2	38.2	9.1				
9584	N222 E151	100.3-100.2	UN	EC	V	16	8.6	4.9				
9586	N222 E151	100.27	UN	EC	III	24.7	40.6	8.9	C	H	C	H
9647	N222 E150	100.18	DS	OB	IV	25.6	24.3	5.5	C	S	C	S
9730	N222 E153	100.2-100.1	LT	EC	IV	8.7	7.1	2.9	C	SH		
9891	N222 E156	100.3	UN	EC	III	30.5	26.2	11.1	S	H		
10049	N222 E154	100.19	UN	EC	IV	29.5	45	9.9	S	H		
10314	N222 E151	100.25	PR	EC	III	27.7	38.4	10.8	C	SH	C	SH
10472	N223 E154	100.33	DS	EC	3	20.3	18.7	4.5	C	SH	C	SH
10535	N223 E154	100.3-100.25	DS	EC	IV	12.3	11.5	3.1	C	SH		
10542	N223 E154	100.27	CO	EC	III	42.5	25.5	10.1	S	SH		
10627	N223 E150	100.2-100.1	UN	SW	III	7.4	9.8	2.8	S	H	S	H
10718	N223 E152	100.3-100.2	UN	SW	III	14.5	30.8	9.1				
10762	N223 E152	100.3-100.2	UN	EC	V	10.3	5.3	3.1				
10859	N223 E153	100.3-100.2	UN	SW	IV	26.2	8.5	5.1	C	SH		
11026	N223 E155	100.34	UN	EC	2	20.8	14.4	8				
11136	N223 E155	100.3-100.2	UN	EC	III	13	7.7	3.1	C	S		
11234	N223 E154	100.19	LT	EC	II	28.8	21.1	10.1	C	S		

Table 6-5 Attributes of bifaces recovered from Area A, Cultural Level 2a.

Catalog #	Unit	Elevation (m)	Portion	Material	Stage	Max. Length (mm)	Max Width (mm)	Max. Thickness (mm)	Use1	Mat. Worked	Use 2	Mat. Worked 2
11252	N223 E154	100.2-100.1	LT	OB	V	13.4	5.4	2.8	C	S		
11423	N223 E158	100.27	UN	SW	IV	29.3	28.1	4.9	C	S	C	S
11791	N224 E155	100.29	DS	EC	III	38.1	38	12.3	S	SH	S	SH
11818	N224 E152	100.31	LT	EC	III	41.1	10.1	8	C	H		
12006	N224 E154	100.29	UN	EC	III	24.4	33.7	8.8				
12043	N224 E154	100.2-100.1	UN	EC	III	12.4	12.5	4.9				
12242	N224 E153	100.2-100.1	LT	EC	III	17.4	7.4	5.4	C	SH		
12248	N224 E153	100.2-100.1	LT	EC	III	14.9	12.4	3.6	C	SH		
12249	N224 E153	100.2-100.1	DS	EC	IV	4.7	6.2	2.3				
12473	N224 E158	100.2-100.1	UN	SW	V	10	5.8	3.5	S	SH		
12609	N224 E155	100.28	DS	EC	II	44.3	42.4	14.7				
12647	N224 E155	100.23	MD	EC	III	43.8	35	12.6	S	H		
12648	N224 E155	100.23	PR	EC	III	44.4	28.6	8.8	S	SH		
12684	N224 E156	100.34	UN	EC	III	32.1	21.2	9.9				
12685	N224 E156	100.33	PR	EC	II	42.5	39.9	9.3	S	SH		

Portion: CO-complete; DS-distal; PR-proximal; LT-lateral; MD-medial; UN-unidentified. Material: EC-Eocene chert; SW-silicified wood; OB-obsidian. Use: C-cut; S-scrape. Mat. Worked: S-soft; SH-semi-hard; H-hard.

materials. One specimen had no use-wear (8,585) and thus appears to have discarded without use following resharpening. One blade-like retouched flake (Figure 6-13, #10,117) is made from obsidian and has deep invasive pressure flakes with abundant retouch on the dorsal surface. The ventral surface is mostly unworked. The specimen is finely-made and apparently was curated. Similar well-made retouched flakes (unifacial knives) were found in Block B as well as in the Early Archaic component at Game Creek (48TE1573).

Fifty-three utilized flakes were found in Cultural Level 2a (Table 6-3, Appendix B). As is the pattern with the rest of the tools from this area, most (86.8%) were manufactured from local raw materials. Only one specimen in the sample was made of material from the Bighorn Basin. This is a Morrison quartzite utilized flake. However, five obsidian flakes and one basalt flake from the Yellowstone Plateau are present. Use-wear analysis of these tools indicates that they were used to cut (30.2%) and scrape (69.8%) a variety of soft (24.5%), semi-hard (49.1%), and hard (24.5%) materials.

Scrapers

Six tools classified as scrapers were recovered from Area A Cultural Level 2 (Table 6-3, Appendix B). All of the scrapers were manufactured from locally occurring raw materials, three being made from Eocene chert and two being made from silicified wood. The first of these tools, #9,320, is a complete end scraper made of brown Eocene chert. It measures 37.2 mm long, 27.6 mm wide, and 13.6 mm thick. It has a bit angle of 81° and a bit width of 24.1 mm (Figure 6-13). Use-wear analysis indicates that it was used to scrape a hard material. No use-wear is present on the sides of the piece. The second scraper (#9,781) is the distal portion of an end/side scraper, manufactured from a milky Eocene chert. The proximal end has been broken off with a bend break. It is 33.1 mm long, 27.2 mm wide and 5.9 mm thick. The bit angle is 76°, and bit width is 19.6 mm, with use-wear indicating that it was used to scrape a hard material. One lateral edge has a length of 15.6 mm and an angle of 37°. It was used to scrape a semi-hard material. The other lateral edge has a length of 15.4 mm and an angle of 37°. It was used to scrape/plane semi-hard material. The third piece, #9,478, is a complete end scraper made from brown Eocene chert. It measures 25.1 mm in length, 30.3 mm in width, and 6.3 mm in thickness. It has a bit width of 30.33 mm and a bit angle of 44°, with use-wear analysis indicating that it was used to scrape a semi-hard material such as green wood. The lateral edges of this item do not exhibit any use-wear. The fourth piece, PA325-11,239 is manufactured from Eocene chert and is a typical end scraper in form but is small in size. It measures 28.5 mm in length, 19.6 mm in width, and 4.6 mm thick. The bit and the sides exhibit retouch originating from the ventral face of the artifact. The bit is straight and measures 4 mm wide, with an angle of 69°. Use-wear indicates that it was used to scrape a semi-hard material. The fifth artifact in this category, PA325-8,883, is a crude end scraper made of grey silicified wood. It is 50.9 mm long, 36.5 mm wide, and 15.4 mm thick. Bit width is 36.5, with a 27.5 mm portion of that retouched to a bit angle of 59°. This segment was used to scrape a hard material. The lateral edges exhibit no use. The sixth scraper (12,306) is a small fragment that was not analyzed for use-wear.

Drill

One drill was found in Area A Cultural Level 2a (#9,956) (Table 6-3, Appendix B). It is manufactured from a local dark green Eocene chert and measures 35.5 mm long, 19.1 mm wide, and 7.9 mm thick. The tool was made on the midsection of a flake, the result of two bend breaks. One bend break surface has been bifacially retouched to form a drill tip, triangular in cross-section and 10.2 mm long and 6.6 mm wide. The working edge length is 6.6 mm, with a bit angle of 60°. The piece does not appear to have been hafted. Use-wear indicates that the tool was used to drill a semi-hard material with counter-clockwise twists. The piece has been resharpened.

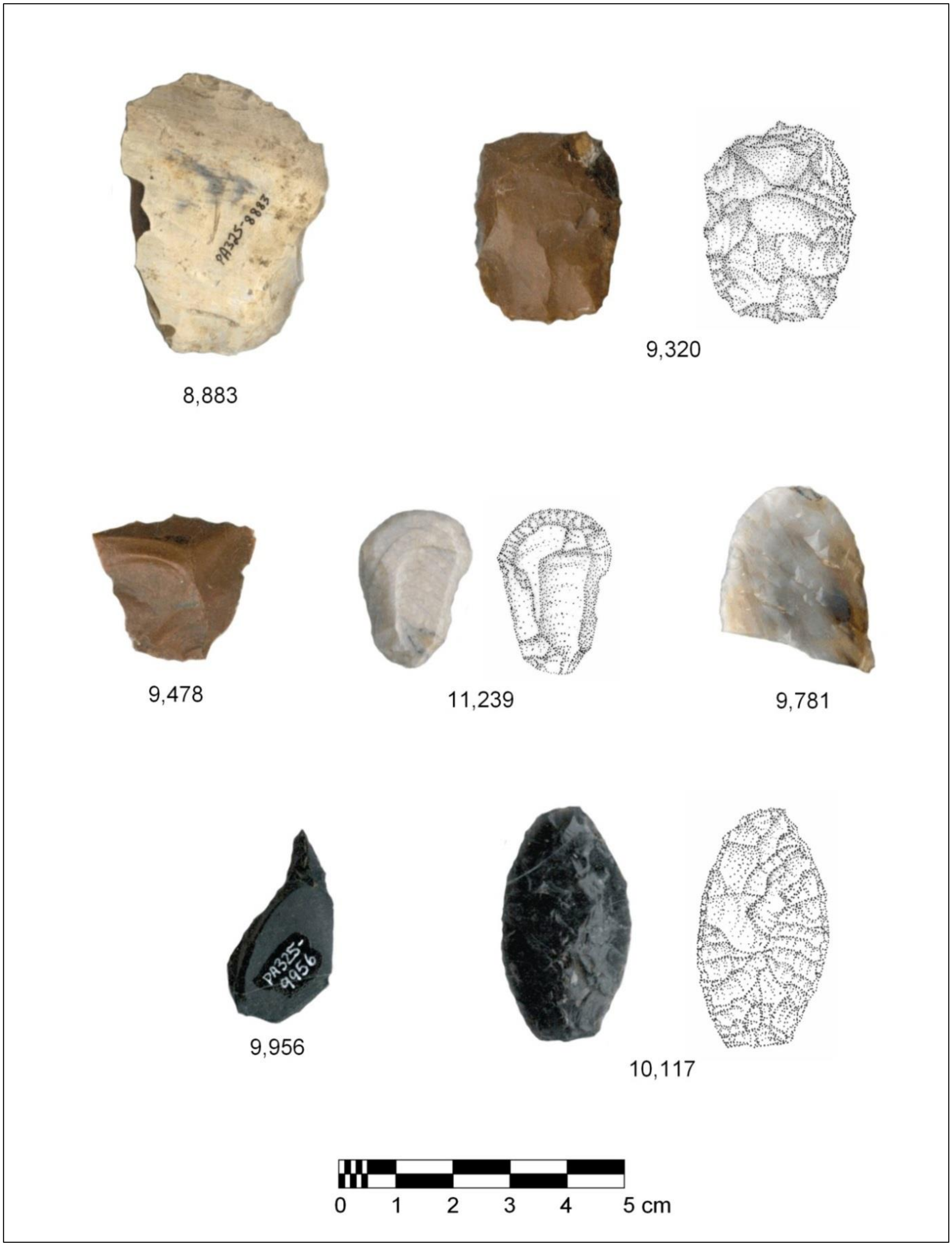


Figure 6-13 Photographs and illustrations of scrapers and retouched flakes recovered from Area A Cultural Level 2a.

Groundstone

A fragment of what appears to have been a metate (#11,383), or milling slab was recovered from Block A Cultural Level 2a. It is a tabular fragment of local, coarse-grained igneous rock, triangular in shape and broken on all three edges. The upper face exhibits smoothing and pecking; the lower face is unmodified. No striations were noted, but the piece has not been washed, making a definite determination difficult. Measurements are 92.6 mm long, 53.0 mm wide and 18.2 mm thick.

Hammerstones

Two hammerstones were found in Area A Cultural Level 2. The first of these, PA325-8621, is a naturally rounded river cobble of igneous volcanic tuff that exhibits battering on both ends. The piece measures 79.5 mm in length, 61.1 mm in width, and 34.0 mm in thickness. The second hammerstone, PA325-12813, is quite similar to the previous specimen. It is another naturally rounded river cobble of igneous volcanic tuff. It has battering on both ends, and on one side. It is 74.4 mm long, 60.2 mm wide, and 45.1 mm thick.

Bone Tools

Nine individual bone tool fragments were recovered from Area A (Figure 6-14), but a number of them refit. Specimens #9,894 and 9,896, both of which are burned, refit to create a bone awl midsection. The former of these pieces was recovered from mixed contexts in the same unit as the latter. The awl is round in cross-section and was made from an unidentified longbone fragment. Specimen #9,896 has a length of 22.7 mm and a diameter of 6.0 mm, and specimen #9,894 is 6.6 mm long and refits to the proximal end of the previous piece.

Specimen #15,377 is the unburned midsection or shaft of a bone needle. It is round in cross-section, and the remaining length is 21.5 mm. The proximal diameter is 2.6 mm and the distal diameter is 2.3 mm. The distal end is broken on a diagonal, and the proximal end appears to be broken as the base of the needle eye.

Specimens #10,537, #10,504, #10,468, and #10,467 are four separate broken sections that refit to form a nearly complete bone awl. All of the fragments were found in the same unit, but two were recovered from mixed contexts. Only a very small portion of the extreme distal tip (point) is missing. All four pieces are burned. The piece is spirally broken from the proximal end of a Bighorn sheep left metatarsal. The proximal end of the metatarsal forms the proximal end of the awl. Total length of the item is 73.4 mm. The distal tip of the awl is worked into a round cross section for 25.4 mm with a diameter of 2.8 mm at the tip. The shaft is highly polished from use for 47.1 mm from the distal end. A few abrasion marks are still present in a pattern diagonal to the long axis of the awl shaft.

Figure 6-14 Photographs of bone tools recovered from Area A Cultural Level 2a.

Specimen #11,084 is the burned midsection of a bone awl. It was made from a medium artiodactyl metatarsal which was split lengthwise through the vascular groove, which was the original center of the awl shaft. The remaining length is 28.6 mm. The original cross section was ovoid with a remaining thickness of 5.1 mm. The entire remaining outer surface has abrasion marks diagonal to the long axis of the shaft, probably from abrading to the original shape.

Specimen #12,218 is an unburned bone awl made on a spirally fractured medium artiodactyl metapodial fragment. It is a rather expedient tool which is basically complete except for the extreme distal point. Total remaining length is 100.4 mm and maximum width is 9.6 mm. The distal 20.6 mm of the piece has been worked into a round tapering point with a round cross section, but is weathered and exhibits no remaining abrasion marks.

Faunal Remains

A total of 4,887 pieces of bone, 462 pieces of tooth enamel, and one fossil tooth were recovered from Area A Cultural Level 2a (Table 6-6). The majority (n=4,557, 85.2%) of the specimens are unidentifiable bone fragments. Identifiable species include bighorn sheep (NISP=50), mule deer (NISP=1), river otter (NISP=2), pine marten (NISP=1), and cottontail rabbit (NISP=1). Two hundred forty-none bone fragments of the medium artiodactyl size class (deer or sheep) were also found. Another five specimens were identifiable only as small mammal and one tooth is an unidentified carnivore. Lastly, five intrusive rodent bones were also found. These show no evidence of human modification. The minimum number of individuals (MNI) present in the assemblage is difficult to access because most of

Table 6-6 Faunal remains recovered from the Area A Cultural Level 2a.

Species	Element	Portion	Side	NISP
bighorn sheep	1st phalange	proximal	L	2
bighorn sheep	2nd phalange	distal	UN	1
bighorn sheep	2nd phalange	proximal	R	2
bighorn sheep	4th carpal	complete	R	1
bighorn sheep	Astragalus	distal	L	1
bighorn sheep	Femur	fragment	L	1
bighorn sheep	fused 2nd, 3rd carpal	complete	L	1
bighorn sheep	Humerus	distal	L	2
bighorn sheep	Humerus	distal	R	1
bighorn sheep	Mandible	fragment	L	2
bighorn sheep	Mandible	fragment	R	1
bighorn sheep	Mandible	tooth row	R	1
bighorn sheep	Mandible	tooth row	UN	2
bighorn sheep	Maxilla	fragment	L	1
bighorn sheep	Metacarpal	distal	L	1
bighorn sheep	Metacarpal	proximal	R	5
bighorn sheep	Metatarsal	proximal	L	5
bighorn sheep	Metatarsal	proximal	R	2
bighorn sheep	Phalange	distal	UN	1
bighorn sheep	Radius	distal	R	1
bighorn sheep	Radius	fragment	L	1
bighorn sheep	Radius	proximal	L	1
bighorn sheep	Radius	proximal	R	1
bighorn sheep	Tibia	fragment	L	2
bighorn sheep	Tibia	fragment	R	2
bighorn sheep	Tibia	shaft	R	1
bighorn sheep	Tooth	complete	R	6
bighorn sheep	Tooth	complete	UN	1
bighorn sheep	Tooth	distal	L	1
pine marten	Femur	fragment	R	1
mustelid sp.	Mandible	fragment	R	1
river otter	Metapodial	complete	UN	1
m. artiodactyl	1st phalange	complete	L	1
m. artiodactyl	1st phalange	complete	UN	1
m. artiodactyl	1st phalange	distal	UN	1
m. artiodactyl	1st phalange	proximal	L	1
m. artiodactyl	1st phalange	proximal	R	1
m. artiodactyl	2nd phalange	distal	UN	1
m. artiodactyl	Calcaneus	fragment	R	1
m. artiodactyl	Carpal	fragment	UN	1
m. artiodactyl	cervical vertebra	distal	AXIAL	1
m. artiodactyl	Femur	shaft	L	1
m. artiodactyl	Humerus	distal	UN	1
m. artiodactyl	Humerus	fragment	L	1
m. artiodactyl	Humerus	fragment	R	1
m. artiodactyl	Humerus	proximal	L	1
m. artiodactyl	Humerus	proximal	UN	1
m. artiodactyl	Humerus	shaft	L	1
m. artiodactyl	Innominate	fragment	L	1
m. artiodactyl	Innominate	fragment	UN	1

Table 6-6 Faunal remains recovered from the Area A Cultural Level 2a.

Species	**Element**	**Portion**	**Side**	**NISP**
m. artiodactyl	long bone	shaft	UN	171
m. artiodactyl	Mandible	fragment	UN	1
m. artiodactyl	Maxilla	fragment	UN	1
m. artiodactyl	Metacarpal	fragment	L	1
m. artiodactyl	Metacarpal	fragment	UN	1
m. artiodactyl	Metacarpal	proximal	UN	1
m. artiodactyl	Metapodial	distal	L	1
m. artiodactyl	Metatarsal	fragment	UN	2
m. artiodactyl	Metatarsal	proximal	L	1
m. artiodactyl	Metatarsal	proximal	UN	1
m. artiodactyl	Phalange	distal	L	1
m. artiodactyl	Phalange	distal	UN	1
m. artiodactyl	prox. sesamoid	complete	UN	1
m. artiodactyl	Radius	fragment	L	2
m. artiodactyl	Radius	proximal	L	1
m. artiodactyl	radius/ulna	fragment	UN	1
m. artiodactyl	radius/ulna	shaft	L	1
m. artiodactyl	Rib	fragment	L	1
m. artiodactyl	Rib	fragment	R	2
m. artiodactyl	Rib	fragment	UN	11
m. artiodactyl	Sacrum	fragment	AXIAL	1
m. artiodactyl	Scapula	fragment	L	1
m. artiodactyl	Scapula	fragment	R	1
m. artiodactyl	Tibia	shaft	R	1
m. artiodactyl	Tooth	distal	UN	3
m. artiodactyl	Tooth	fragment	UN	5
m. artiodactyl	Ulna	fragment	R	1
m. artiodactyl	Unknown	fragment	UN	14
m. artiodactyl	Unknown	shaft	UN	1
unidentified	Rib	fragment	UN	1
mule deer	Calcaneus	proximal	L	1
unidentified	Cranium	fragment	AXIAL	1
unidentified	Cranium	fragment	UN	2
unidentified	long bone	fragment	UN	2
unidentified	long bone	proximal	UN	1
unidentified	long bone	shaft	UN	2
unidentified	long bone	shaft	UN	42
unidentified	Scapula	fragment	UN	1
unidentified	Tooth	distal	UN	1
unidentified	Tooth	fragment	UN	445
unidentified	Unknown	fragment	UN	4,512
unidentified	Unknown	fragment	UN	28
unidentified	Unknown	shaft	UN	2
rabbit	Tibia	proximal	R	1
rodent	Intrusive		UN	5
Total				5,349

Table 6-7 Breakage type, presence of cut/impact marks and burning in the faunal assemblage from Area A Cultural Level 2a.

Species	Green/Dry Break	Cut/Impact Marks	Burned	NISP
bighorn sheep	Dry			16
bighorn sheep	Green			24
bighorn sheep	Na			10
m. artiodactyl	Dry	X	X	1
m. artiodactyl	Dry			70
m. artiodactyl	Dry		X	9
m. artiodactyl	Green	X		12
m. artiodactyl	Green	X	X	1
m. artiodactyl	Green			137
m. artiodactyl	Green		X	18
m. artiodactyl	Na			1
mule deer	Dry			1
pine marten	Dry			1
mustelid sp.	Dry			1
river otter	Dry		X	1
rabbit	Na		X	1
unidentified	Un			1864
unidentified	Un		X	3093
unidentified	Dry			64
unidentified	Dry		X	3
unidentified	Green			14
unidentified	Green		X	2

the bone was pulverized. Based on the identifiable elements there is only one bighorn sheep, one mule deer, one river otter, one pine marten and one cottontail rabbit present in the assemblage (Table 6-6). Given the dearth of identifiable deer bone in the assemblage, it is likely that much of the medium artiodactyl bone is attributable to bighorn sheep.

There was abundant evidence for human modification of the faunal assemblage. Of the total sample, 208 pieces were spirally fractured indicating breakage when the bone was still green. These include 24 bighorn sheep, 168 medium artiodactyl and 16 unidentifiable bones (Table 6-7). Fourteen medium artiodactyl bones show evidence of chopping or cutting. A total of 3,129 specimens showed evidence of burning.

The faunal assemblage from this component is comprised of highly fractured and burned bone suggestive of intensive processing. The high number of unidentified specimens indicates that bones were cracked for the extraction of marrow, and articular ends, vertebrae and cranial elements were further pulverized and boiled for production of bone grease. Subsistence appeared to have focused on bighorn sheep, but included smaller animals such as rodents, small mammals, river otters, pine martins, cottontail rabbits, and marmots.

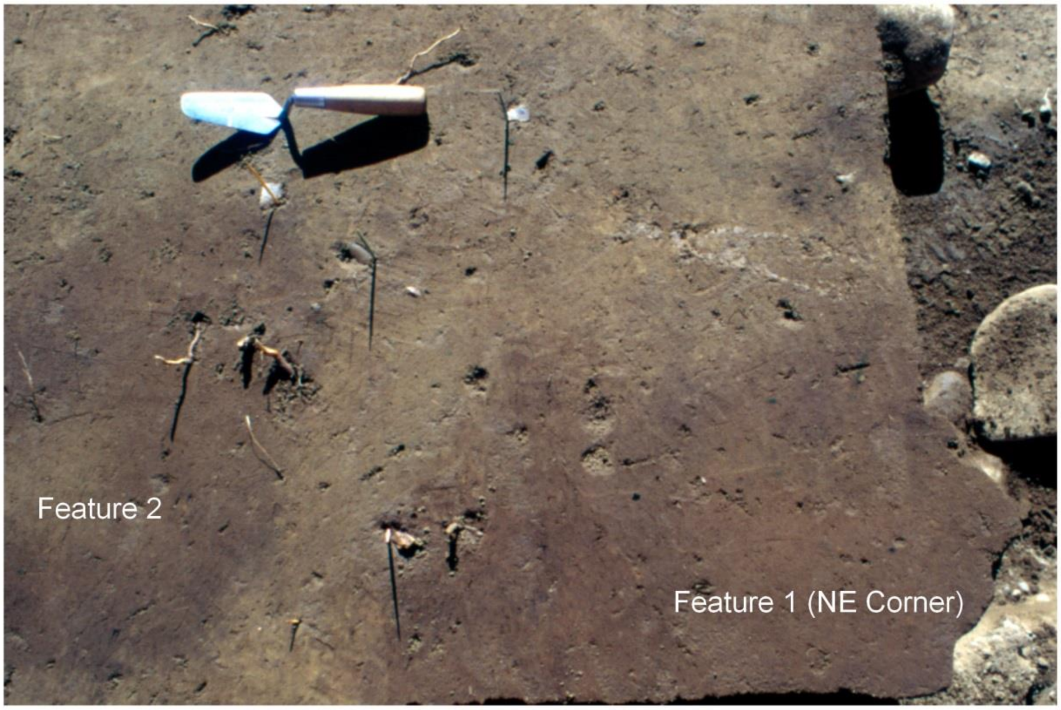
Feature 2

Feature 2 was an unprepared hearth, shaped in plan view like an egg sliced in half longitudinally (Figures 6-15 through 6-17). It was identified about 20 cm northeast of Feature 1 at an elevation of 100.19, or about 15 cm below Feature 1 and was associated with the Cultural Level 2a component. It was about 46 cm long in its maximum dimension (northwest-southeast), 35 cm in diameter northeast-southwest, and 9 cm deep. The feature contained dark brown oxidized sandy silt with some charcoal chunks. No fire-cracked rock was present. Fill from the feature was floated for recovery of charred organic remains. The sample contained one carbonized buffaloberry, five unidentifiable charred seed fragments, and five carbonized pieces of cactus. According to Bach (Appendix C), "[c]actus can be consumed from the spring through the fall, however, tubers [were] generally collected and consumed in the spring to early summer months. With that said, the presence of the possible burned buffaloberries and legume seed and unknown carbonized seed fragments suggests a fall occupation." Feature 2 was not dated, but produced 123 milligrams of charcoal as well as carbonized annual plant remains that would provide an amble sample for future radiocarbon dating.

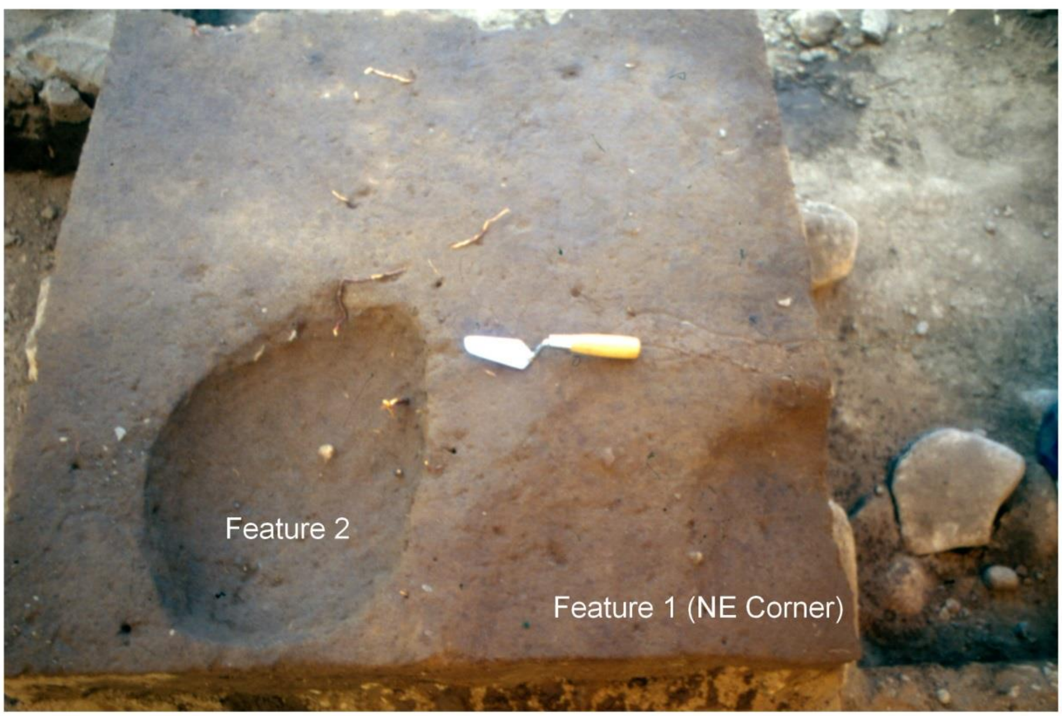
Lithic Concentrations

In addition to the Feature 2 hearth, Cultural Level 2a also contained four lithic concentrations. Although not recorded as formal features in the field, they were generally recognized by the excavators and are readily discernible on the artifact distribution maps (Figures 6-17 and 6-18). The concentrations varied in size from about 20 cm in diameter to just over 1 m. These concentrations consist mostly of debitage made of local cherts, with some tools present, especially utilized and retouched flakes.

Lithic Concentrations (LC) 1 and 2 were located about three meters west-southwest of Feature 2 in N222 E150 and N222 E151. LC 1 was located in the eastern portion of N222 E150 and the southwestern portion of N222 E 151 and was concentrated between 100.28 and 100.24 m elevation. The concentration measured more than a meter east-west by about 60 cm north south. Most of the debitage (96.4%) was a yellowish-brown locally available Eocene chert. LC 2 was located in the northeastern portion of N222 E151 between about 100.29 and 100.26 m elevation and measured about 60 cm northwest-southeast by 40 cm southwest-northeast. Most of the debitage (96.2%) from LC 2 was green Eocene chert. Little charcoal or burned bone was associated with either of the concentrations. The raw material from both concentrations is homogenous, more so than the Block as a whole. Thus, it is assumed they were not hearth clean outs but more the result of tool making episodes.



View to the east



View to the east

Figure 6-15 Photographs of Features 1 and 2, Block A Cultural Level 2.

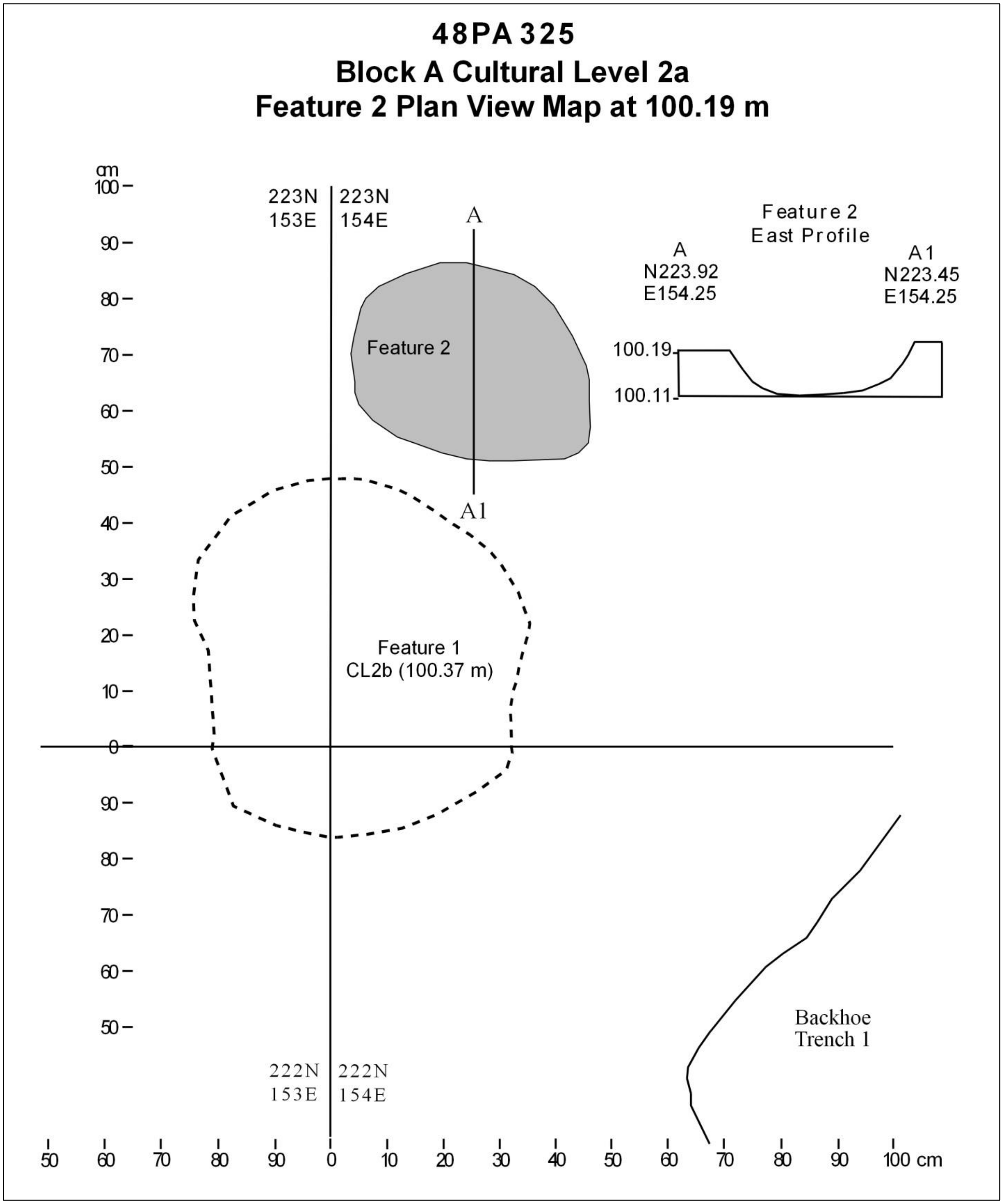


Figure 6-16 Illustration of Feature 2, Block A, Cultural Level 2a.

Lithic concentration 3 was located in the southwestern corner of N223 E151, only about 20 cm northwest of LC 2. It measured about 50 cm east-west by 30 cm north-south. It occurred at a slightly higher elevation (100.33-100.30) than LC 1 and LC 2 (100.29-100.24), but was probably part of the same occupation. Like LC 2 it consisted primarily of green Eocene chert (91.7%) debitage with a small amount of silicified wood and bone. It too appeared to reflect a knapping station rather than a refuse pile.

Lithic concentration 4 was located about two meters northwest of Feature 2. It covered the western half of N224 E152 and measured about one meter north-south by 65 cm east-west. It too contained a large quantity of green chert debitage and small amounts of obsidian, silicified wood, and bone. It occurred primarily in upper component of Cultural Level 2 between 100.33 m and 100.27 m elevation. An amorphous stain, approximately 4 cm in thickness that contained some charcoal surrounded by well consolidated sand, was found immediately on top of LC 4. One small rock was noted at the edge of the sand. It is unclear if the staining is associated with LC 4 or represents an eroded feature or a separate dumping episode. LC 4 probably represents a discrete knapping episode because the vast majority (97.1%) of the debitage is of the same locally available green Eocene Chert.

Spatial Analysis

Cultural Level 2a contained Feature 2 which was situated 18 cm below and north of Feature 1 at approximately 100.2 m elevation (180 cmbs). A concentration of chipped stone was found immediately south of Feature 2. Within and adjacent to the concentration were found one projectile point, one scraper, two bifaces, two flake tools and numerous pieces of butchered bone (Figures 6-17 and 6-18). Clustering of debitage and tools adjacent to hearths typically indicate hearth centered use of space (Binford 1978; Surrovell and Waguespack 2007). There was a concentration of over 1,000 small pulverized bone fragments, many of which were burned, found less than a meter northwest of Feature 2. There was relatively little chipped stone found in the cluster of bone. It would appear that the bone concentration represents a discarded pile of grease-rendered pulverized bone. The absence of clear lines of demarcation in the distribution of artifacts suggests that Feature 2 was probably not enclosed in a structure.

The greatest density of chipped stone found in Cultural Level 2a, which included numerous expedient flake tools and bifaces, as well as butchered bone, was found around LC1, LC2 and LC3. This activity area is not directly associated with Feature 2. LC1 and 2 are interpreted as knapping stations, rather than refuse dumps. The relatively high density of butchered point plotted bone in and around LC1 and 2 indicates that some amount of butchering occurred in the area. There is a cluster of unburned rock about 2m south of Feature 2 and 3.5 m east of LC1 and 2 that may represent a toss zone - an area away from direct activities where larger pieces of refuse were deposited (Binford 1978).

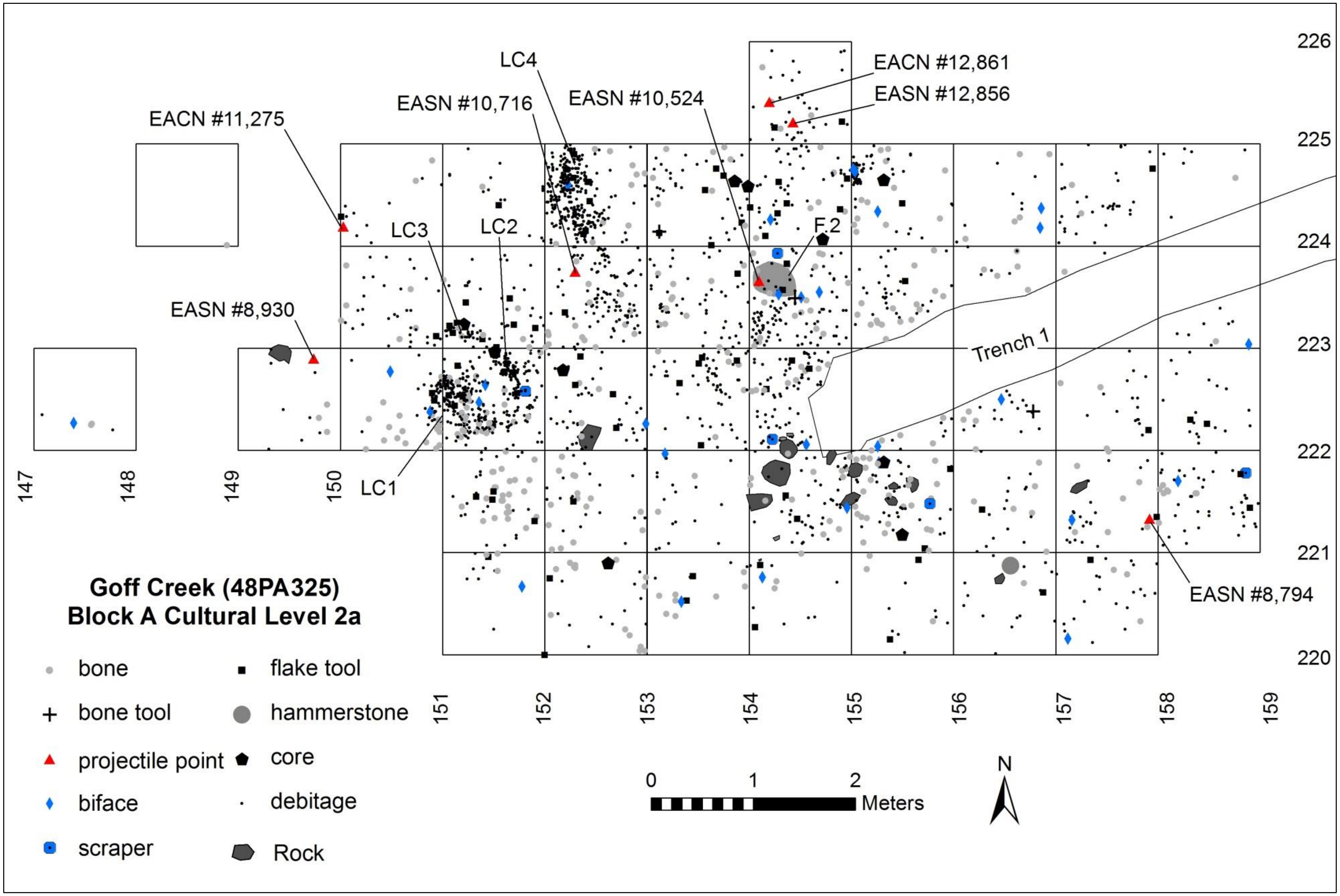


Figure 6-17 Plan view map of Block A Cultural level 2a.

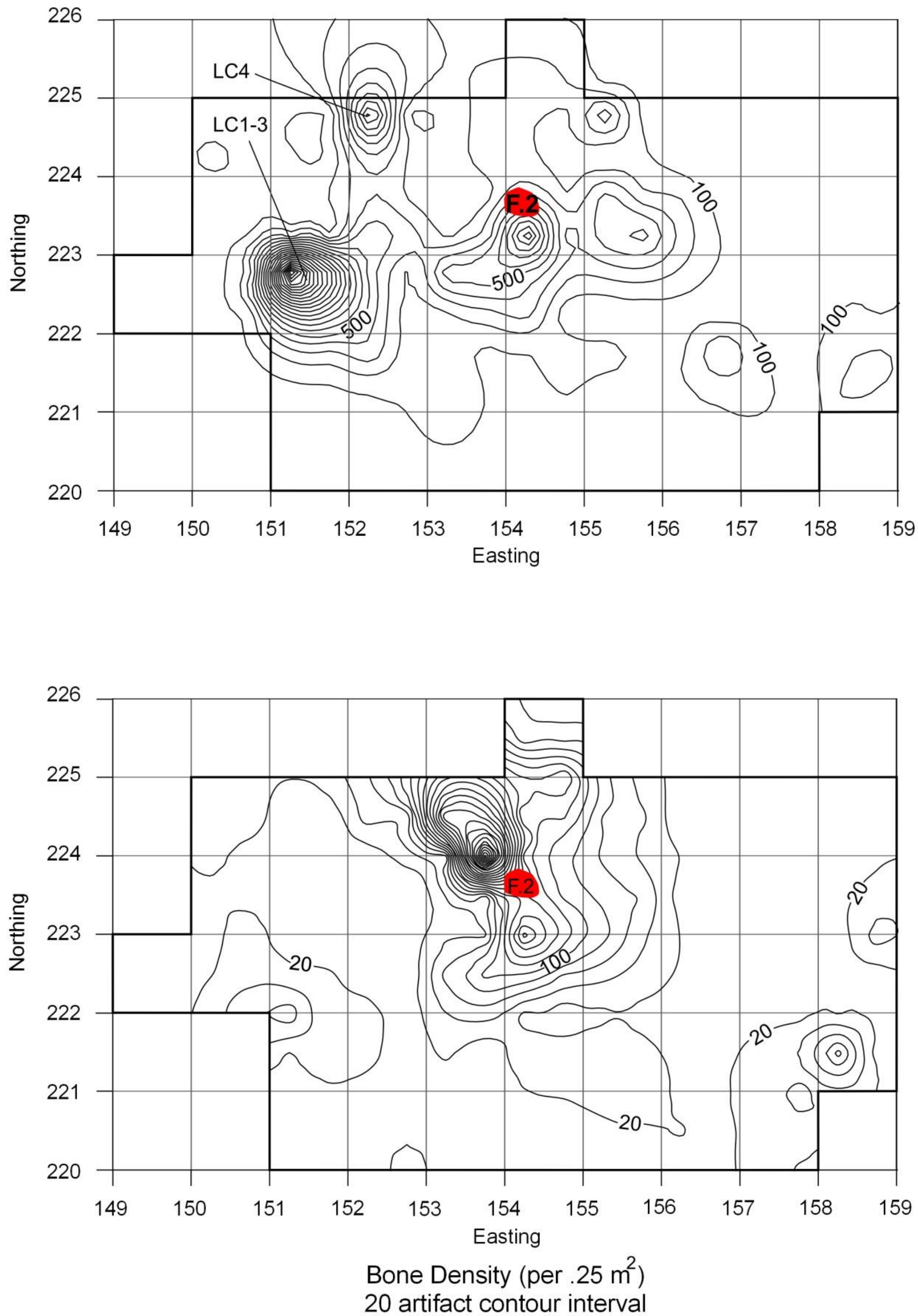


Figure 6-18 Map showing the interpolated artifact densities for Block A Cultural Level 2a.

The distribution of highly processed bone, numerous chipped stone tools and a debitage assemblage reflective of stone tool maintenance and production suggest a daily subsistence pattern focused on the intensive processing of bighorn sheep. The hearth in Cultural Level 2a (Feature 2) does not appear to have been a center of activity, and there is no evidence that it was enclosed within a shelter. These data, combined with the sparse macrofloral assemblage that included the late-summer to fall ripening buffaloberry, and a sizeable assemblage of obsidian point to a late summer to early fall occupation.

Cultural Level 2b

Cultural Level 2b contained significantly fewer artifacts than the underlying cultural level. In all, 3,442 chipped stone artifacts, including 54 tools, 289 pieces of bone and one metate were recovered from Cultural Level 2b (Tables 6-8 and 6-9). One unprepared hearth, Feature 1, which was dated to 5730±30 BP (Beta-406660), was also identified, as well as three lithic concentrations that appear to have been flint knapping stations. The assemblages reflect a variety of domestic activities centered on bighorn sheep procurement and intensive processing of bone for marrow and bone grease extraction.

Lithic Raw Material Utilization

The raw material composition of Cultural Level 2b differed significantly from the Cultural Level 2a assemblage (x^2=113.6, df=5, p<.0000). Although locally available Eocene chert was again the most common type of stone, there was a much smaller percentage of silicified wood and obsidian (Table 6-8). The most striking difference between the Cultural Level 2a and 2b assemblages is the dramatic increase in the proportion of cherts derived from the Bighorn Basin. Over 10 percent of the assemblage was comprised of Phosphoria chert, much of which was recovered from LC7. The high proportion of raw material procured in or near the Bighorn Basin may indicate arrival at the site from the east.

The lithic raw material composition of Cultural Levels 2a and 2b differ in several potentially meaningful ways. Samples from Cultural Levels 2a and 2b drawn from the point plotted artifacts (those that can be segregated into the two components) reveal that the differences between the assemblages are statistically significantly (x^2=113.6, df=5, p<.0000). Cultural Level 2a contained four times the obsidian and miscellaneous quartzite than Cultural Level 2b (Table 6-3). Conversely, non-local chert, which was predominantly Phosphoria chert, comprised nearly 8 percent of the Cultural Level 2b sample, but only 0.8 percent of the Cultural Level 2a sample. These data provide further evidence that the two components in Cultural Level 2 were not only apparent, but real. Moreover, it would appear that the Cultural Level 2a component was produced by people traveling east, out of the Yellowstone Plateau, but the people who created the Cultural Level 2b component had recently left the Bighorn Basin to the east.

Table 6-8 Area A, Cultural Level 2b chipped stone artifacts by raw material type.

Material Type	**Projectile Point**	**Biface**	**Retouched Flake**	**Utilized Flake**	**Tools Total**	**Core**	**Tested Cobble**	**Debitage**	**Total**
Local Chert	**1**	**5**	**18**	**14**	**38**		**3**	**2,755**	**2,796**
% of artifact	100	71.4	72.0	70.0	71.7		100	81.4	81.2
% of material	<.1	0.2	0.6	0.5	1.4		0.1	98.5	
Non-Local Chert			**4**	**3**	**7**			**361**	**368**
% of artifact			16.0	15.0	13.2			10.7	10.7
% of material			1.1	0.8	1.9			98.1	
Silicified Wood		**2**	**3**	**3**	**8**	**1**		**180**	**189**
% of artifact		28.6	12.0	15.0	15.1	100		5.3	5.5
% of material		1.1	1.6	1.6	4.2	0.5		95.2	
Obsidian								**47**	**47**
% of artifact								1.4	1.4
% of material								100	
Misc. Qtz								**30**	**30**
% of artifact								0.9	0.9
% of material								100	
Basalt								**4**	**4**
% of artifact								0.1	0.1
% of material								100	
Morrison Qtz								**5**	**5**
% of artifact								0.1	0.1
% of material								100	
Misc								**3**	**3**
% of artifact								0.1	0.1
% of material								100	
Total	**1**	**7**	**25**	**20**	**53**	**1**	**3**	**3,385**	**3,442**

Debitage Assemblage

The Cultural Level 2b debitage assemblage is similar to Cultural Level 2a. The majority of the assemblage is again comprised of flake fragments (52.7%) and broken flakes (28.2%), most (66.7%) of which are smaller than ¼”. However, there were significantly more cortical pieces of debitage (20.4%) in Cultural Level 2b than in Cultural Level 2a (11.5%). This may reflect more on or near site procurement, testing or early reduction of stone, a hypothesis supported by the presence of three tested cobbles. Nevertheless, the assemblage overall, according to Sullivan and Rozen (1985) is indicative of tool manufacturing and maintenance activities.

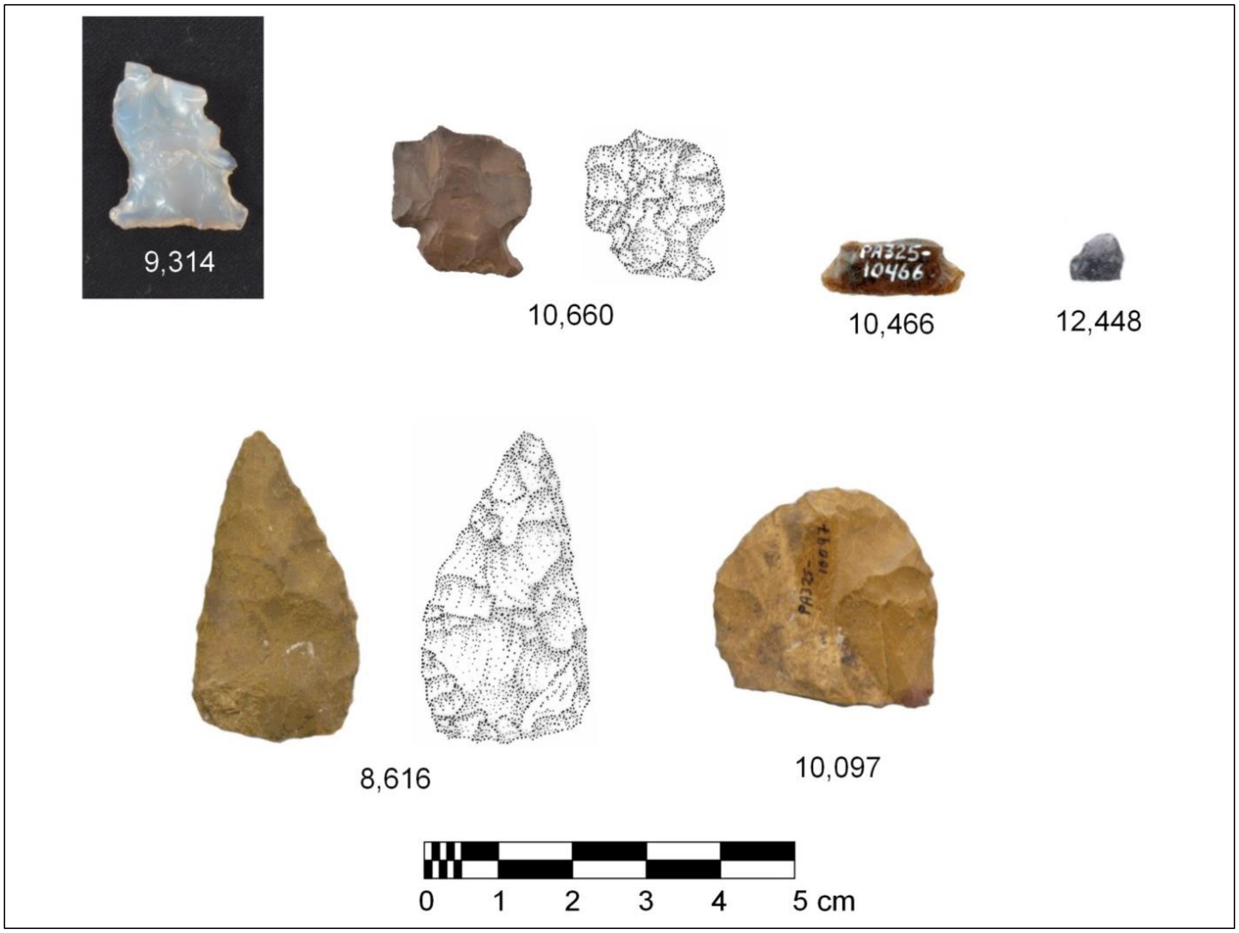


Figure 6-19 Photographs of projectile points and bifaces recovered from Cultural Level 2b and 2a/b.

Chipped Stone Tools

The Cultural Level 2b chipped stone tool assemblage was relatively small and more homogenous that Cultural Level 2a. No scrapers or drill were recovered. Only one projectile point was found, a corner-notched dart (Figure 6-19, 9,314) that is markedly similar to the Blackwater type points found at Mummy Cave in Cultural Layer 16 (Table 6-9). The small (n=7) biface assemblage contained specimens from stages II, III, IV and V, all but one of which were only small fragments (Table 6-10). The one complete biface (#8,616) is a well-made knife made of Eocene chert. Use-wear analysis revealed that all but one of the bifaces was used to cut (28.6%) or scrape (57.1%) semi-hard (42.8%) and hard (42.8%) materials. The expedient flake tools, comprised of 25 retouched flakes and 20 utilized flakes, showed a similar pattern of use with about 80 percent used to scrape and 20 percent to cut semi-hard (57.8%), hard (28.9%) and soft (13.3%). Overall the chipped stone tool assemblage reflects varieties of activities including butchering, tool maintenance and manufacturing, but absent are clear markers of hide preparation and clothing production and maintenance.

Table 6-9 Attributes of projectile Points recovered from Area A Cultural Level 2b and 2a/b.

Catalog#	Block	Unit	Elevation (m)	Cultural Level	Material	Portion	Point Type	Haft Type	Prox. Shld. Angle (°)	Max. Length (mm)	Base Width (mm)	Base Length (mm)	Haft Width (mm)	Max. Thickness (mm)	Notch Depth (mm)	Notch Width (mm)	Haft Grinding	Fracture Type
9314	A	N221 E155	100.29	2b	EC	NC	BW	CN	141	22	18.5	8.8	13.4	4.1	2.9	5.6	X	IMP
10466	A	N223 E154	100.4-100.3	?	EC	BA	BW	CN	141	8	19.3		13.9	2.7	2.9		X	BND
10660	A	N223 E152	100.4-100.3	?	EC	BA	BW	CN	120	20		6.1	11.9	4.4	2.6	5.1	X	IMP
12448	A	N224 E158	100.4-100.3	?	OB	ER		CN	120	8.1				3.6			X	BND

Material: EC-Eocene Chert; SW-Silicified Wood; MOQ-Morrison Quartzite; OB-obsidian. Portion: CO-Complete; NC-nearly complete; BA-base; ER-ear/lateral base fragment. Point Type: PH-Pahaska; BW-Blackwater. Haft Type: SN-side-notched; CN-corner-notched. Fracture Pattern: BND-bend break; BUR-burinated; TA-thermally altered.

Table 6-10 Attributes of bifaces recovered from Cultural Level 2b and 2 a/b.

Catalog #	Unit	Elevation (m)	Cultural Level	Portion	Material	Stage	Max. Length (mm)	Max. Width (mm)	Max. Thickness (mm)	Use 1	Mat. Worked 1	Use 2	Mat. Worked 2
8332	N221 E154	100.33	2b	DS	EC	IV	47.2	37	7.8	C	SH	C	SH
8616	N220 E156	100.29	2b	CO	EC	IV	42.2	22.5	6.8	C	SH	C	SH
8706	N221 E156	100.4-100.3	2b	LT	EC	V	20.1	4.9	2.9				
9661	N222 E153	100.4-100.3	2b	LT	EC	IV	14.1	19	2.8	C	SH		
10097	N222 E157	100.37	2b	UN	EC	III	28.6	30.4	11.5	S	H		
10648	N223 E152	100.39	2b	UN	SW	III	44.4	23.5	10.2	S	H		
10665	N223 E152	100.39	2b	UN	SW	II	35	46.3	11.7	S	H		
11072	N223 E155	100.35	2b	PR	EC	III	28.6	38.6	12	S	SH		
8680	N221 E153	100.3-100.2	?	UN	EC	V	5.3	4.5	2.2				
8729	N221 E156	100.3-100.2	?	DS	EC	V	4.6	6.7	1.3				
10662	N223 E152	100.4-100.3	?	LT	SW	III	25.3	11	7	S	SH		
10663	N223 E152	100.4-100.3	?	LT	EC	V	16.8	3.8	1.8				
10984	N224 E153	100.4-100.3	?	LT	EC	III	19	9.5	5.1	S	SH		
11087	N223 E155	100.4-100.3	?	DS	EC	V	10.8	10.3	4.4	S	SH		
11486	N224 E151	100.4-100.3	?	DS	TSQ	IV	7.2	9	2.1				
12447	N224 E158	100.4-100.3	?	LT	OB	V	12.1	4	1.9				
12538	N226 E162	100.4-100.3	?	DS	EC	V	17.8	15.5	3.3				
12845	N225 E154	100.4-100.3	?	LT	PC	V	9.3	4.3	1.2				

Portion: CO-complete; DS-distal; PR-proximal; LT-lateral; MD-medial; UN-unidentified. Material: EC-Eocene chert; SW-silicified wood; OB-obsidian. Use: C-cut; S-scrape. Mat. Worked: S-soft; SH-semi-hard; H-hard

Groundstone

One metate (#8,414) was found. It consists of a rectangular slab of local, coarse grained igneous rock that is slightly concave on its upper surface. The piece exhibits no trimming or shaping. The central portion of the upper surface of the piece appears to show minor pecking and smoothing. The bottom face is completely unmodified. No striations are visible, but the piece has not been washed, making it difficult to determine if they are present. The piece is 211 mm long, 208 mm wide, and 32 mm thick.

Faunal Assemblage

Cultural Level 2b produced a small faunal assemblage containing 258 bone and 31 tooth fragments. Bighorn sheep is the only identifiable species represented by three elements (Table 6-11). The 31 medium artiodactyl elements are likely also from bighorn sheep. A minimum of one individual is present in the assemblage. Most (88.2%) of the faunal remains found were highly fragmentary and could not be identified to species. There is ample evidence of human modification of faunal remains including 25 specimens exhibiting green bone spiral fracturing, two specimens with cut or impact marks, and 94 specimens that have been charred or calcined (Table 6-12). The faunal assemblage again, as in Cultural Level 2a, indicates a focus on bighorn sheep procurement and intensive bone marrow/grease processing.

Table 6-11 Faunal remains recovered from the Area A Cultural Level 2b.

Species	**Element**	**Portion**	**Side**	**NISP**
bighorn sheep	femur	fragment	L	1
bighorn sheep	mandible	fragment	R	1
bighorn sheep	tibia	distal	L	1
m. artiodactyl	humerus	distal	UN	1
m. artiodactyl	long bone	shaft	UN	26
m. artiodactyl	radius	distal	R	1
m. artiodactyl	rib	fragment	UN	1
m. artiodactyl	tibia	fragment	L	1
m. artiodactyl	tooth	shaft	UN	1
Unidentified	long bone	shaft	UN	12
Unidentified	tooth	fragment	UN	30
Unidentified	unidentified	fragment	UN	211
Unidentified	unidentified	fragment	UN	1
Unidentified	unidentified	shaft	UN	1
Total				289

Table 6-12 Breakage type, presence of cut/impact marks and burning in the faunal assemblage from Area A Cultural Level 2b.

Species	Green/Dry Break	Cut/Impact Marks	Burned	NISP
Unidentified	un			155
M. Artiodactyl	green	x		1
bighorn sheep	dry			1
M. Artiodactyl	dry			10
Unidentified	dry			10
bighorn sheep	green			1
M. Artiodactyl	green			16
Unidentified	green			1
Unidentified	un		X	86
Unidentified	dry	X	X	1
M. Artiodactyl	dry		X	1
bighorn sheep	green		X	1
M. Artiodactyl	green		X	3
Unidentified	green		X	2

Feature 1

Feature 1 (Figures 6-20 through 6-22) was an unlined hearth that was identified in four different excavation units (N222 E153, N222 E154, N223 E153, N223 E154). This served to frustrate attempts to correlate the different portions of the feature and to determine its exact nature and boundaries. Only the northeastern portion was photographed (Figure 6-15), and no profile was drawn. The hearth was identified at approximately 100.37 m (~163 cmbs) and is associated with the Cultural Level 2b component. Feature 1 was roughly circular in outline and basin-shaped in cross-section. It was roughly 65 cm in diameter north-south, 60 cm in diameter east-west, and 20 cm deep. The feature fill consisted of oxidized slightly gravely fine-grained sediment and charcoal flecks with well-defined boundaries. No fire-cracked rock was present, but a tabular rock about 15 cm in diameter was found in the south end of the feature and a diffuse scatter of unburned rock was found immediately north-northeast of the hearth. The fill was collected and processed for the recovery of macrobotanical remains. One charred buffaloberry seed, two unidentifiable charred seed fragments and four pieces of unidentified carbonized starchy tuber were identified in the sample (Appendix C). Buffaloberries ripen in the late summer and fall, but the fruits were frequently dried and stored for future use (Galvan 2007) so their presence does not provide a strong indicator of the season of occupation. Some starchy tubers, such as sego lily, were also frequently stored for future consumption. Charcoal, likely from Douglas-fir (Appendix C) was submitted for AMS radiocarbon dating and produced an age estimate 5730±30 BP (Beta 406660).

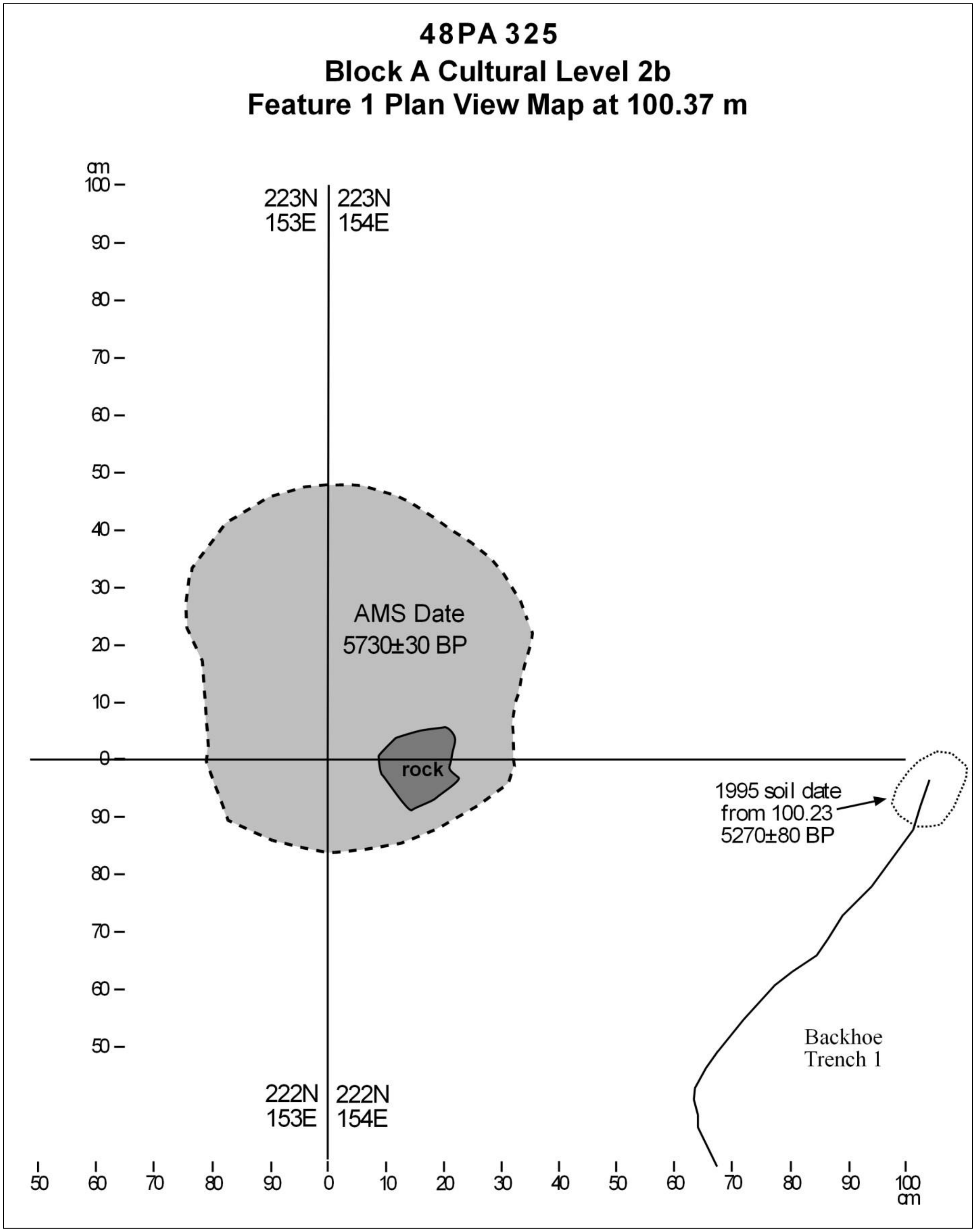


Figure 6-20 Illustration of Feature 1, Block A, Cultural Level 2b.

Lithic Concentrations

Lithic concentration 5 was found in the northwestern quadrant of N224 E154 and northeastern quadrant of N224 E155, about 1.4 meters northeast of Feature 1 between about 100.38 m and 100.32 m elevation (162-168 cmbs). It measured about 65 cm east-west by 60 cm north-south. It was made up primarily of locally available chert debitage (94.5%) and small amounts of obsidian, silicified wood, igneous, miscellaneous chert, and bone. The bone, included two sheep mandibles and a skull fragment, were found on the northern edge of N224 E155. It would again appear that this concentration represents an episode of tool production, perhaps related to butchering.

Lithic concentration 6 was the smallest and was located in the central portion of N224 E157, approximately 3.4 meters northeast of Feature 1. It measured about 25 cm east-west by 20 cm north-south. It was primarily found between 100.34 m and 100.3 m elevation (166-170 cmbs). It was made up primarily of locally available chert (99%) and small amounts of silicified wood, obsidian, and bone fragments. Some charcoal flecking was noted, but almost none of the debitage was burned. Thus it is reasonable to infer that LC 6 is again probably the result of a single tool production episode.

Lithic concentration 7 was located 1.5 m southeast of Feature 1 in the northeastern corner of N221 E154 and northwestern corner of N221 E155 at an elevation of 100.34-100.3 m (166-170 cmbs). It measured about 65 cm east-west by 50 cm north-south. Several rocks, including one piece of FCR, were recorded within and immediately adjacent to the concentration. Although most of the chipped stone (71%) in the concentration is locally available Eocene chert, a disproportionate amount of the stone is non-local Paleozoic chert (28%). No charcoal flecking was mentioned in LC 7 but was noted throughout the rest of associated excavated level. Like the rest of the lithic concentrations, most of the material in LC 7 was unburned.

Spatial Analysis

Feature 1, LC 5, 6 and 7 and a relatively dense layer of lithics and bone fragments were recovered from Cultural Level 2b. The level was most apparent between 100.35 m and 100.3 m (165-170 cmbs) in the E152-157 units between N221 and N224 (Figures 6-2 through 6-4). Relatively few artifacts were found in direct association with Feature 1, but a bone awl fragment and a biface were recovered just to the north of the feature (Figure 6-21 and 6-22). Lithic Concentrations 5 through 7 represent discrete tool production locales. Each of the concentrations is more than a meter from Feature 1, which suggests that the hearth was not the locus of activities during the Cultural Level 2b occupation. The lithic concentrations (LC5-7) are made up primarily of locally available chert debitage, with small quantities of other lithic materials, and bone. Most of the tools associated with the concentrations are utilized and retouched flakes, although several bifaces in various stages of production were also found within or in

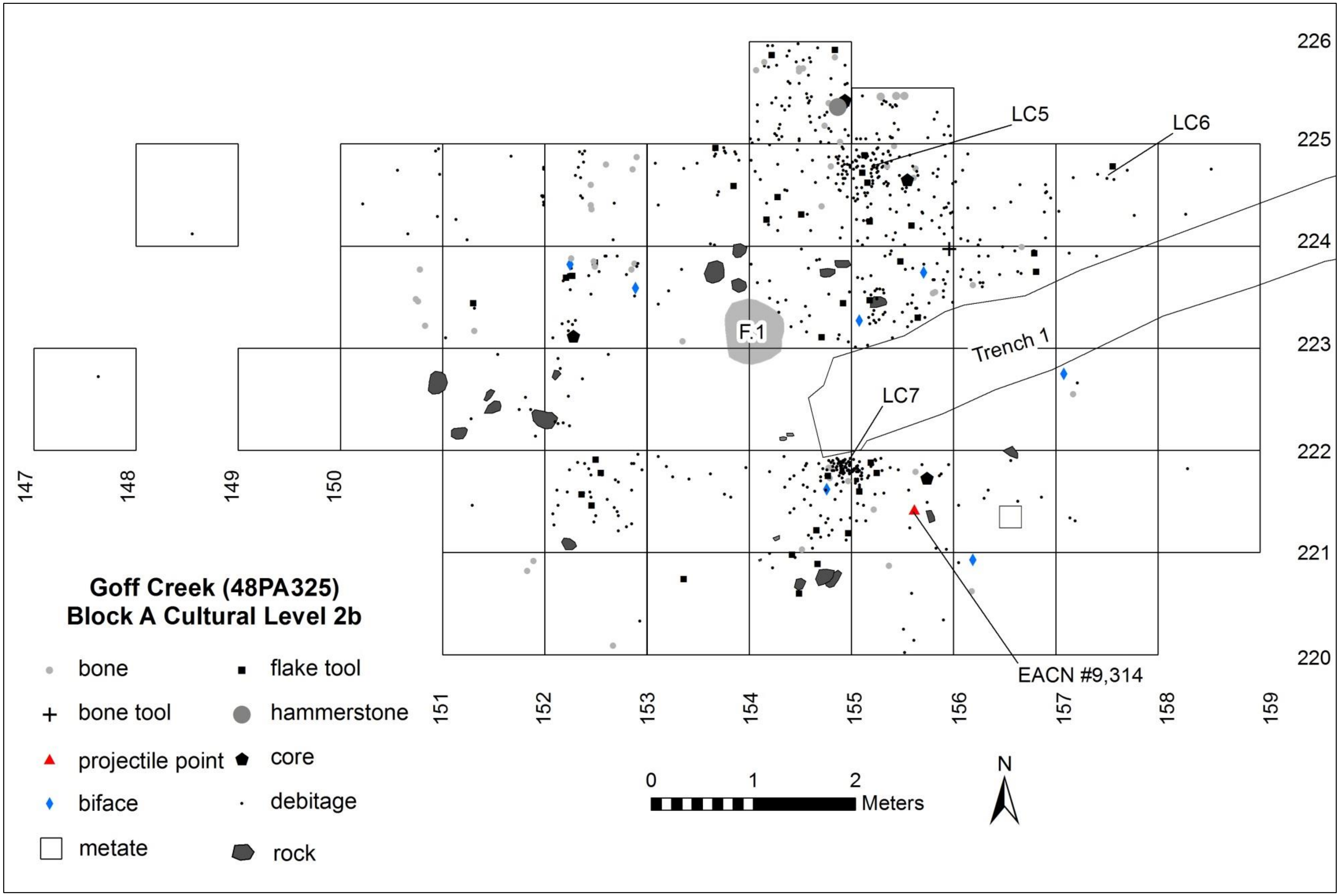
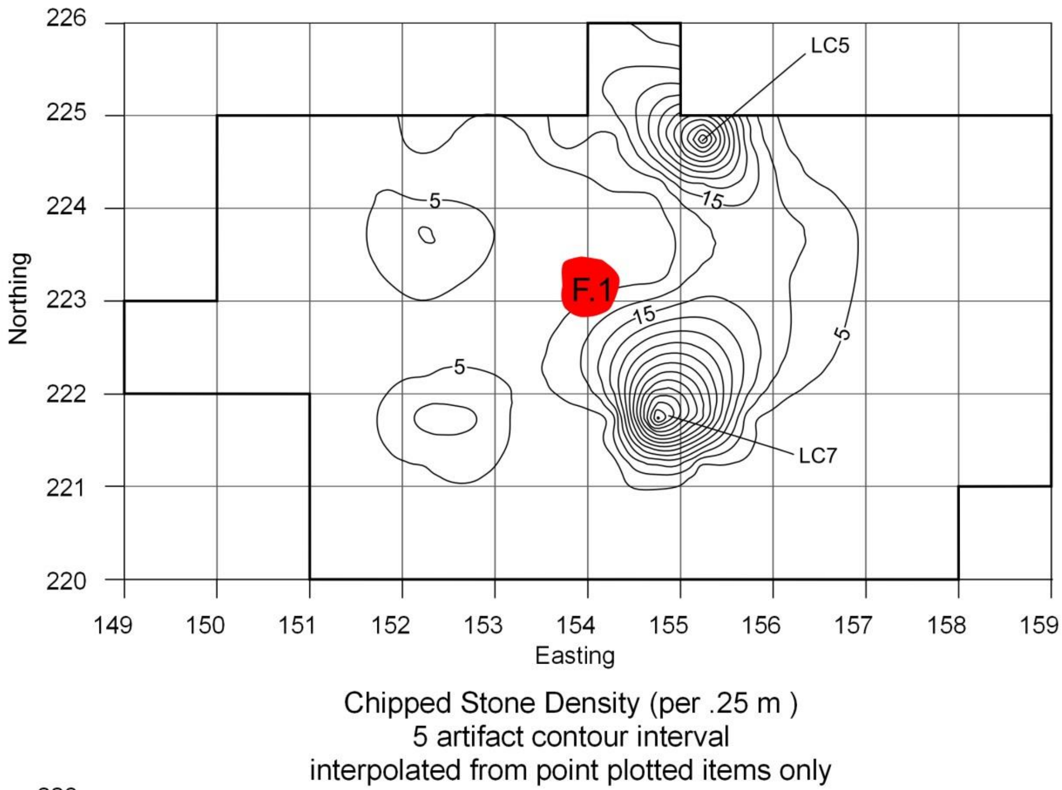


Figure 6-21 Plan view map of Block A Cultural Level 2b.



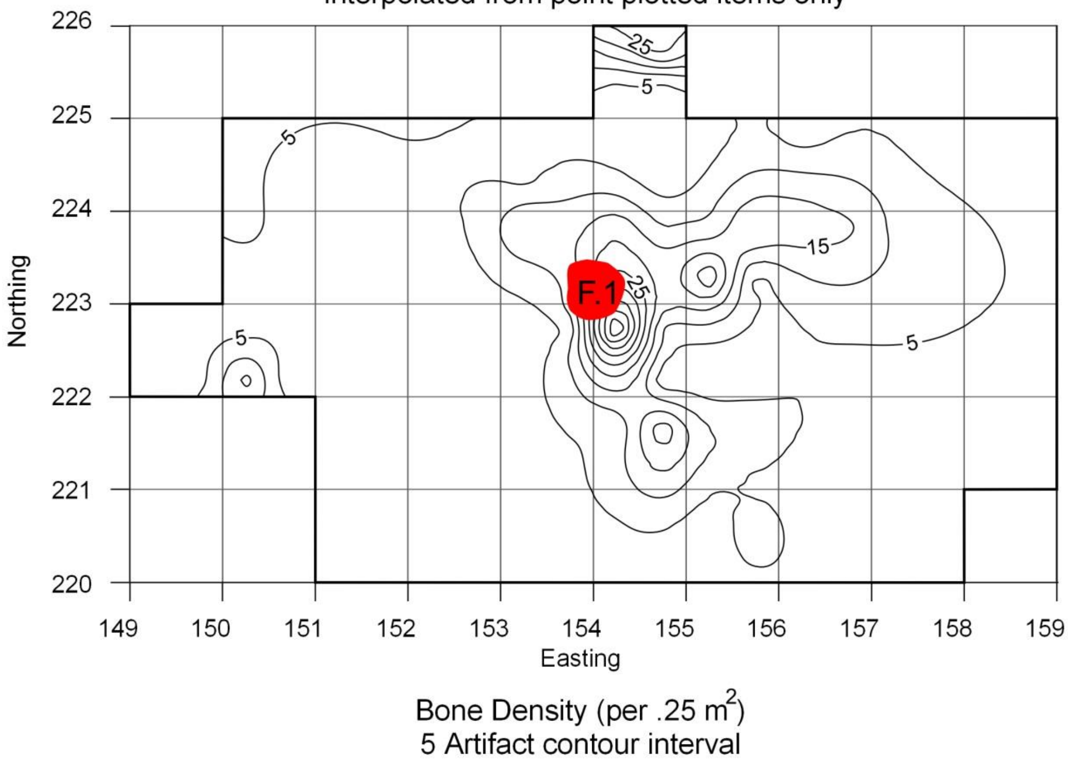


Figure 6-22 Map showing the interpolated artifact densities from Block A Cultural Level 2b.

Table 6-13 Chipped stone artifacts by material type recovered from mixed (2a/b) deposits.

Material Type	**Projectile Point**	**Biface**	**Retouched Flake**	**Utilized Flake**	**Tools Total**	**Debitage**	**Total**
Local Chert	**2**	**7**	**13**	**8**	**30**	**15,769**	**15,800**
% of artifact	66.7	63.6	76.5	88.9	75.0	83.6	83.6
% of material	<.1	<.1	0.1	0.1	0.2	99.8	
Silicified Wood		**1**	**3**		**4**	**1,835**	**1,839**
% of artifact		9.1	17.6		10.0	9.7	9.7
% of material		0.1	0.2		0.2	99.8	
Non-Local Chert		**1**			**1**	**518**	**519**
% of artifact		9.1			2.5	2.7	2.7
% of material		0.2			0.2	99.8	
Misc. Quartzite		**1**		**1**	**2**	**413**	**415**
% of artifact				11.1	5.0	2.2	2.2
% of material				0.2	0.5	99.5	
Obsidian	**1**	**1**			**2**	**286**	**288**
% of artifact	33.3	9.1			5.0	1.5	1.5
% of material	0.3	0.3			0.7	99.3	
Morrison Qtz			**1**		**1**	**10**	**11**
% of artifact			5.9		2.5	0.1	0.1
% of material			9.1		9.1	90.9	
Porcellanite						**10**	**10**
% of artifact						0.1	0.1
% of material						100.0	
Basalt						**9**	**9**
% of artifact						<.1	<.1
% of material						100.0	
Misc.						**4**	**4**
% of artifact						<.1	<.1
% of material						100.0	
Total	**3**	**11**	**17**	**9**	**40**	**18,854**	**18,894**

Table 6-14 Faunal remains recovered from mixed Cultural Level 2a and 2b deposits.

Species	**Element**	**Portion**	**Side**	**NISP**
m. artiodactyl	2nd phalange	distal	UN	1
m. artiodactyl	prox. sesamoid	complete	UN	1
mustelid sp.	long bone	distal	UN	1
Carnivore	tooth	fragment	UN	1
Unidentified	rib	proximal	UN	1
Unidentified	tooth	fragment	UN	265
Unidentified	tooth	fragment	UN	1
Unidentified	unidentified	fragment	UN	1,620
Rodent	intrusive			2
Total				1,893

close proximity to the lithic concentrations. There were fewer faunal remains in Cultural Level 2b than in Cultural Level 2a, but there were two dense clusters of highly fragmented bone found (Figure 6-22). These bone concentrations appear to be dumps of grease-rendered bone. There were three somewhat diffuse concentrations of unburned rock (Figure 6-21). No discernible patterns are present in the rock, but the sediment within Cultural Level 2 did not naturally contain any sizable rock. Thus, the rock probably represents human transported material that was perhaps used to crack bone for marrow extraction or as camp furniture to hold meat drying racks.

Mixed Cultural Level 2 Artifacts

A large number of artifacts recovered from 1/8" screening cannot be assigned to a particular cultural level because they were found in 10-cm thick levels that included deposits from both Cultural Level 2a and 2b. Over 18,000 chipped stone artifacts (Table 6-13), including three projectile point fragments (Table 6-9, Figure 6-19) and 11 biface fragments (Table 6-10), were found in the mixed deposits. As might be expected from a mixed assemblage it shares attributes with both Cultural Levels 2a and 2b. Two of the projectile points most closely resemble the Blackwater points from Mummy Cave. The third projectile point is only a small obsidian ear fragment that may have come from a Pahaska type point. Since very little obsidian was recovered from Cultural Level 2b, there is a greater probability that small ear fragment was associated with the Cultural Level 2a occupation. The mixed faunal assemblage (Table 6-14) was also large, but the vast majority (99.6%) of specimens were small unidentifiable bone or tooth fragments. None of the faunal remains could be identified to species, but it is likely that the two medium artiodactyl bones were from bighorn sheep. The *mustelid* long bone fragment is probably from either the river otter or pine marten found in Cultural Level 2a. Several fragments of bone awls were found in the mixed deposits, but they are discussed above because they could be refitted with other fragments recovered from Cultural Level 2a.

Summary and Discussion

Area A contained three cultural levels. Cultural Level 1 was confined to Strata IIa and IIb and consisted of a diffuse scatter of chipped stone and bone. Much of the bone in Cultural Level 1 was burned, which suggests that a hearth is present somewhere in the vicinity, but it was not located. No radiocarbon dates are available for Cultural Level 1 in Area A. Furthermore, only two projectile points were found in the component, neither of which is complete enough for positive identification to type. Thus, the age of the lower component is unknown.

Cultural Levels 2a and 2b were found mostly in Strata IIIb and IIIc, but Cultural Level 2a extended into the upper 10 cm or so of Stratum IIb. Although post-depositional disturbances, which included an alluvial channel and widespread evidence of rodent burrowing, has impacted the integrity of the deposits to varying degrees, enough spatial data remained to allow the identification of several discrete activity areas in Cultural Levels 2a and 2b. The raw material composition of the Cultural Levels 2a and 2b are significantly different and may reflect the timing of the occupations. However, the lithic and faunal assemblages reflect the same focus on bighorn sheep procurement and intensive processing for marrow and bone grease extraction. The evidence indicates that Cultural levels 2a and 2b were probably separated by a relatively short period of time.

Cultural Level 2a was found between about 100.30 m and 100.15 m elevation (170-185 cmbs) and contained Feature 2 and four tool production/butchering loci. No radiocarbon dates are available for Cultural Level 2a, but all of the identifiable diagnostic artifacts conform to previously described Early Archaic side and corner-notched dart types. Both Blackwater side/corner-notched and Pahaska side-notched types are present in the Cultural Level 2a assemblage in roughly equal numbers. At Mummy Cave the Blackwater point type was only recovered from the Cultural Layer 16, the earliest of the Early Archaic Levels dated to approximately 7630±170 BP (Husted and Edgar 2002). The later Early Archaic cultural layers at Mummy Cave produced only Pahaska side-notched points. These findings led Husted and Edgar (2002) to speculate that the Blackwater point type predated the Pahaska type. The evidence from Cultural Level 2a suggests that the two point types, rather than representing temporally sequential styles, may merely be ends of a morphological continuum. Francis and Widman (1999) reached a similar conclusion for the Early Archaic notched points from the Trappers Point site. Furthermore, the data indicate that the Blackwater point type may have longer temporal span than Husted and Edgar (2002) thought, because Cultural Level 2a very likely dates a thousand years later than Cultural Layer 16 at Mummy Cave.

Cultural Level 2b consisted of three lithic concentrations, interpreted as tool production loci, and Feature 1 found predominantly between 100.40 m and 100.30 m elevation (160-170 cmbs). A bulk soil sample taken from Stratum IIIc was submitted for standard radiometric processing and produced an age estimate of 5270±30 BP (Beta-87106). A piece of charcoal from Feature 1, also in Stratum IIIc, produced an AMS age estimate of 5730±30 BP (Beta-406660). The latter date probably more accurately reflects the age of the component, because bulk soil dates are prone to produce ages younger than the target event. Only one diagnostic projectile point, a Blackwater corner-notched point, was found in Cultural Level 2b.

Eakin (2012) suggested that assemblages that contain significant proportions of obsidian may evidence a late summer or fall occupation by people traveling east (out of the mountains) in preparation for winter, whereas assemblages that contain sizeable quantities of Morrison quartzite, Madison or Phosphoria chert, which are most common in the Bighorn Basin, may indicate a spring or early summer occupation by people traveling west up the North Fork of the Shoshone River. Eakin's (2012) hypothesis finds some support when the raw material compositions of Cultural Level 2a and 2b are compared. The former level contained about 3.6% obsidian, but less than one percent Bighorn Basin materials. Conversely, Cultural Level 2b was comprised of 10.7 percent Phosphoria and Madison formation cherts, but only 1.4 percent obsidian.

CHAPTER 7

RESULTS OF EXCAVATION: AREA B

Michael Page, Carmen Clayton, Dale Wedel and Brian Waitkus

Excavation Area B consists of Block B and encompasses a 31 m^2 area located approximately 13 m south of the former alignment of US Highway 14 (Figure 7-1). Twenty seven units were completely excavated and four were partially excavated. Portions of the partial units were removed in the excavation of Backhoe Trench 2. The excavation of Block B was initiated following the discovery of a buried Early Plains Archaic component in Backhoe Trench 2 in the fall of 1995. In the spring of 1996, approximately 100 cm of overburden above the cultural deposit was mechanically stripped, and excavations were conducted in July, August, and September of that year. Most of the units had between five and seven levels excavated, reaching a total depth of 99.7 m elevation (~150 cmbs).

Stratigraphy

The stratigraphy of Area B was similar to Area A. The vertical distribution of artifacts again indicated two primary cultural levels (Figures 7-3 through 7-7). The lower cultural level was approximately 20 cm thick and occurred near the contact of strata IIa and IIb between about 99.9 m to 99.7 m elevation (130-150 cmbs). Given the stratigraphic position, it is likely that this level corresponds with Cultural Level 1 in Area A. In Block B, Cultural Level 1 produced 6,387 chipped stone artifacts, 790 faunal, six features and two lithic concentrations. The stratigraphic distribution of features provides some evidence for multiple, stratified occupations. However, no clear and consistent boundaries could be defined using artifact distributions. The three radiocarbon dates obtained from Block B Cultural Level 1 produced a wide range of age estimates (6700-5700 BP), which again indicates the presence of multiple components. Lastly, although most of the artifacts and all but perhaps one feature are probably associated with the Early Archaic occupation(s), Cultural Level 1 also produced a Late Paleoindian-aged Cody point fragment. The evidence shows that Cultural Level 1 likely contains cultural material deposited over several thousand years that have since been mixed into a palimpsest.

The upper cultural level was an approximately 20 cm thick layer that was dispersed through strata IIIc, IIId and the upper part of IIb at about 100.1 m to 99.9 m elevation (110-130 cmbs [Figures 7-3 through 7-7]). Given its stratigraphic position, Cultural Level 2 in Block B probably reflects the same Early Archaic occupations identified in Cultural Level 2 in Area A. Like Area A, there is evidence for two components within Cultural Level 2, but compressed stratigraphy and post-depositional mixing prevent separation of the components. Cultural Level 2 produced 14,824 chipped stone artifacts, 5,077 pieces of bone, as well as six features and one lithic concentration. Although no radiocarbon dates are available, all of the recovered projectile points conform to Early Archaic styles.

View to the northwest

View to the south

Figure 7-1 Photographs of excavation Block B, Goff Creek (48PA325).

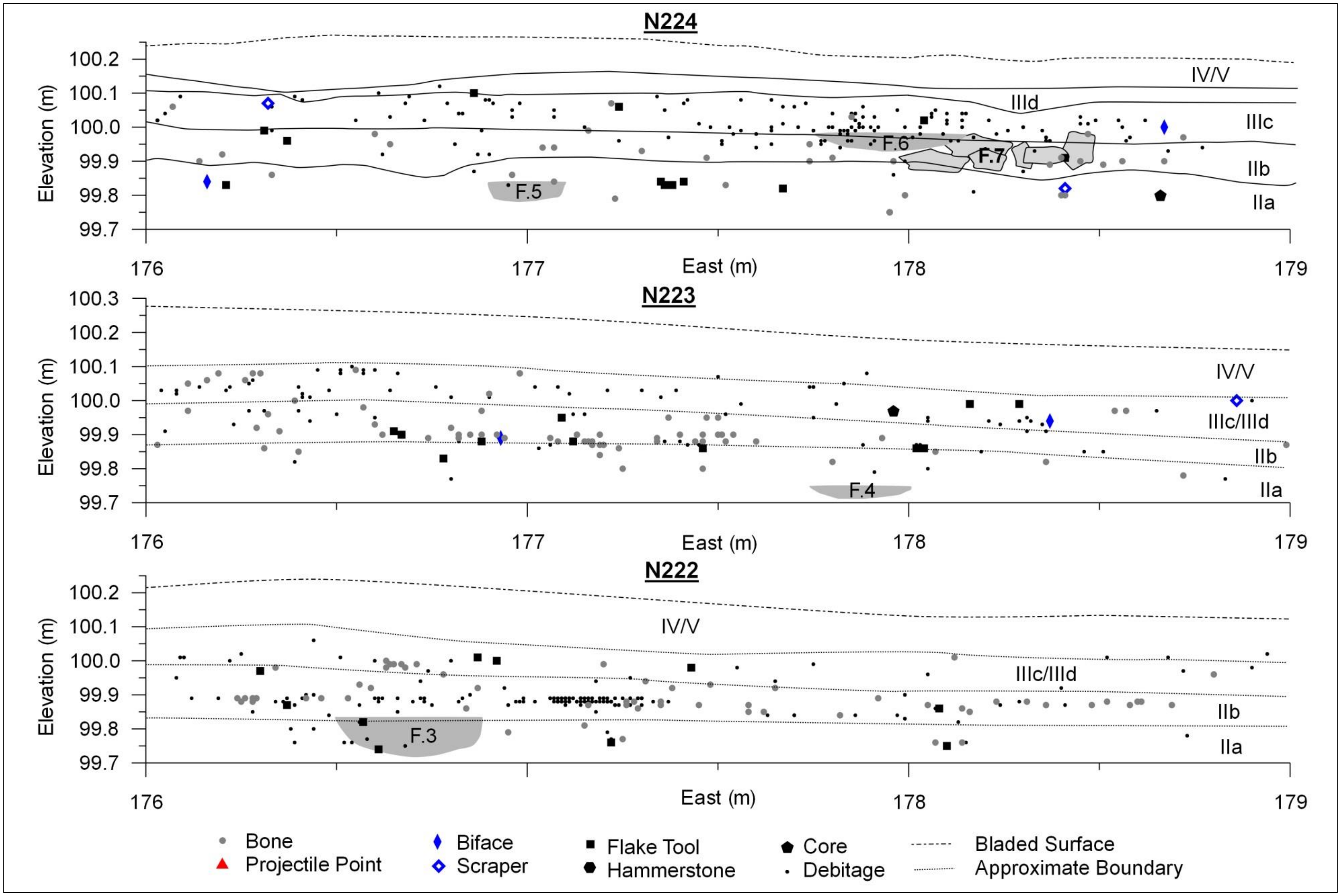


Figure 7-2 Backplots and profiles of Block B, N222-224.

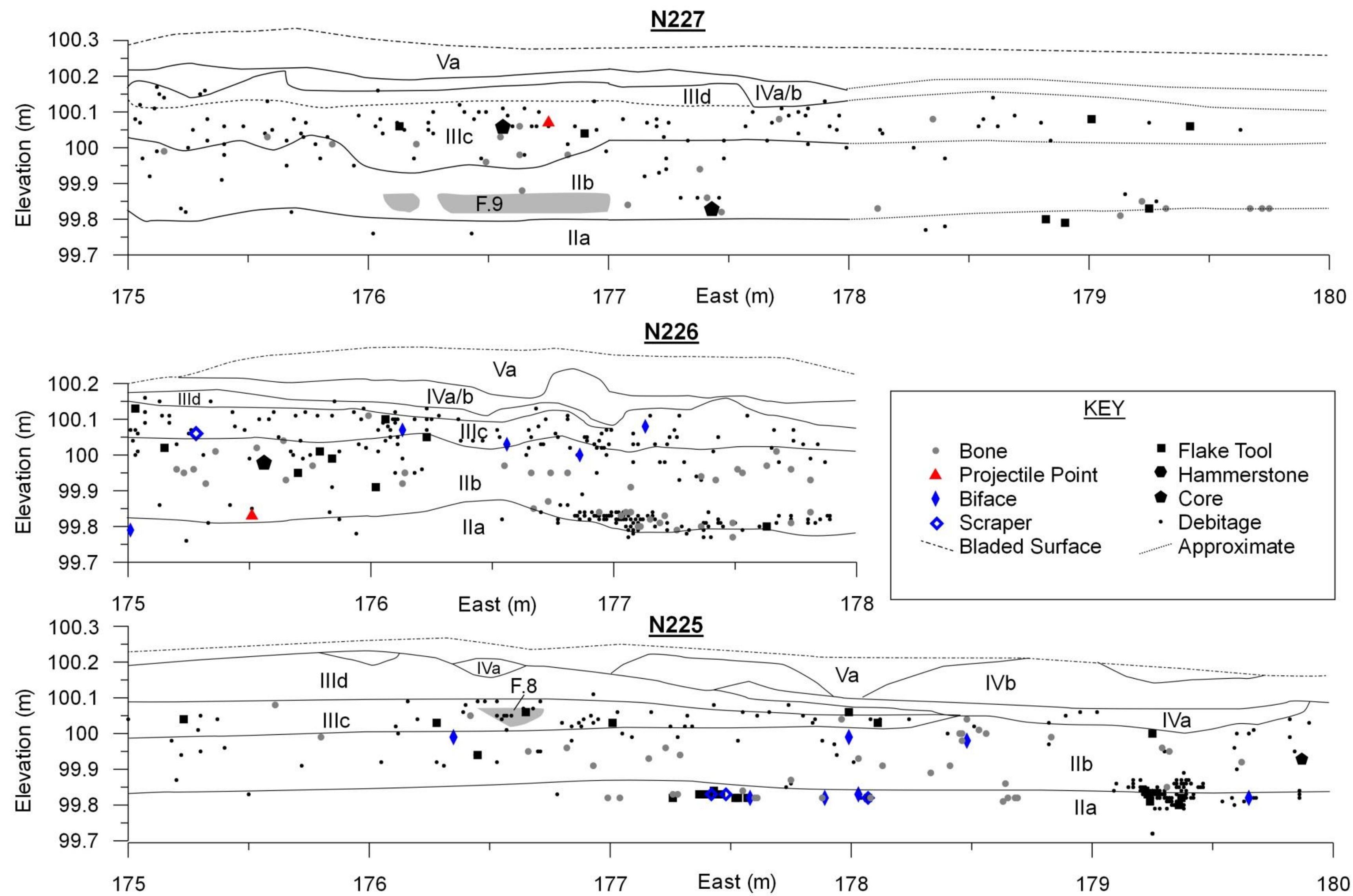


Figure 7-3 Backplots and profiles of Block B, N225-227.

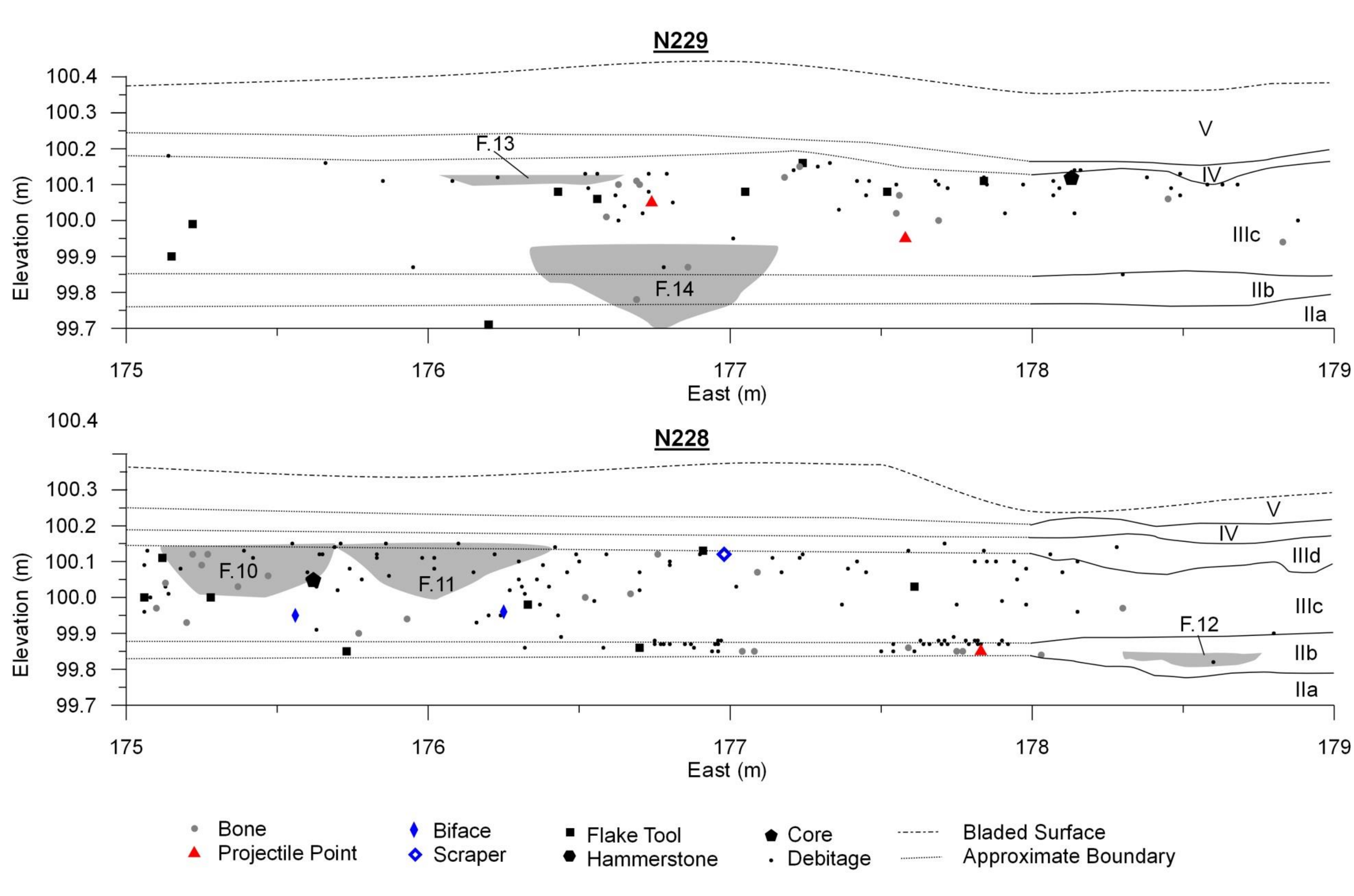


Figure 7-4 Backplots and profiles of Block B, N228-229.

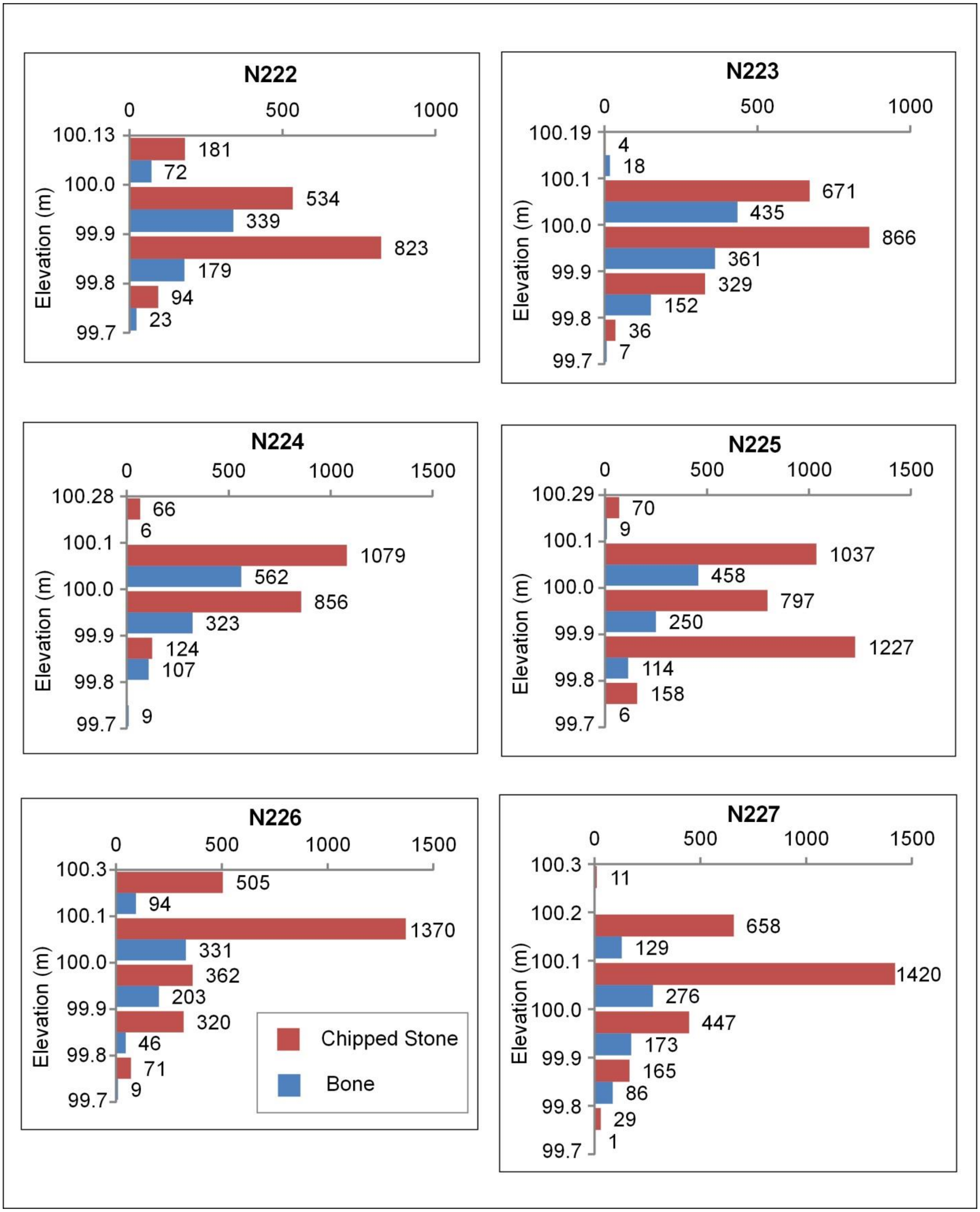


Figure 7-5 Chipped stone and bone artifact frequencies for Block B, N222-227.

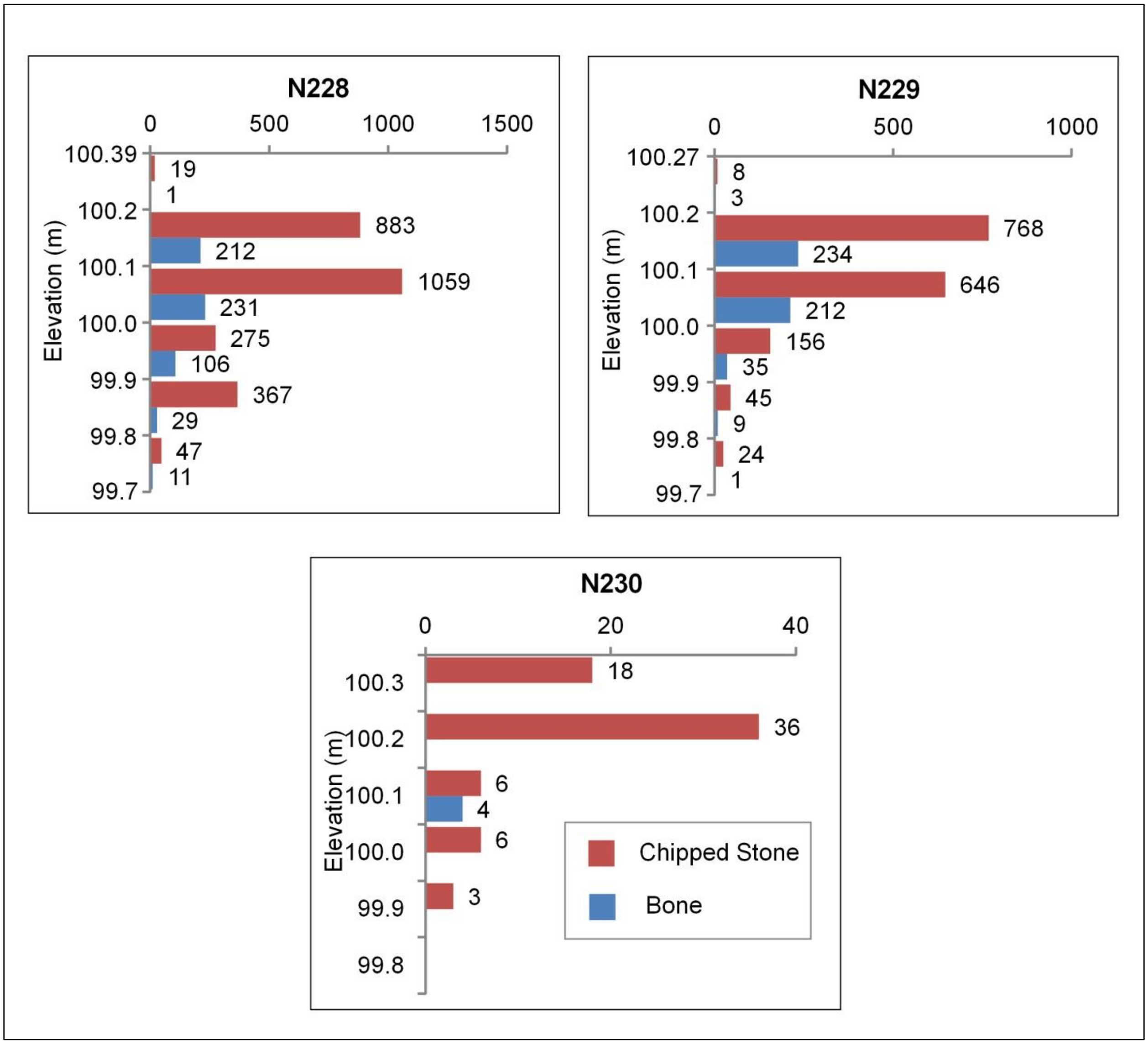


Figure 7-6 Chipped stone and bone artifact frequencies for Block B, N228-230.

Cultural Level 1

Cultural Level 1 produced a scatter of lithics and bone, Features 3, 4, 5, 9, 12, and 14, and Lithic Concentrations 2 and 3. It was densest in the center of the block north of Feature 3. Six projectile points, one hafted knife, seven bifaces, 26 utilized flakes, 22 retouched flakes and four scrapers were found in Block B Cultural Level 1 (Table 7-1). The projectile points were found between 33 and 65 cm below surface, depending on the unit, and include five Early Plains Archaic points and one Cody complex point fragment. No discernable chrono-stratigraphic boundaries or discrete occupational horizons were identified. However, Feature 4, found near the base of the cultural level may be associated with the Late Paleoindian occupation. The wide range of radiocarbon ages and temporal diagnostics indicate that Cultural Level 1 is a palimpsest of artifacts accumulated over perhaps four thousand years.

Chipped Stone

A total of 6,387 chipped stone artifacts, including 57 stone tools were recovered from Cultural Level 1 (Table 7-1). The majority (50.3%) of the chipped stone is from locally available silicified wood (32.9%) and Eocene chert (17.4%). Yet, Tensleep quartzite, a stone that is not locally available, represented the largest single category of toolstone. Relatively small percentages (2.3%) of the artifacts are obsidian, Morrison quartzite (1.5%) or, non-local chert (0.8%), basalt/igneous (<0.1%), unknown chert (<0.1%), and coarse grained quartzite (<0.1%) representing lesser percentages (Table 7-1). Comparison of raw material frequencies of tools and debitage reveals that a much greater proportion of the chipped stone tools (91.2%) are made of locally available materials. The high percentage of Tensleep Quartzite in the assemblage reflects the reduction of one or two Tensleep quartzite nodules recovered from Lithic Concentrations 1 and 3.

Table 7-1 Block B, Cultural Level 1 chipped stone artifacts by raw material type.

MATERIAL TYPE	ARTIFACT TYPE									
	Projectile Point	**Hafted Knife**	**Biface**	**Scraper**	**Retouched Flake**	**Utilized Flake**	**Tools Total**	**Core**	**Debitage**	**Material Total**
Tensleep QTZ	**2**				**1**	**2**	**5**		**2,857**	**2,862**
% of artifact	33.3				4.5	7.7	8.8		45.2	44.8
% of material	0.1				<0.1	0.1	0.2		99.8	
Silic. Wood			**4**		**10**	**10**	**24**	**2**	**2,075**	**2,101**
% of artifact			57.1		45.5	38.5	42.1	100	32.8	32.9
% of material			0.2		0.5	0.5	1.1	0.1	98.8	
Local Chert	**2**	**1**	**1**	**4**	**8**	**12**	**28**		**1,085**	**1,113**
% of artifact	33.3	100	14.3	100	36.4	46.2	49.1		17.2	17.4
% of material	0.2	0.1	0.1	0.4	0.7	1.1	2.5		97.5	
Obsidian			**1**				**1**		**147**	**148**
% of artifact									2.3	2.3
% of material									99.3	
Morrison QTZ	**1**				**3**		**4**		**94**	**98**
% of artifact	16.7				13.6		7.0		1.5	1.5
% of material	1.0				3.1		4.1		95.9	
Nonlocal Chert						**1**	**1**		**49**	**50**
% of artifact						3.8	1.8		0.8	0.8
% of material						2.0	2.0		98.0	
Miscellaneous	**1**		**1**			**1**	**3**		**12**	**15**
% of artifact	16.7		14.3			3.8	5.3		0.2	0.2
% of material	6.7		6.7			6.7	20.0		80.0	
Artifact Total	**6**	**1**	**7**	**4**	**22**	**26**	**57**	**2**	**6,319**	**6,387**

Debitage

Lithic analysis reveals that flake fragments (49.5%) are the most common artifact type with broken flakes (30.5%), debris (7.2%), and complete flakes (12.8%) composing the rest of the sample. Thus, the tool maintenance/manufacture category comprises almost 90% of the assemblage. Of the complete flakes (n=481), only 25 exhibit evidence of a cortex and represent less than one percent of the total debitage assemblage. The overall assemblage then indicates that on-site primary lithic reduction is not the main activity reflected by the assemblage. It appears that most debitage within Cultural Level 1 was produced from finished or nearly finished tools. This is generally supported by the small size of artifacts in the assemblage, with over 75 percent of the assemblage measuring less than one-quarter inch in maximum dimension. Sullivan and Rosen (1985) found that high percentages of broken and non-cortical flakes indicate tool manufacture and maintenance rather than core reduction. This trend is supported by the sparse recovery of cores, only two of which were found. Generally speaking, the Cultural Level 1 lithic assemblage indicates stone working activities in the excavation block focused on repair and maintenance of tools and weaponry derived of toolstone from both local and non-local sources.

Projectile Points and Hafted Knife

Of the six projectile points found in Block B, four are side-notched dart points, one is a corner-notched dart point, and one is a midsection fragment of what appears to be a Late Paleoindian Cody complex point fragment (Table 7-2). Three of the five notched dart points, including both side and corner-notched specimens, are represented by only small lateral base fragments. Point #13,953 is made of locally available Eocene chert, point #14,403 is made of Morrison quartzite, and point #14,244 is made of miscellaneous quartzite. All three show some evidence of grinding on the haft margins. Two of the point fragments consist of complete side-notched bases (#15,376 and #13,633 [Figure 7-7]). Point #15,376 is made of locally available Eocene chert and point #13,633 is made of an unidentified quartzite. Both point fragments have lightly ground basal margins. All of the notched points are stylistically similar to Early Archaic side and corner-notched darts documented at sites throughout the region (Husted and Edgar 2002; Kornfeld et al. 2010; Larson 2012).

Point #13,940 is a midsection of a Cody complex point (Figure 7-7). The point is made of an unidentified tan chert. The edges of the blade are convex and symmetrical. The distal end displays a bend break. The absence of the base precludes the precise assignment of type (e.g. Scottsbluff or Eden), but the well-executed, serial, comedial flaking pattern, with limited margin retouch, is a diagnostic trait of the Cody complex (Bradley and Frison 1987). The Cody point was found close to and at about the same depth as an Early Archaic point fragment (#13,953) on the eastern edge of Block B.

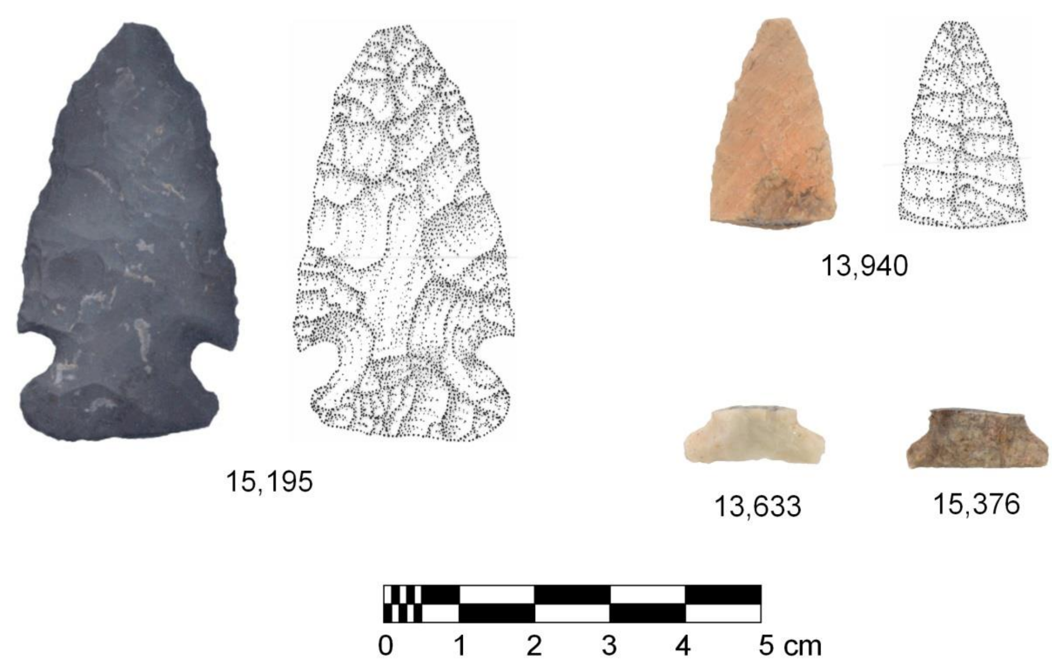


Figure 7-7 Photographs of hafted knife and projectile points recovered from Block B Cultural Level 1.

Table 7-2 Attributes of projectile points and hafted knife recovered from Block B Cultural Level 1.

Catalog#	Unit	Elevation (m)	Material	Portion	Point Type	Haft Type	Prox. Shld. Angle (°)	Max. Length (mm)	Base Width (mm)	Haft Width (mm)	Max. Thickness (mm)	Notch Depth (mm)	Notch Width (mm)	Fracture Patter
13633	N224 E176	99.85-99.80	TSQ	BA	PH	SN	152	7.7	18.7	11.5	4.8	4.1		BND
13940	N226 E175	99.83	UIC	TP	CY			27.9			5.8			BND
13953	N226 E175	99.90-99.80	EC	ER		CN	122	12.3			3.7			BND
14244	N225 E178	99.90-99.80	TSQ	ER		SN		9.7			3			BND
14403	N226 E176	99.85-99.80	MOQ	ER		SN		7			1.8			BND
15376	N229 E178	99.90-99.80	EC	BA	PH	SN	143	9	19	12.8	4.1	2.9		BND
15195	N228 E177	99.85	EC	CO		SN		50.1	25.9	17.6	8.6	4.7	6.5	NA

Material: EC-Eocene Chert; MOQ-Morrison Quartzite; TSQ-Tensleep Quartzite; UIC-unidentified chert. Portion: CO-Complete; BA-base; ER-ear/lateral base fragment; TP-tip. Point Type: PH-Pahaska; CY-Cody. Haft Type: SN-side-notched; CN-corner-notched. Fracture Pattern: BND-bend break.

A large side-notched knife (#15,195) made of gray Eocene chert was also found in Block B Cultural Level 1 (Table 7-2, Figure 7-7). The knife was created mostly through percussion with some pressure retouch on the edges. It is mostly complete except for the extreme distal tip that was removed with a bend break. One convex lateral edge with a 58° angle has undercutting and large, deep step fracturing indicating scraping a hard surface. The opposing convex lateral edge has a 66° angle displaying some attrition and use. The base and notches are ground. The distal tip displays a bend break fracture.

Bifaces

Seven bifaces were recovered from Block B Cultural Level 1 (Table 7-3; Appendix B). Five were made from locally available material, and two were made of non-local materials. Six of the bifaces are stage III, and one is a stage V. Biface 12,786 is a black/yellow Eocene chert stage III biface fragment displaying a bend break (Figure 7-9). All remaining edges were utilized to scrape a semi-hard material. Biface #12,794 is a stage III fragment made from a gray and white chert that may be from the Madison formation (Figure 7-9). The specimen appears to have broken during manufacture along an internal flaw. The portion of a convex lateral edge displays rounding, small and large scalar scars, and small step fractures on both surfaces that suggest it was used to cut a semi-hard material. However, grinding of platforms during reduction may have produced the edge scarring rather than use wear. Biface #13,632 is a gray silicified wood stage III biface tip fragment with a dive-through hinge fracture (Figure 7-9). The convex lateral edge displays rounding, blunting, undercutting, small scalar scars, and deep step fractures from use on a hard material. Biface #14,229 is a complete gray silicified wood stage III biface with no visible use wear. Biface 14,806 is a gray silicified palm wood stage III lateral edge fragment. The biface

Table 7-3 Attributes of bifaces recovered from Block B Cultural Level 1.

Catalog #	Unit	Elevation (m)	Portion	Material	Stage	Max. Length (mm)	Max Width (mm)	Max. Thickness (mm)	Use1	Mat. Worked	Use 2	Mat. Worked 2
12,786	N225 E177	99.82	UN	EC	III	39.2	25.8	9.2	S	SH	S	SH
12,794	N225 E177	99.82	UN	UIC	III	46.7	27.2	9.8	C	SH		
13,158	N223 E176	99.89	CO	SW	III	63.8	40.7	18.2	S	SH	S	SH
13,632	N224 E176	99.84	DS	SW	III	47.5	33.1	10	S	H		
14,229	N225 E178	99.83	CO	SW	III	44.9	32.8	8.2				
14,806	N225 E179	99.82	LT	SW	III	30.7	7.9	5				
13,954	N226 E175	99.79	UN	OB	V	15	11.9	5.1				

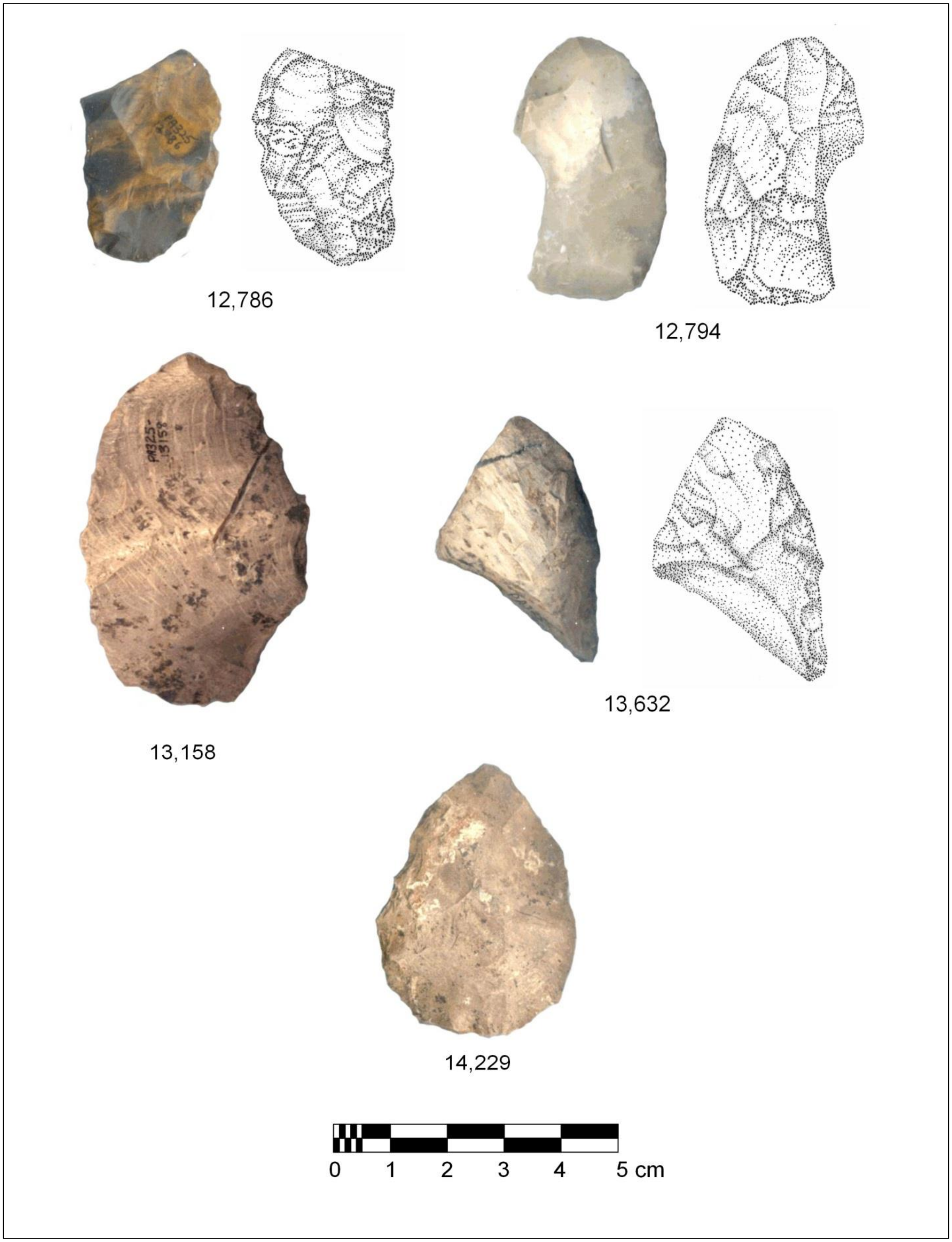


Figure 7-8 Photographs of bifaces recovered from Block B Cultural Level 1.

fractured as a result of an internal flaw in the material. There is no visible use wear on the remaining lateral edge. Biface #13,954 is a small obsidian stage V biface fragment displaying a bend break. Biface #13,158 is a complete stage III specimen made of silicified wood that appears to have been used to scrape a semi-hard material.

Utilized and Retouched Flakes

Twenty-six expedient tools displaying edge utilization were recovered from Block B Cultural Level 1. The utilized flakes are predominately made of variously colored Eocene chert (n=12), and silicified wood (n=10). The material types of the remaining utilized flakes include two miscellaneous quartzites, and one each of Madison chert and an unknown chert (Table 7-1). Thirteen of the tools exhibit only one utilized edge, while eight tools showed use wear on two edge locations and five on three edges for a combined total of 44 utilized edges. Cutting was the dominate use wear of the utilized flake edges (n=25). Within this use activity seven flake edges were used to cut a soft material and 18 to cut a semi-hard material. Scraping activities were identified on 19 of the utilized flake edges. Two of the edges worked a soft material and 17 edges worked a semi-hard material.

The 19 expedient tools displaying edge retouch are predominately made of silicified wood and variously colored Eocene chert (Table 7-1). The material types of the remaining retouched flakes included Morrison quartzite (n=3), and one miscellaneous quartzite. Thirteen of the tools had one edge utilized, while two tools showed retouching/use wear on two edges, and four tools on three edges.

Scraping was the dominate use wear identified on 20 edges of the 19 retouched flakes. Within this use activity seven edges were used to scrape a soft material, ten were used to scrape a semi-hard material, and three were used to scrape a hard material. Scraping/planing activity on semi-hard material was identified on five of the retouched flake edges. Grooving was identified on one edge. A cutting activity on semi-hard material was identified on two of the edges. One edge use wear was of indeterminate use on soft material.

Scrapers

Four scrapers were found in Block B Cultural Level 1 (Table 7-4, Figure 7-9; Appendix B). They consist of two end scrapers (#13,727 and #14,230) and two side scrapers (#14,007, #14,008). All of the scrapers are made from locally acquired Eocene aged chert. Use wear analysis reveals that the tools were used to scrape semi-hard material, and hide materials. One of the scrapers (#14,008) has a Limace or slug-like overall shape. The scrapers were horizontally located in the southern portion of Block B, north and east of Feature 3 and at approximately the same elevation as the feature.

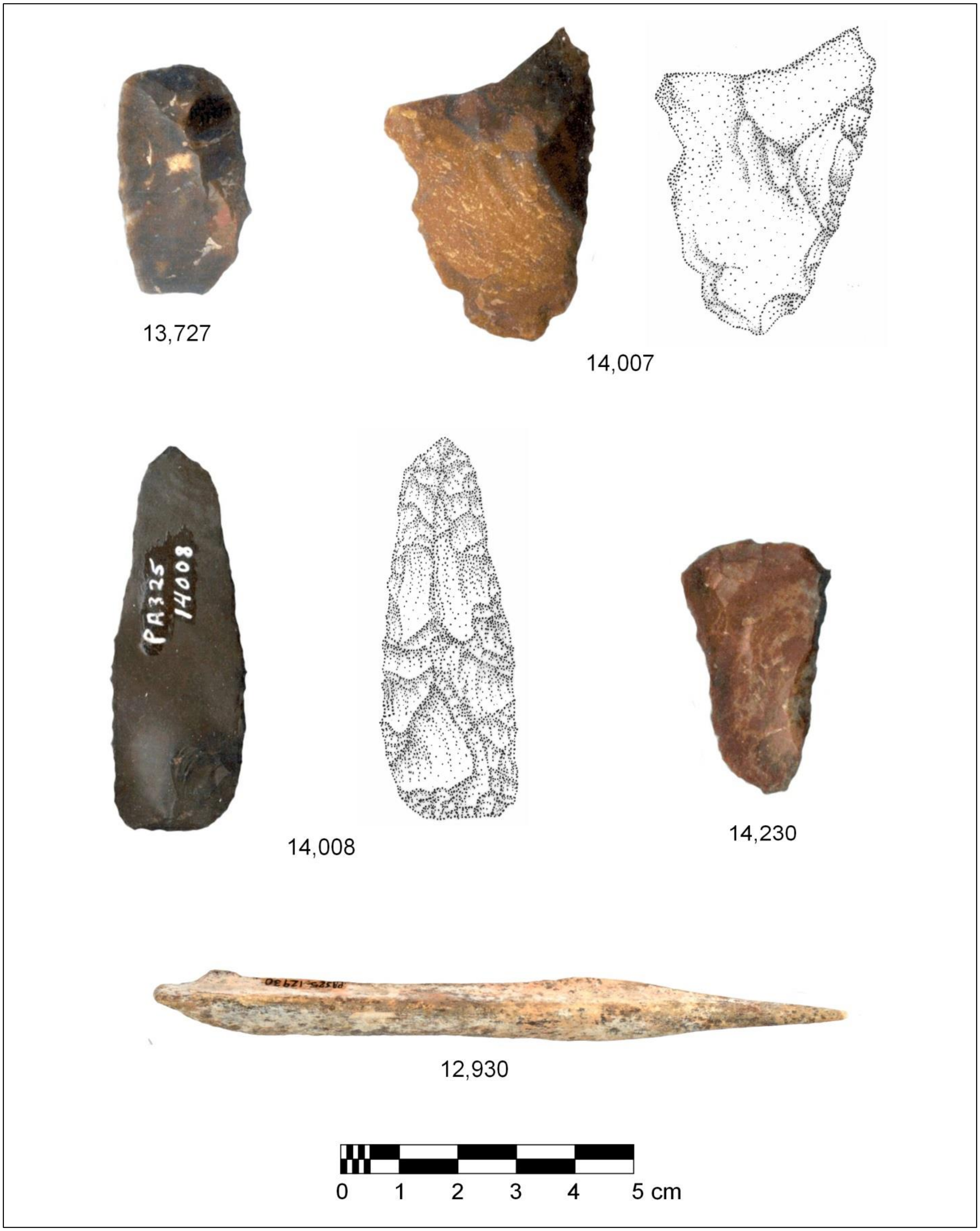


Figure 7-9 Photographs of scrapers and bone awl recovered from Block B Cultural Level 1.

Table 7-4 Scrapers recovered from Block B Cultural Level 1.

Cat#	Type	Portion	Material	Length	Width	Thickness	Mat. Worked 1	Mat. Worked 2
13,727	end	Complete	local chert	39.75	23.05	8.67	hide	
14,007	side	Proximal	local chert	54.54	36.64	7.71	s-hard	
14,008	side	Complete	local chert	64.84	22.94	10.36	s-hard	s-hard
14,230	end	Complete	local chert	40.93	24	6.77		

Faunal Remains

A total of 703 bone and 87 pieces of tooth enamel were recovered from Block B Cultural Level 1 (Table 7-5). Of these, the majority (n=702, 88.6%) is comprised of unidentifiable fragments. Bighorn sheep is the only identifiable species present in the assemblage and is represented by 12 specimens. There was a minimum of one individual sheep present. Another 78 specimens were identified as medium-sized artiodactyl, and are likely from sheep as well. There is abundant evidence for human modification (i.e. butchering and processing). Spiral bone fractures indicative of fresh green bone breaks were noted on 80 specimens, two of which also bore impact cones (Table 7-6). Some degree of burning was noted on 210 specimens. The faunal assemblage from Cultural Level 1 is comprised primarily of highly fractured bone indicative of bone cracking for marrow extraction. The relatively small number of articular ends indicates that the cancellous bone was likely pulverized and boiled for bone grease extraction.

Table 7-5 Number of identifiable faunal specimens from Block B Cultural Level 1.

Species	**Element**	**Portion**	**Side**	**NISP**
bighorn sheep	humerus	fragment	L	1
bighorn sheep	metacarpal	proximal	L	2
bighorn sheep	mandible	fragment	L	1
bighorn sheep	mandible	fragment	R	2
bighorn sheep	scapula	fragment	R	1
bighorn sheep	tibia	fragment	R	1
bighorn sheep	tooth	complete	UN	1
bighorn sheep	tooth fragment	distal	UN	3
m. artiodactyl	femur	fragment	R	1
m. artiodactyl	femur	fragment	UN	4
m. artiodactyl	humerus	fragment	UN	2
m. artiodactyl	innominate	fragment	R	1

Table 7-5 Number of identifiable faunal specimens from Block B Cultural Level 1.

Species	Element	Portion	Side	NISP
m. artiodactyl	innominate	fragment	L	1
m. artiodactyl	innominate	fragment	UN	1
m. artiodactyl	long bone	fragment	UN	1
m. artiodactyl	long bone	proximal	UN	1
m. artiodactyl	long bone	shaft	UN	48
m. artiodactyl	metacarpal	fragment	L	1
m. artiodactyl	metapodial	proximal		1
m. artiodactyl	metapodial	shaft	UN	2
m. artiodactyl	metatarsal	fragment	L	1
m. artiodactyl	metatarsal	fragment	R	1
m. artiodactyl	metatarsal	fragment	UN	1
m. artiodactyl	1st phalange	proximal	UN	1
m. artiodactyl	2nd phalange	proximal	R	1
m. artiodactyl	rib	fragment	UN	1
m. artiodactyl	radius	fragment	L	1
m. artiodactyl	radius	fragment	UN	1
m. artiodactyl	radius	fragment	R	1
m. artiodactyl	scapula	fragment	L	1
m. artiodactyl	scapula	fragment	R	1
m. artiodactyl	tibia	fragment	R	1
m. artiodactyl	tooth fragment	distal	UN	1
m. artiodactyl	unidentified	fragment	UN	1
unidentified	long bone	fragment	UN	1
unidentified	long bone	shaft	UN	38
unidentified	tibia	fragment	L	1
unidentified	tooth	complete	UN	1
unidentified	tooth fragment	fragment		81
unidentified	unidentified	fragment		577
unidentified	unidentified	shaft	UN	1
total				790

Bone Tool

A complete, unburned, bone awl made from a spirally broken splinter of a medium artiodactyl metapodial was also found in Block B Cultural Level 1(Figure 7- 9). The specimen is 116.5 mm long and 10.6 mm wide and triangular in cross section with the distal 30.9 mm worked into a round, tapering point. The awl is well-preserved, and the bit retains some use wear polish.

Table 7-6 Breakage type, presence of cut/impact marks and burning in the faunal assemblage from Block B Cultural Level 1.

Species	Break	Cut/Impact	Burned	NISP
bighorn sheep				1
bighorn sheep	dry			7
bighorn sheep	green			4
m. artiodactyl				1
m. artiodactyl	dry			12
m. artiodactyl	dry		X	1
m. artiodactyl	green			63
m. artiodactyl	green		X	1
unidentified				449
unidentified			X	204
unidentified	dry			31
unidentified	dry		X	4
unidentified	green			10
unidentified	green	X		2
total				790

Features

Six features (3, 4, 5, 9, 12, and 14) were found within Block B Cultural Level 1 (Figure 7-11). Feature 4 was found with stratum Ia at 99.75 m elevation (145 cmbs), below all the other features, and may be associated with the Late Paleoindian Cody complex component. However, no radiocarbon dates, and no associated diagnostics are available to confirm this. Features 3, 5, 9 and 12 were all identified in stratum IIb between 99.87 m and 99.83 m elevation (133-137 cmbs). Multiple projectile points diagnostic of the Early Archaic were found at about the same elevation and three radiocarbon dates from the level all fall within the Early Archaic period as well. Feature 14 was found in stratum IIIc approximately 6-10 cm above the remaining features and 5-20 cm below the features in the overlying cultural level. This feature may date to the same occupations as Features 3, 5, 9 and 12 because it is upslope of those features. It is also possible that it is from a slightly later occupation. Although, the vertical distribution of features suggests three components, no corresponding associated cultural material can be identified with confidence due to compressed stratigraphy and post-depositional mixing.

Feature 4 was a shallow, basin-shaped, unlined hearth located within excavation unit N223 E177 (Figures 7-10 and 7-11). A portion of the feature extended to the east into unit N223 E178 but was not recognized during excavation. Feature 4 measured 23 cm N-S and a partial measurement of 15 cm E-W. Original E-W dimensions are estimated to be about 30 cm. It had a depth of 4 cm, with its top elevation at 99.75 m and its bottom at 99.71 m (145-149 cmbs). The feature contained lightly stained fill and some charcoal flecking but no fire-cracked rock. No bone was observed in the fill. The fill was collected for flotation, but produced only 82 mg of unidentifiable charcoal. The feature was not dated.

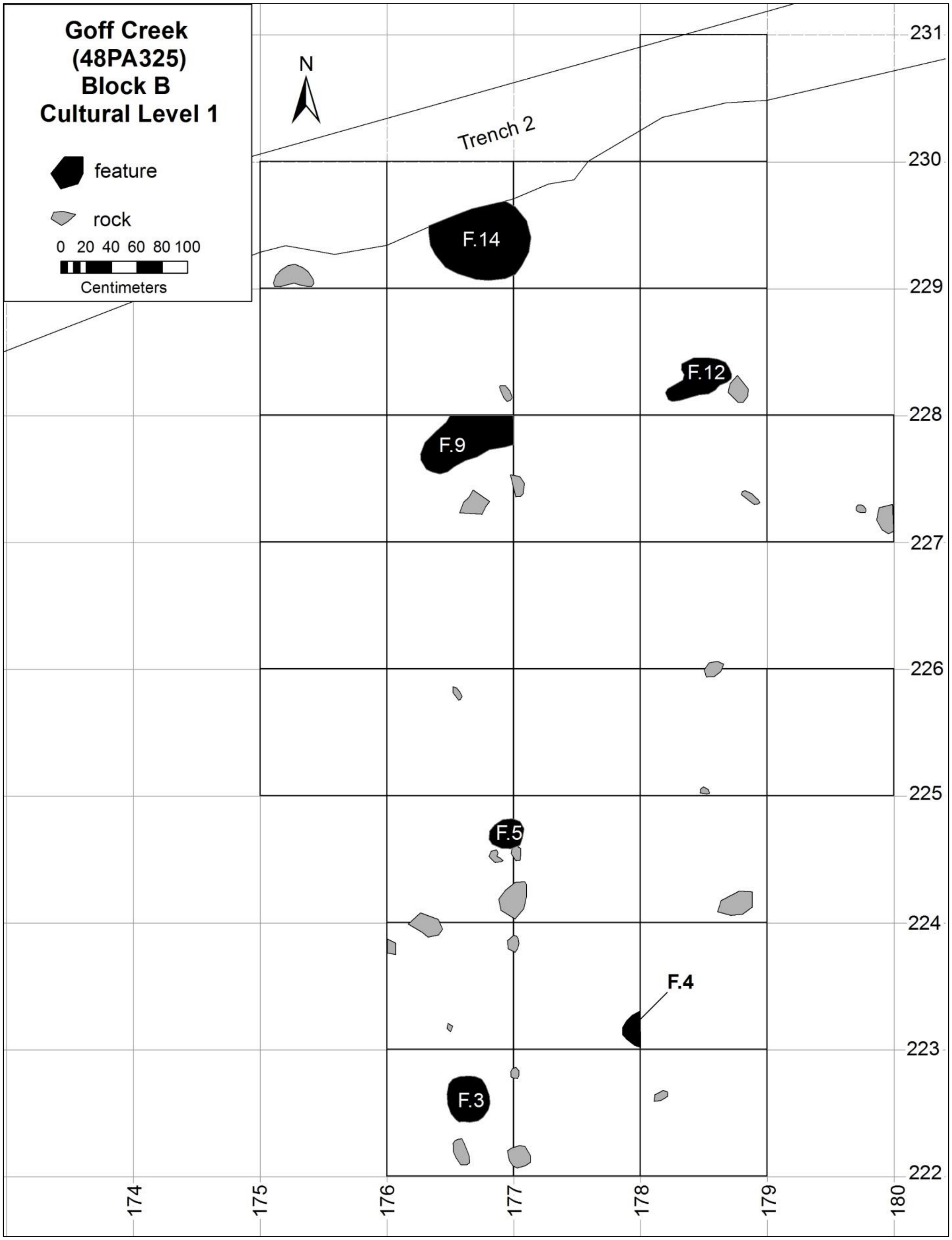


Figure 7-10 Plan view map of Block B Cultural Level 1 showing location of features.

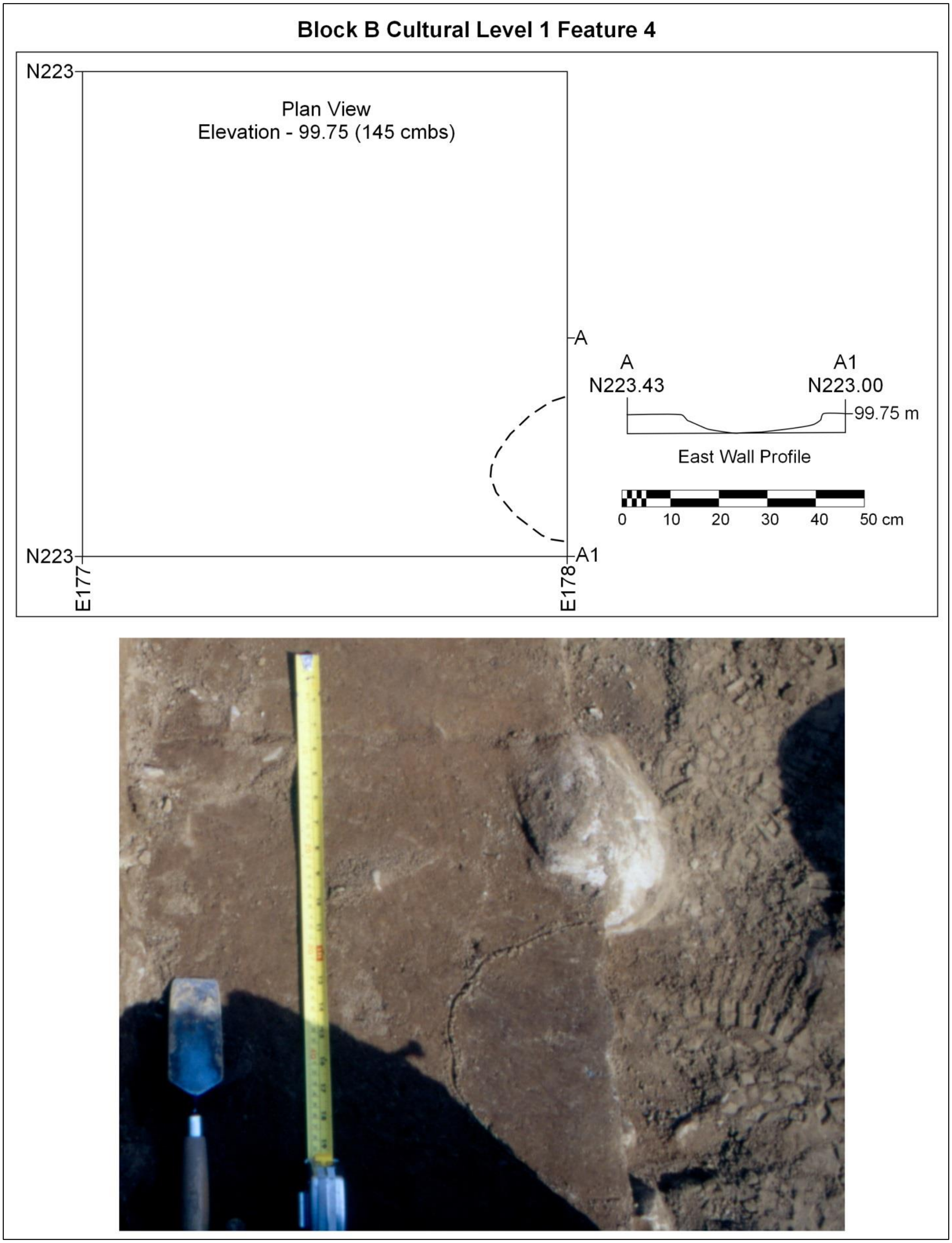


Figure 7-11 Photograph and illustration of Feature 4, Block B Cultural Level 1.

Feature 5 was a shallow, basin-shaped, unlined hearth located primarily within excavation unit N224 E176 with approximately one quarter of the feature extending into unit N224 E177 (Figures 7-10 and 7-12). It was not recognized during excavation of that unit, however, so that portion of the feature is not documented. The part that was documented measured 24 cm N-S and a partial measurement of 23 cm E-W. Original E-W dimensions are estimated to be about 30 cm. The feature was 6 cm deep, ranging in elevation from 99.84 m to 99.78 m (136-142 cmbs). The feature fill was dark brown to almost black in color with no visible charcoal chunks. Insect cast disturbance was noted in the fill area. No fire-cracked rock was present. No bone was observed, but one flake was mapped in the feature. The feature fill from unit N224 E176 was collected for flotation and possible carbon dating. A bulk sample of organic sediment was submitted for a standard radiometric date. The sample produced a date of 5700±80 BP (Beta 97539), which is very likely younger than the target event due to the inherent inaccuracy of bulk organic sediment dates (Birkland 1984; Pessenda et al. 2001; Stein 1992). Unfortunately, only 1 mg of charcoal, too small for even an AMS date, remains.

Feature 3 was a roughly basin-shaped, unlined hearth (Figures 7-10 and 7-13) located entirely within excavation unit N222 E176. It measured 36 cm N-S, 32 cm E-W, and had a depth of 12 cm, with its top elevation of 99.83 m (137 cmbs) and its bottom at 99.71 m (149 cmbs). The feature fill was darker than surrounding sediment with charcoal chunks but no fire-cracked rock. No bone was observed, but one utilized flake was recovered *in situ*. The fill was collected for flotation and dating resulting in the recovery of several grams of wood charcoal. A sample of charcoal was submitted for standard radiometric dating. The sample was small and extended counts were taken. Nevertheless, the sample produced an age estimate of 6700±230 (Beta 97534). The large standard deviation limits the interpretive value of the date because when calibrated at 2σ it produces an age range of nearly 1,000 years. A sample of 1.4 grams of charcoal remains from the feature, which is sufficient for multiple AMS radiocarbon dates.

Feature 12 was an amorphous, somewhat basin-shaped, poorly defined stain located within excavation unit N228 E178 (Figures 7-10 and 7-14). It is unclear whether it was a hearth remnant or perhaps hearth clean out. It measured approximately 35 cm N-S by 50 cm E-W and 4 cm deep, ranging in elevation from 99.85 m to 99.81 m (135-139 cmbs). The feature fill consisted of mottled staining that was darker in the center and became lighter towards the edges. No charcoal or fire-cracked rock was present. No bone was observed. One rock was mapped on the south side of the feature but it was not identified as being FCR. The southern half of the fill was collected for flotation, but no macro-floral material was recovered.

Feature 9 consisted of two amorphous stains, possibly hearth clean out, located in the northern portion of excavation unit N227 E176 (Figures 7-10 and 7-15). The larger stain appears to have extended to the north and east (N228 E176, N228 E177, N227 E177) but was not recognized in those units. The

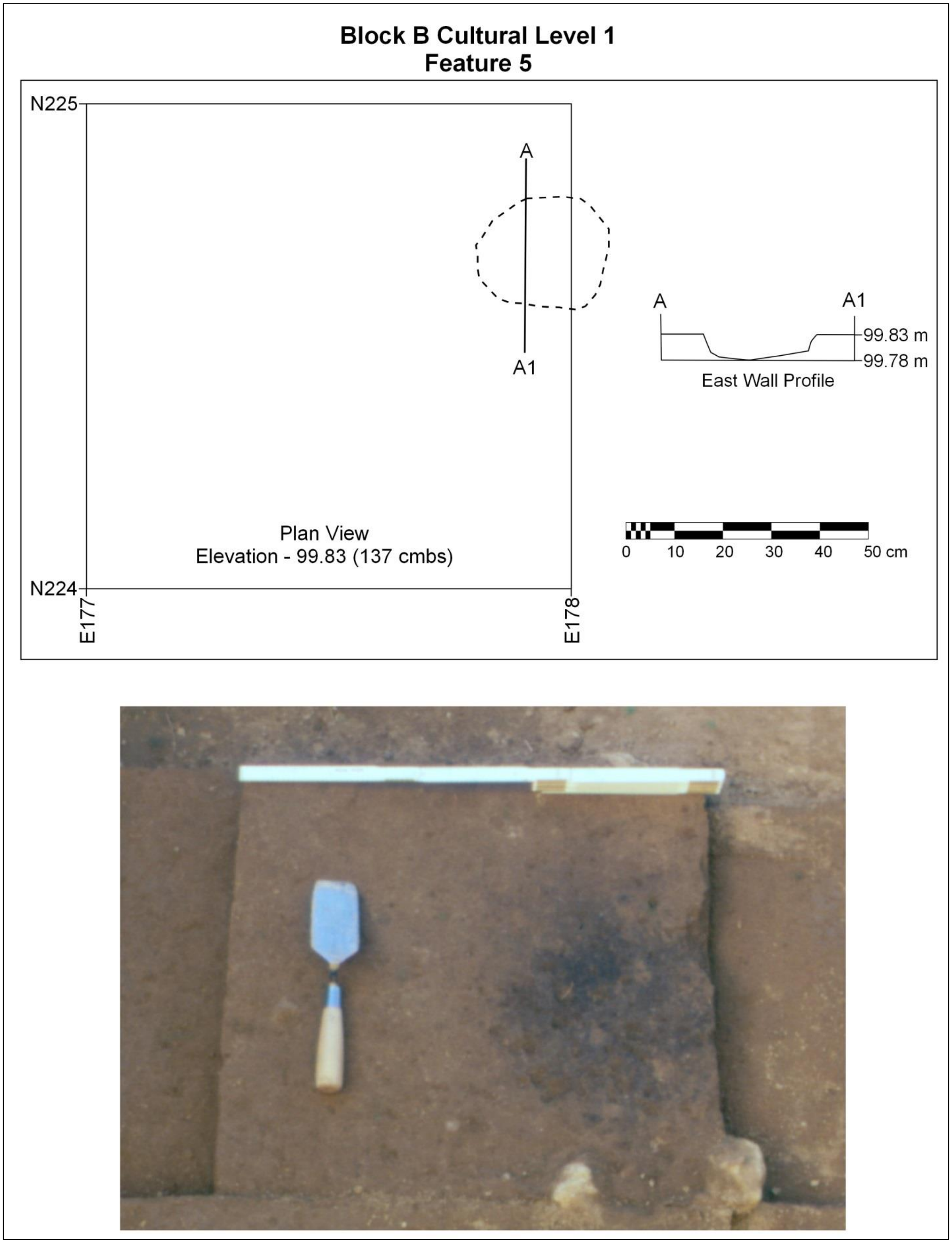


Figure 7-12 Photograph and illustration of Feature 5, Block B Cultural Level 1.

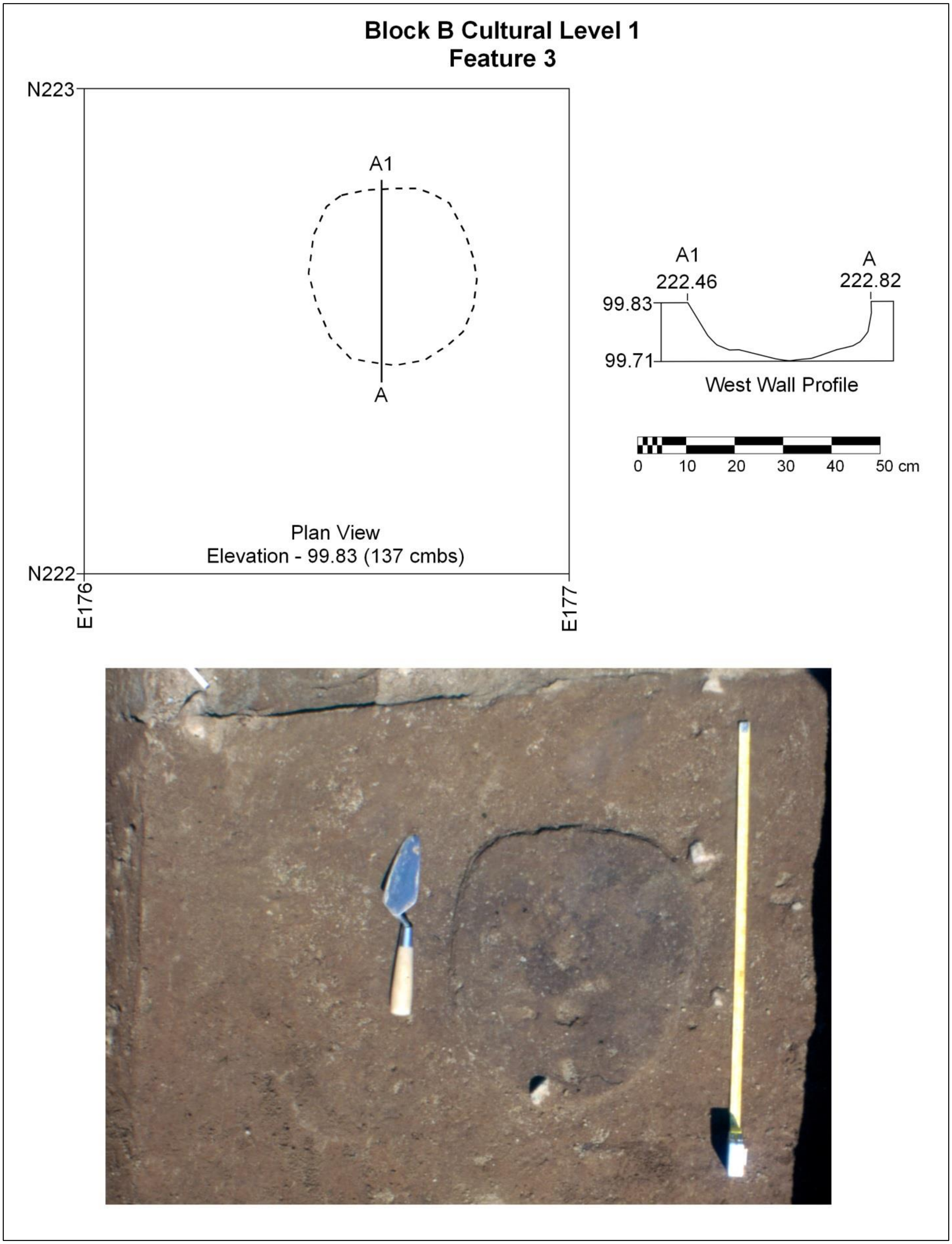


Figure 7-13 Photograph and illustration of Feature 3, Block B Cultural Level 1.

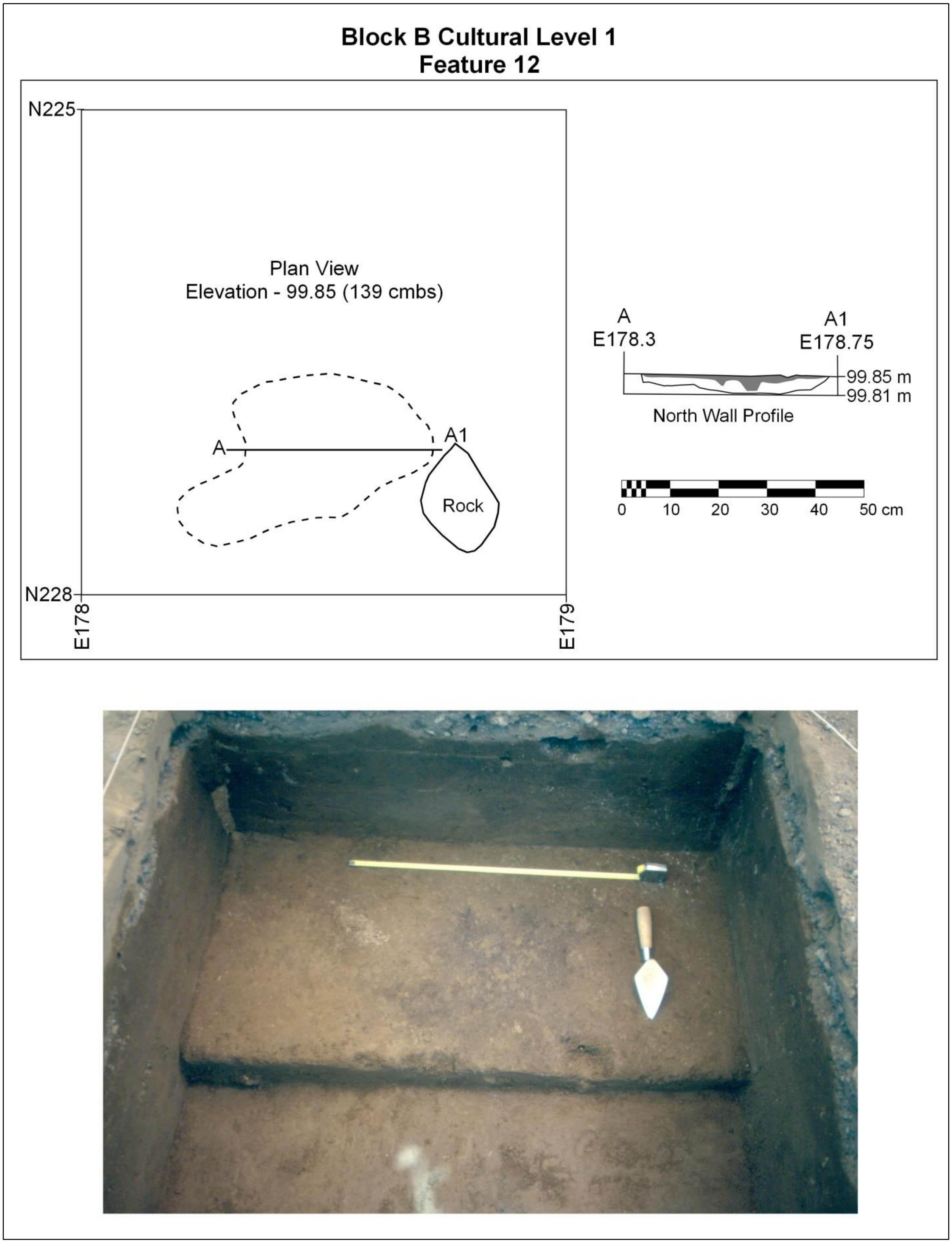


Figure 7-14 Photograph and illustration of Feature 12, Block B Cultural Level 1.

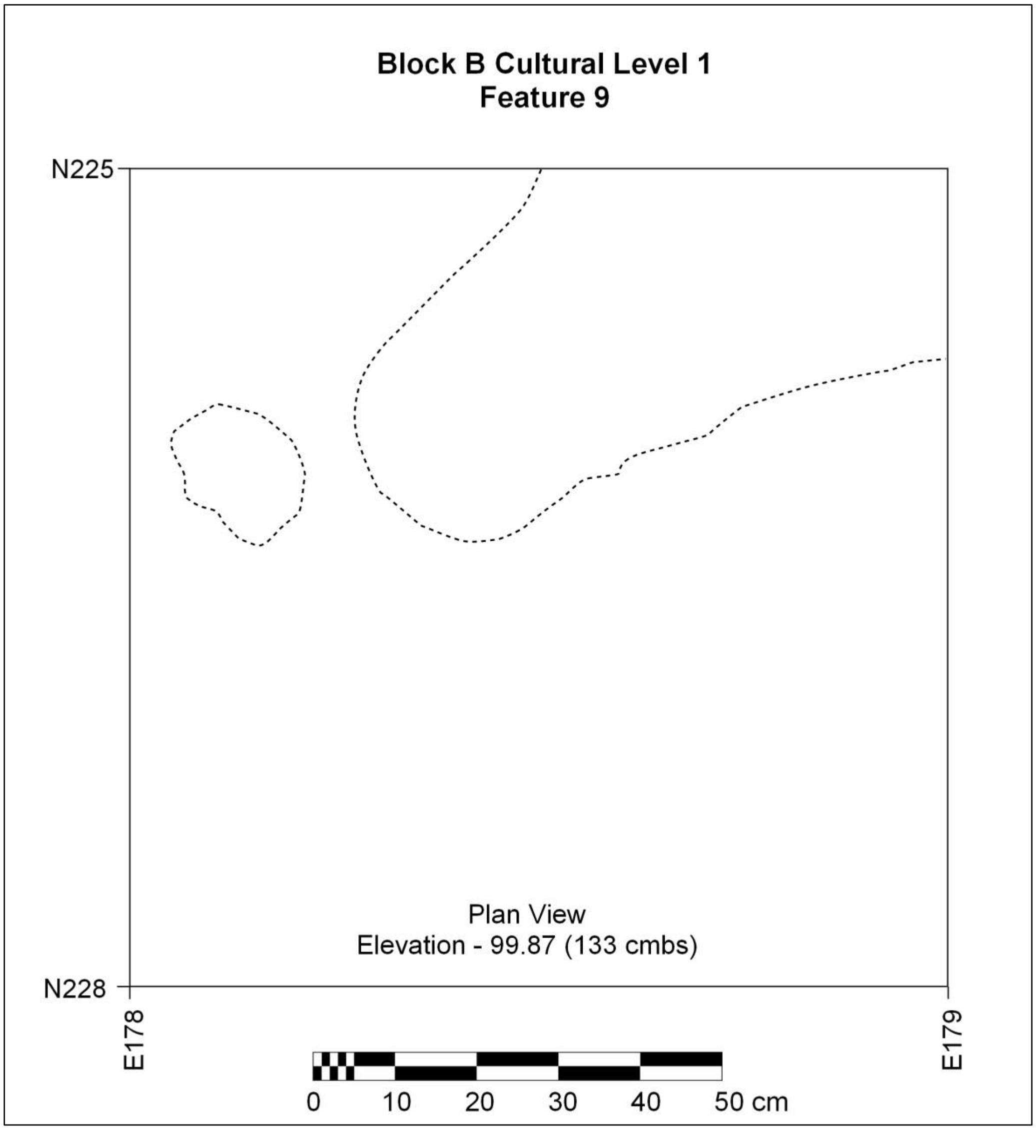


Figure 7-15 Illustration of Feature 9, Block B Cultural Level 1.

larger excavated portion measured 45 cm N-S, 70 cm E-W, and 4 cm deep. The smaller stain, to the west of the larger, measured approximately 15 cm N-S by 20 cm E-W and 4 cm deep, ranging in elevation from 99.87 m to 99.83 m (133-137 cmbs). The feature fill consisted of dark stain. No charcoal was present. Many small pieces of fire-cracked rock were present. No bone was observed. One rock was mapped in south of the feature. It was not designated as FCR. No profile or photograph exists for Feature 7. A sample of the fill from the southwestern portion of the larger stain was collected for flotation, which resulted in the recovery of 134 mg of wood charcoal, but no identifiable seeds or starchy plant material The feature produced an insufficient amount of charred material for a standard radiometric date.

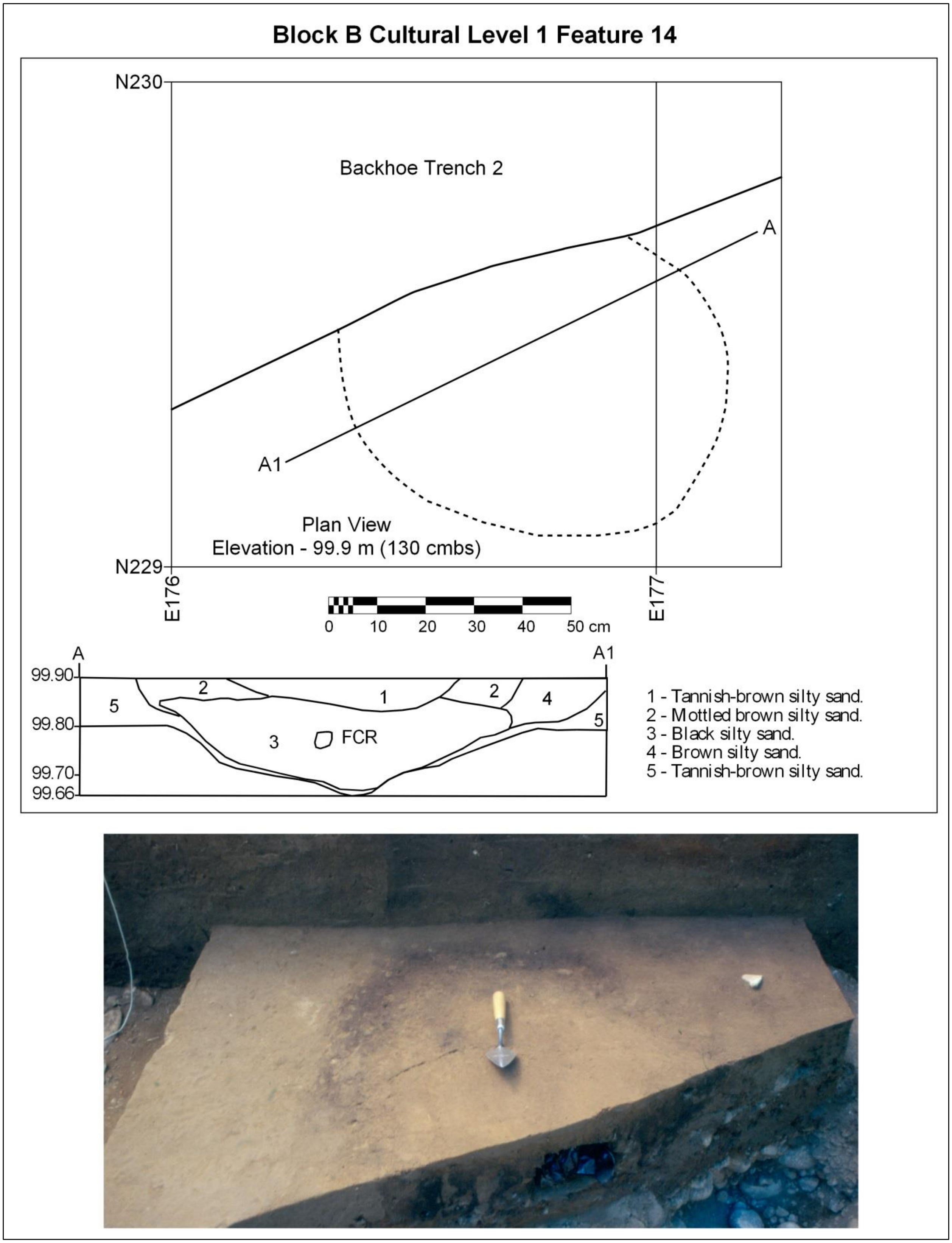


Figure 7-16 Photograph and illustration of Feature 14, Block B Cultural Level 1.

Feature 14 was a basin-shaped, roughly oval, unlined hearth located in excavation units N229 E176 and N229 E177, with its north side being truncated by Backhoe Trench 2 (Figures 7-10 and 7-16). The partial N-S measurement is 61 cm, with the original dimension probably about 65 cm. The E-W measurement is 79 cm, and the depth is 26 cm, ranging in elevation from 99.93 m to 99.67 m (127-153cmbs). The central portion of the feature is very dark black in color, with the upper portions being a mottled dark brown. The surrounding sediment consists of brown silty sand with a few pebbles. Twelve pieces of fire-cracked rock weighing 0.92 kg were present in the feature. One piece was located in the fill, with the remaining scattered on the base of the hearth. The piece in the fill was angular and broken. Of the pieces at the base of the hearth, five are complete rounded pebbles and seven are sub-angular broken pebbles. These rocks were likely not placed in the hearth, but were in the sediments the hearth was dug down into. One burned bone fragment was mapped in place in the feature, and additional bone fragments were observed in the fill. No flakes or tools were observed. Slightly more than three quarters of the feature fill was collected for flotation and carbon dating. A bulk sample of organic sediment returned a standard radiometric age estimate of 6150±80 BP (Beta 87107).

In 1997 Celeste Havener with LaRamie Soils Service analyzed flotation material from the south half of Feature 14 (Appendix D). Three samples were examined, two from N229 E176 (level 6, 99.80-99.70 m and level 7 99.70-99.60 m) and one from N229 E177 (level 7, 99.70-99.60 m). Cheno-am, wild buckwheat (Polygonacaeae), and sunflower (Asteraceae) seeds were recovered along with one insect head. Fuelwood from the feature consisted of cottonwood/willow and pine. The presence of the seeds suggests the hearth was possibly used for food processing.

The purpose of Feature 14 remains unclear. The depth indicates that it was excavated prior to use, which is unusual since most of the hearths at the site were unprepared. The shape and depth of the feature are similar to roasting pits used to process roots and tubers, but the paucity of fire-cracked rock in or around the feature is atypical of a roasting pit. The feature may have served as a boiling pit that was lined with vegetation then hide. Once the feature was abandoned it was filled with sediment creating the dark organic stain that encircled the edge of the pit.

Lithic Concentrations

In addition to the hearths, Block B Cultural Level 1 also contained three lithic concentrations. Although not recorded as formal features in the field, they were generally recognized by the excavators and are readily discernible on the artifact distribution maps (Figures 7-17 and 7-18).

Lithic concentration 1 was located at the south end of the block in the western portion of N222 E177 immediately adjacent to Feature 3. The concentration consisted of 97 piece-plotted pieces of debitage, 2,079 pieces of micro-debitage and 21 small bone fragments found between 99.89 m and 99.87

m (133-135 cmbs). It measured about 30 cm east-west by 18 cm north-south. Most of the debitage (97%) consisted of Tensleep quartzite. No charcoal or fire-cracked rock was associated with the lithic concentration so it is assumed the concentration represents a single tool production episode using a nodule that arrived at the site as a prepared core or early stage biface because few cortical flakes were found. It is unclear whether Lithic Concentration 1 is associated with the nearby Feature 3. Most of the piece-plotted items in the concentration were 3-5 cm above the elevation of Feature 3, but this may be due to post-depositional mixing rather than a later occupation.

Lithic Concentration 2 was located was located in the western portion of N225 E179 between 99.89 m and 99.79 m elevation (131-141 cmbs) and measured about 35 cm northeast-southwest by 20 cm northwest-southeast (Figures 7-17 and 7-18). The concentration consisted of 145 piece-plotted flakes and five expedient flake tools made exclusively of locally available silicified wood. A fragment of a bighorn sheep mandible was found at the northern edge of the concentration. One bag of fill was collected from the lithic concentration which produced 1,050 (>1/8") pieces of debitage, all but seven pieces of which were silicified wood. Very few bones and no charcoal were associated with the concentration so it is assumed it was likely a single episode knapping station. The lithic concentration is not directly associated with any of the features.

Lithic Concentration 3 was located in the northeastern quarter of N226 E176 and northwestern quarter of N226 E177 (Figures 7-17 and 7-18). It measured about 85 cm northwest-southeast by 60 cm northeast-southwest. The concentration contained 225 pieces of debitage, 67 of which were piece-plotted. The piece-plotted items were dispersed between 99.87 m and 99.77 m (133-143 cmbs). Four material types are present in sizeable quantities, including silicified wood (30.7%), Tensleep quartzite (29.8%), local chert (25.8%) and Morrison quartzite (13.8%). No tools or bone were associated with the concentration. Like the other lithic concentrations, it appears to be a single episode knapping station where at least four different nodules were worked.

Spatial Analysis

In the northern half of the block there were relatively few artifacts found in direct association with Features 9, 12 and 14. Feature 9 was likely a refuse pile from the cleaning of a hearth, especially given the spatially associated concentration of pulverized bone, much of which was burned. The absence of artifacts around Feature 9 is therefore not surprising. Feature 12 appears to have been an unlined hearth with an associated concentration of debitage, bone, a hafted knife and a few flake tools. The concentration was just west of Feature 12 and upwind of the prevailing westerly winds in the valley (Eakin 2011). Similarly, there was a small cluster of debitage, bone and a flake tool south of Feature 14 that may reflect limited domestic activities associated with bone grease production around a boiling pit.

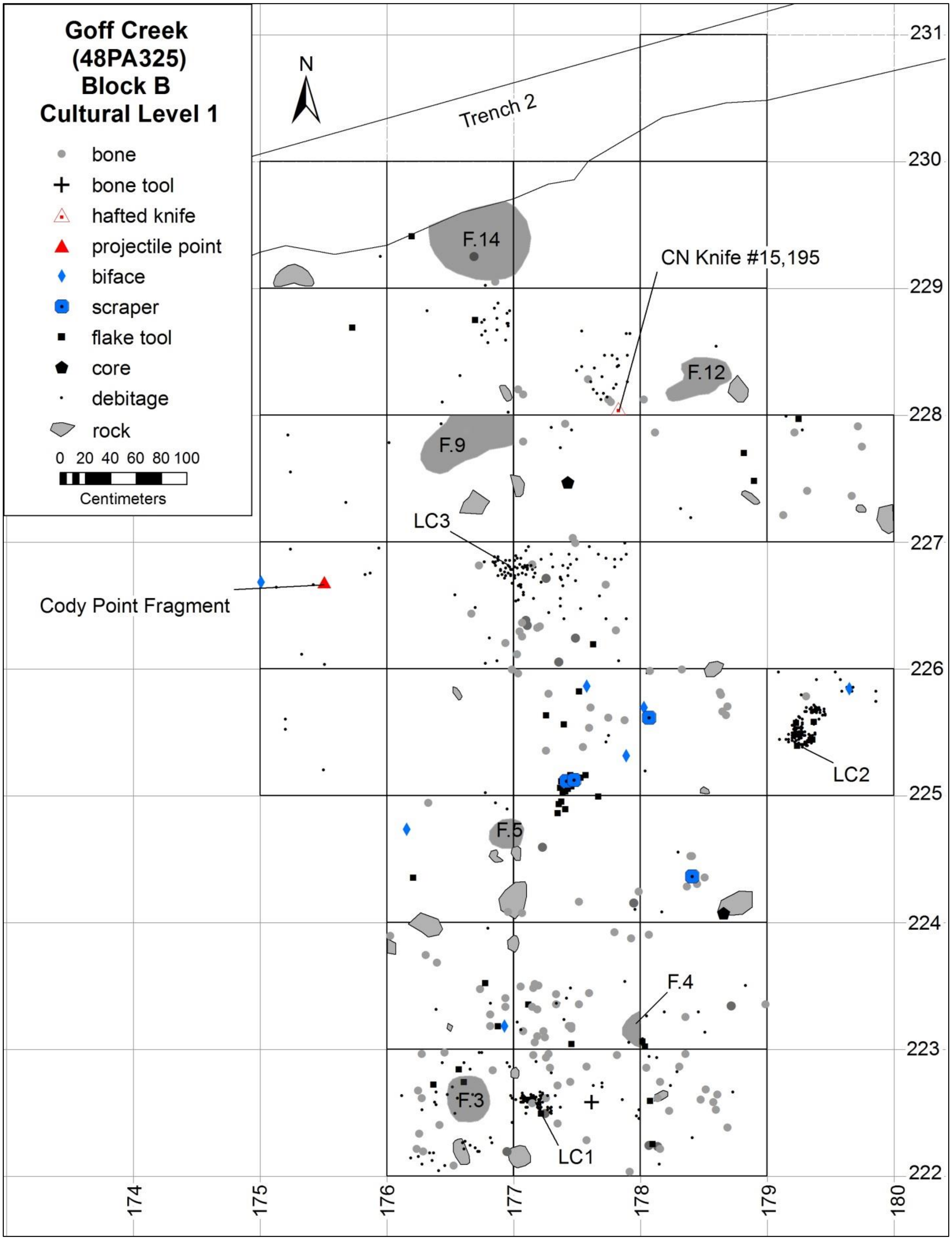


Figure 7-17 Plan view map of Block B Cultural Level 1

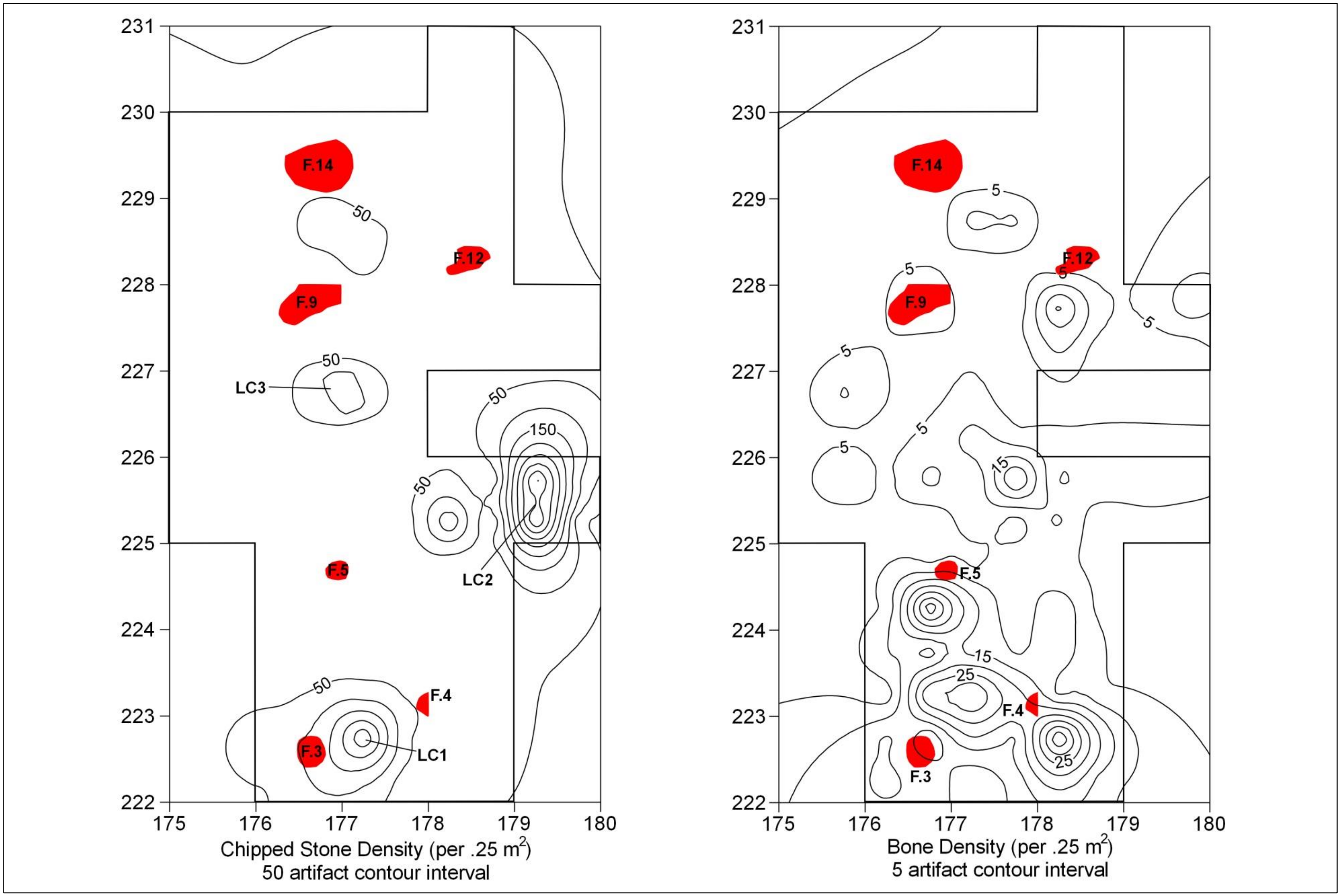


Figure 7-18 Map showing the interpolated artifact densities for Block B Cultural Level 1.

The small concentrations of debitage and tools adjacent to Features 12 and 14 likely represent hearth-centered use of space and are positioned out of the prevailing wind direction. This may indicate that the hearths were exterior features and the limited number of artifacts would indicate a short-term use of the space. There is no evidence that any of the features were enclosed in a structure. There is a diffuse scatter of rock west and south of Features 9, 12 and 14 that may represent a toss zone.

A dense concentration of debitage, designated Lithic Concentration 3 was located approximately one meter south of Feature 9 (Figures 7-18) that is interpreted as a knapping station were at least four tools of different material type were manufactured or maintained. One dense cluster of highly fragmented bone that probably represents a hearth or boiling pit clean-out was found just south of Feature 12. As noted above, the presence of such dumps is a predictable result of intensive bone grease production.

The southern half of Block B also contained three features (3, 4 and 5) and two lithic concentrations (1 and 2). Lithic Concentration 1 was identified less than a meter east of Feature 3 and west-southwest of Feature 4 and likely represents an episode of stone tool production. A small cluster of flake tools and bone were identified on the west and northwest side of Feature 3 as well. What appears to be a cache or a misplaced (lost) bag of stone tools, containing 13 utilized or retouched flakes and two scrapers was found 40-60 cm northeast of Feature 5. Some bone was also found in the immediate vicinity. A debitage concentration containing a diffuse scatter of five bifaces and a scraper was found one meter to the east of the cache and one meter west of Lithic Concentration 2 (Figure 12-4). Four clusters of pulverized bone were found adjacent to Features 3, 4 and 5, which again suggest the cleaning and reuse of hearths or boiling pits for bone grease processing. Three of the four bone clusters were located east and at least a half of a meter away from Feature 3. Unlike the northern features, artifacts were found clustered upwind and downwind of the hearth, and there is an asymmetrical patterning of artifacts by type with bone and flake tools found to the west and debitage to the east. Similar patterning of artifacts was found at the Barger Gulch site and was interpreted as hearth-centered use of space within a structure (Surovell and Waguespack 2007). Unfortunately, the boundary of the excavation block was less than a meter from Feature 3, which prevents a more detailed analysis of spatial patterning.

Cultural Level 2

Cultural Level 2 was well defined and was found in every unit of Block B. The level was approximately 20 cm thick and was dispersed through strata IIIc, IIId and the upper part of IIb at about 100.1 m to 99.9 m elevation (110-130 cmbs). It was densest in the south central and northwestern portion of the block around several identified features. Cultural Level 2 produced 14,824 chipped stone artifacts, 5,077 faunal remains, one mano, and two bone tool fragments. Features 4, 5, 6, 8, 9, and 11 and a Lithic Concentration were also found in Block B Cultural Level 2.

Lithic Raw Material Utilization

Chipped stone was assigned to one of 11 categories of raw materials, consisting of a variety of local and exotic stone. The majority of the lithic assemblage consists of locally available Eocene chert (71.8%) and silicified wood (14%). There was a significant quantity of obsidian found in the level which may have some bearing on the season of occupation or mobility patterns. Other nonlocal materials, such as Tensleep quartzite (4.5%), Morrison quartzite (0.9%), unidentified chert (0.5%), non-local chert (0.1%), coarse grained quartzite (0.03%), basalt/igneous (0.02%), quartz crystal (0.01%) and porcellanite (0.01%), most of which are available predominantly to the east of the site, are uncommon.

Table 7-7 Block B, Cultural Level 2 chipped stone artifacts by raw material type.

MATERIAL TYPE	**ARTIFACT TYPE**											
	Projectile Point	**Hafted Knife**	**Biface**	**Drill**	**Scraper**	**Retouched Flake**	**Utilized Flake**	**Tools Total**	**Tested Cobble**	**Core**	**Debitage**	**Material Total**
Local Chert	**4**	**1**	**10**		**4**	**29**	**13**	**61**		**1**	**10,600**	**10,662**
% of artifact	44.4	100	52.6		100	74.4	50.0	60.4		33.3	72	71.9
% of material	<.01	<.01	0.1		<0.1	0.3	0.1	0.6		<0.1	99.4	
Silicified Wood	**1**		**6**	**3**		**8**	**10**	**28**	**3**	**2**	**2,055**	**2,088**
% of artifact	11.1		31.6	100		20.5	38.5	27.7	100	66.7	14	14.1
% of material	0.0		0.3	0.1		0.4	0.5	1.3	0.1	0.1	98.4	
Obsidian	**3**		**3**			**1**	**1**	**8**			**1,182**	**1,190**
% of artifact	33.3		15.8			2.6	3.8	7.9			8.0	8.0
% of material	0.3		0.3			0.1	0.1	0.7			99.3	
Misc. QTZ						**1**	**1**	**2**			**657**	**659**
% of artifact						2.6	3.8	2.0			4.5	4.4
% of material						0.2	0.2	0.3			99.7	
Morrison QTZ	**1**							**1**			**132**	**133**
% of artifact	11.1							1.0			0.9	0.9
% of material	0.8							0.8			99.2	
Unidentified Chert											**69**	**69**
% of artifact											0.5	0.5
% of material											100.0	
Non-Local Chert							**1**	**1**			**11**	**12**
% of artifact							3.8	1.0			0.1	0.1
% of material							8.3	8.3			91.7	
Miscellaneous											**11**	**11**
% of artifact											0.1	0.07
% of material											100.0	
Artifact Total	**9**	**1**	**19**	**3**	**4**	**39**	**26**	**101**	**3**	**3**	**14,702**	**14,809**

Locally available materials, such as Eocene chert (60.4%) and silicified wood (27.7%) also dominate the tool assemblage at roughly the same percentage (88.1%) as the debitage (86%) assemblage (Table 7-7). Obsidian/ignimbrite accounts for 7.9 percent of the tools, which is similar to the 8 percent of debitage. Miscellaneous quartzite comprises 2.0 percent of the tool assemblage, while Morrison quartzite and non-local chert make up 1.0 percent each of the tool assemblage. No coarse grained quartzite, unknown chert, quartz crystal, or porcellanite tools were recovered from Block B Cultural Level 2.

Debitage

Lithic analysis reveals that flake fragments (50.9%) are the most common artifact type with broken flakes (29.9%), debris (7.3%), and complete flakes (11.8%) composing the rest of the sample. Thus the tool maintenance/manufacture category comprises almost 93% of the assemblage. Of the complete flakes (n=2,001), only 99 exhibit evidence of a cortex and represent 0.5 percent of the total debitage assemblage. The overall assemblage then indicates that on-site primary lithic reduction is not the main activity indicated by the assemblage. It appears that most debitage within the upper cultural component was produced from finished or nearly finished tools. This is generally supported by the small size of artifacts in the assemblage, 77 percent of which are less than one-quarter inch in maximum dimension. Sullivan and Rosen (1985) found that high percentages of broken and non-cortical flakes indicate tool manufacture and maintenance rather than core reduction. Generally speaking, the Cultural Level 2 lithic assemblage indicates stone working activities in the excavation block focused on repair and maintenance of tools and weaponry derived from both local and non-local stone sources.

Projectile Points and Hafted Knives

Nine projectile points and one hafted knife were found in Cultural Level 2 (Table 7-8, Figure 7-19, Appendix B). All of the specimens were found between 100.1 and 99.9 m (110-130 cmbs). Of the nine projectile points, two are complete, one is nearly complete with a heavily resharpened margin, one is a base fragment and five are small lateral base (ear) fragments. Five of the projectile points were made of locally available Eocene chert and silicified wood, three were made of obsidian and one of Morrison quartzite. All of the fragmented points exhibit bend breaks indicative of fractures caused during impact. Grinding of haft margins was noted on each of the specimens recovered in Cultural Level 2.

Notch angle, the measure by which notch type is assigned, could only be ascertained on seven of the points. As in Cultural Level 2 of Area A, the majority (n=5) of the points are corner-notched darts, but two small fragments are tentatively assigned as side-notched. Most of the points were too fragmentary to allow assignment to a named type. Specimen #15,287 (Figure 7-19), though heavily resharpened, appears to conform to the Pahaska side-notched type defined by Husted and Edgar (2002). The other complete point, #15,233 (Figure 7-19), most closely resembles the Elko corner-notched type (Holmer 2009) with its steep proximal shoulder angle and tall base (Table 7-8). The nearly complete and heavily resharpened specimen (#14,503) does not closely resemble any named type. Unlike Area A, no points of the Blackwater type, which was also defined by Husted and Edgar (2002), were recovered from Block A Cultural Level 2.

A large complete hafted knife (#12,594) was also recovered from Block B Cultural level 2 (Figure 7-20). The specimen is made of Eocene chert. The knife is 75.7 mm in length with a maximum width of 26.8 mm and maximum thickness of 9 mm. Both edges of the blade show extensive use wear indicative of cutting a semi-hard material.

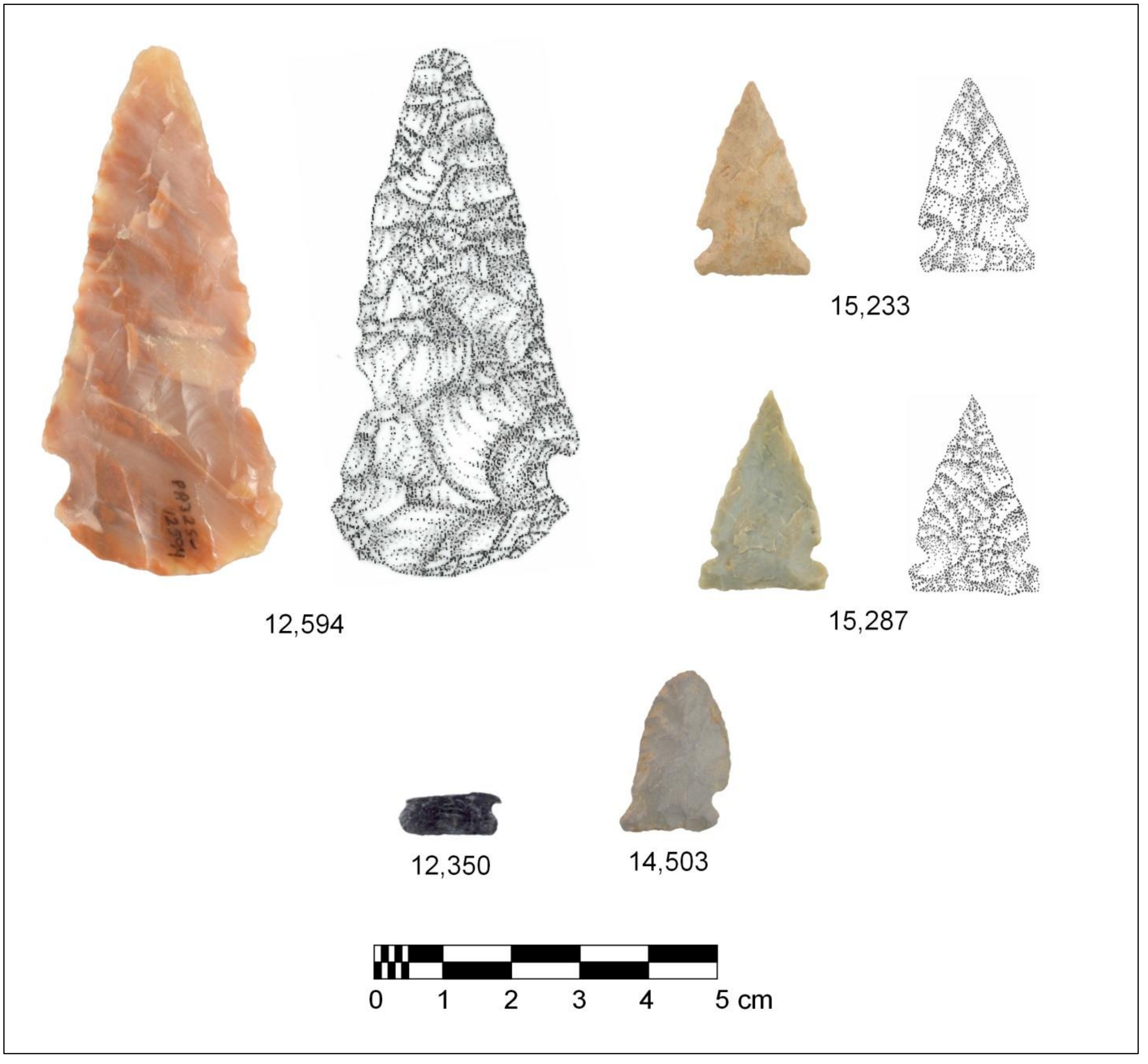


Figure 7-19 Photographs of projectile points and hafted knife recovered from Block B Cultural Level 2.

Table 7-8 Attributes of projectile points and hafted knife recovered from Block B Cultural Level 2.

Catalog#	Unit	Elevation (m)	Material	Portion	Point Type	Haft Type	Prox. Shld. Angle (°)	Max. Length (mm)	Base Width (mm)	Base Length (mm)	Haft Width (mm)	Max. Thickness (mm)	Notch Depth (mm)	Notch Width (mm)	Haft Grinding
12,594*	N222 E178	100.13-100.04	EC	CO		CN		78.7	33		29.1	9	3.9	6.5	NA
12,350	N223 E177	100.10-100.00	OB	BA	?	CN	126	7.2	17.1	5.7	14.8	3.7	1.5	3.4	BND
12,747	N225 E177	100.10-100.00	OB	ER		SN	150	14.7				3.1			BND
12,758	N225 E177	100.10-100.00	OB	ER		SN		6.4				2.7			BND
14,503	N227 E176	100.07	EC	NC	?	CN	126	23.5	14.6	6.4	11.7	4.2	2.1	3.8	NA
14,512	N227 E176	100.10-100.00	EC	ER		CN	140	8.6				3	3.1		BND
15,287	N229 E176	100.05	EC	CO	PH	SN	157	29.9	19	7.6	13.6	4.9	2.2	3.4	NA
13,216	N222 E178	100.00-99.90	EC	ER		CN	135	9.5				3.9			BND
15,233	N229 E177	99.95	MOQ	CO	EC	CN	135	28.6	17.2	7.4	11.6	3.7	2.8	4.7	NA
15,417	N222 E176	100.00-99.90	SW	ER		SN		10.1				2.6			BND

* Hafted Knife. Material: EC-Eocene Chert; SW-Silicified Wood; MOQ-Morrison Quartzite; OB-obsidian. Portion: CO-Complete; NC-nearly complete; BA-base; ER-ear/lateral base fragment. Point Type: PH-Pahaska; BW-Blackwater; EC-Elko. Haft Type: SN-side-notched; CN-corner-notched. Fracture Pattern: BND-bend break.

Bifaces

Nineteen bifaces were recovered from Block B Cultural Level 2, of which two are complete and 16 are fragmentary (Table 7-9, Figure 7-20, Appendix B). A variety of raw materials were used in the manufacture of the bifaces. The most common material was Eocene chert, represented by 10 specimens. Silicified wood, also locally occurring, was used in the manufacture of six bifaces. Non-local raw materials occur in much smaller numbers. Obsidian was used to make three bifaces. The bifaces were categorized using five manufacturing stages defined by Frison and Bradley (1980:31-39). No bifaces attributed to Stage I were recovered, while two specimens are classified as Stage II. Stage III is represented by nine specimens. Five bifaces are categorized as Stage IV and two are classified as Stage V. Use-wear analysis conducted on the bifaces disclosed no identifiable use on 14 specimens. One biface had indeterminate use, and the rest were used to cut or scrape semi-hard and hard materials.

Two small biface fragments that could not be identified to portion are believed to be projectile point fragments. The first, #13,128,is an obsidian stage V biface fragment with a bend break that measures 9.6 mm long, 4.3 mm wide, and 1.7 mm wide. No visible use wear observed. The second, #15,203 is an obsidian stage V biface fragment with a bend break. It measures 5.3 mm long, 3.4 mm wide and 2.3 mm thick. There is no visible usewear.

Table 7-9 Attributes of bifaces recovered from Block B Cultural Level 2.

Catalog#	Portion	Material	Stage	Length	Width	Thickness	Use 1	Mat. Worked 1	Use 2	Mat. Worked 2
13128	UN	Obsidian	V	9.6	4.3	1.7				
13282	lateral	Local Chert	II	25.6	17.6	11.9				
13516	UN	Local Chert	III	19.9	15.3	8.3	scrape	s-hard		
13677	UN	Local Chert	III	43.5	27.7	10.9				
13759	UN	Local Chert	III	23.8	13.6	10.4				
13810	UN	Silic Wood	III	42.7	31.5	7.8				
12766	distal	Local Chert	IV	28.1	23.9	7.5	scrape	s-hard	scrape	s-hard
14218	lateral	Local Chert	IV	26.5	11.2	5.5				
13913	UN	Silic Wood	III	15.2	11.4	5.5				
14285	proximal	Local Chert	III	31.7	15.1	10.2				
14317	complete	Silic Wood	III	52	30.7	17	scrape	s-hard	scrape	s-hard
14319	UN	Obsidian	III	28	16.9	9.1	cut	s-hard		
13973	UN	Silic Wood	III	48.1	17.4	9.1	scrape	hard		
14428	UN	Local Chert	II	19.8	17.1	6.3				
14451	lateral	Local Chert	IV	16.8	5.9	2.3				
14994	complete	Silic Wood	IV	38.3	21	6.2				
14782	complete	Silic Wood	III	89.5	60.1	22.4				
15282	lateral	Local Chert	IV	14.8	6.9	3.6				
15203	UN	Obsidian	V	5.3	3.4	2.3				

Expedient Flake Tools

Thirty-nine retouched flakes were recovered from Block B Cultural Level 2 (Table 7-7; Appendix B). All but two of these specimens were manufactured from locally occurring raw materials. Use-wear analysis indicates that most of these tools were used to cut and scrape a variety of soft, semi-hard, and hard materials. One was used to groove semi-hard material. One each were used to scrape/plane hard and semi-hard material. One exhibited both scraping and grooving of semi-hard material. One specimen had no use-wear.

Twenty-six utilized flakes were found in Block B Cultural Level 2 (Table 7-7, Appendix B). As is the pattern with the rest of the tools from this area, most were manufactured from local raw materials. Use-wear analysis of these tools indicates that most were used to cut and scrape a variety of soft, semi-hard, and hard materials. Four were used to scrape/plane semi-hard material.

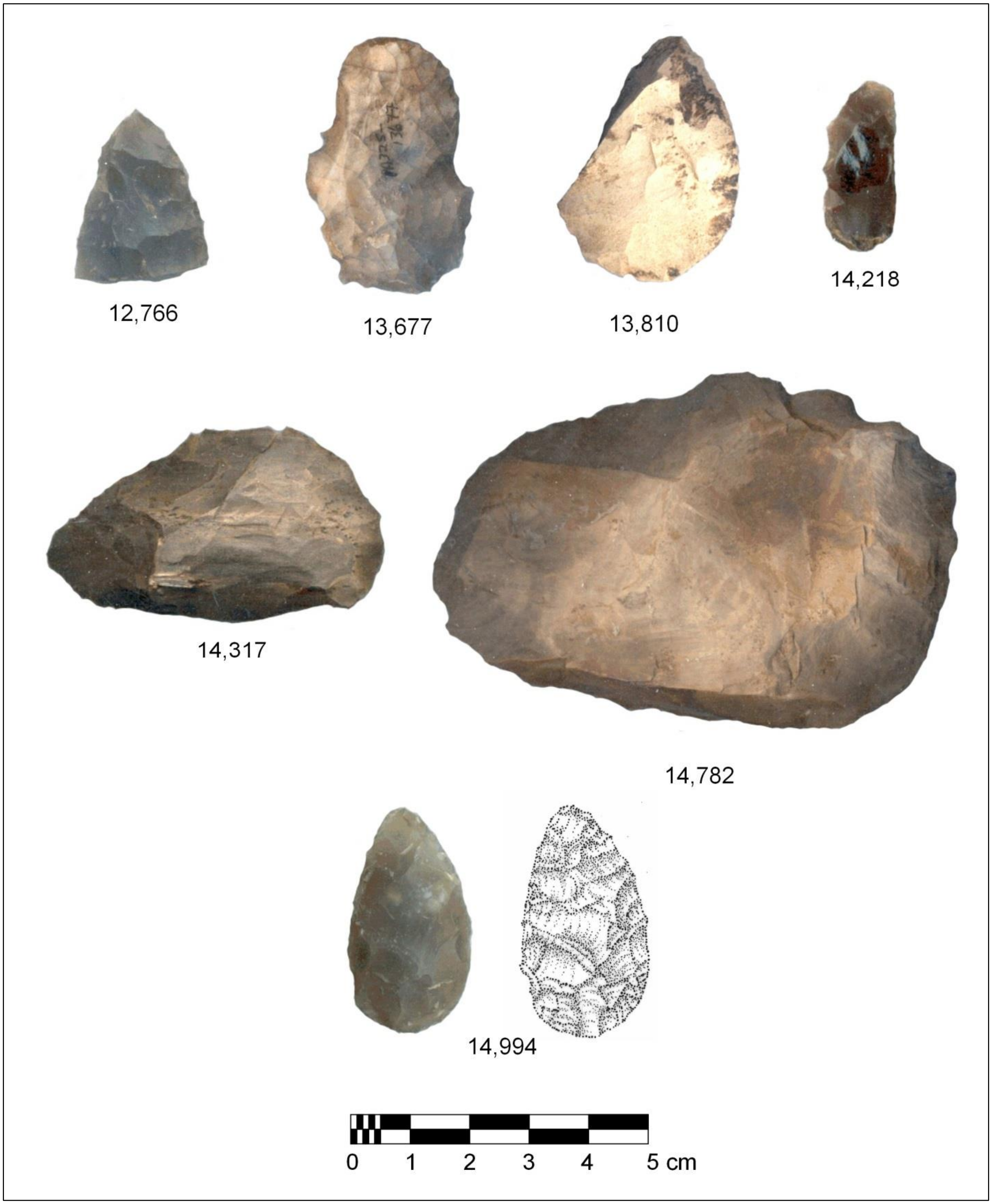


Figure 7-20 Photograph of complete and nearly complete bifaces from Block B Cultural Level 2.

Scrapers

Four tools classified as scrapers were recovered from Area B (Table 7-10, Figure 7-21). All of the scrapers were manufactured from locally occurring Eocene chert. The first of these tools, #13,262, is a complete end scraper made of maroon Eocene chert and measures 39.78 mm long, 17.65 mm wide, and 6.58 mm thick. It has a bit angle of 57° and a bit width of 16.10 mm. Use-wear analyses indicates that it was used to scrape a soft material. No use-wear is present on the sides of the piece.

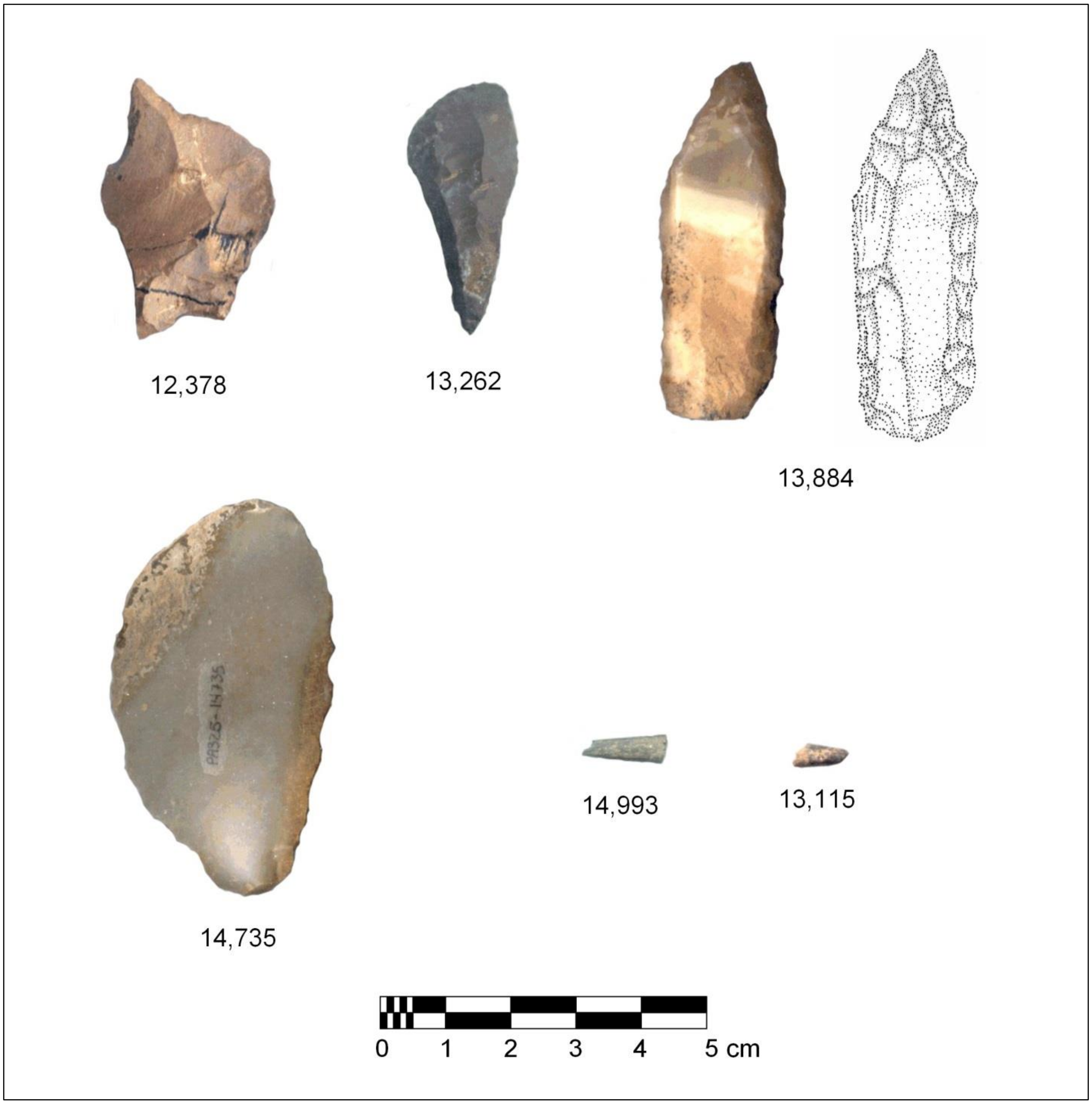


Figure 7-21 Photographs of drill, scrapers and bone awls recovered from Block B Cultural Level 2.

Table 7-10 Attributes of scrapers found in Block B Cultural Level 2.

Cat#	Type	Portion	Material	Length	Width	Thickness	Use 1	Mat. Worked 1	Use 2	Mat. Worked2
13,262	end	complete	Eocene chert	39.8	17.7	6.6				
13,371	end	distal end	Eocene chert	32.8	28.6	15.3				
13,884	side	complete	Eocene chert	59.3	19.4	7.9	scrape	hard	scrape	hard
14,735	end	complete	Eocene chert	60.7	33.5	13.1	scrape	hard	scrape	hard

The second scraper (#13,371) is the distal portion of an end scraper manufactured from a white Eocene chert. It is 32.79 mm long, 28.56 wide, and 15.25 mm thick. Bit angle is 78° and bit width is 21.28 mm, with use-wear indicating that it was used to scrape a soft material.

The third specimen, #13,884, is a complete double sided Limace style scraper made from tan/yellow Eocene chert. It measures 59.26 mm long, 19.39 mm wide, and 7.90 mm in thickness. It has a bit width of 0.02 mm and a bit angle of 86°, with use-wear analysis indicating that it was used to a hard to semi-hard material such as green wood. The side angle of the first lateral edge of this item measures 55°. It was used to scrape a hard material. The second lateral edge had an angle of 74° and was used to scrape hard to semi-hard material.

The fourth scraper, #14,735, is a complete side/end scraper manufactured from grey Eocene chert. It measures 60.72 mm in length, 33.49 mm in width, and 13.07 mm thick. The bit measures 21.94 mm wide, with an angle of 73°. Use-wear indicates that it was used to scrape a semi-hard material. One lateral edge has an edge angle of 63° and the second has an edge angle of 67°. Both lateral edges were used to scrape hard material.

Drill/Borer

Three drills were found in the upper cultural component of Block B (Table 7-7, Figure 7-21). All of them were manufactured from silicified wood. One of the specimens is complete, and the remainder consists of small bit fragments. The complete tool was used in both a clockwise and counter clockwise direction. Multiple stacks were recreated on the cutting edges suggesting drilling into a hard or semi-hard material. In cross section, the drill has a triangular shape.

Table 7-11 Attributes of drills recovered from Block B Cultural Level 2.

Catalog #	Unit	Elevation	Material	Portion	Max Length (mm)	Max. Width (mm)	Max. Thickness (mm)	Bit Length (mm)	Bit Width	Mat. Worked	Cross-Section
12,378	N223 E177	99.91	SW	CO	40.2	26.7	2.6	10.2	8.6	SH	TR
13,197	N223 E177	100.1-100.0	SW	TP	8.7	5.5	3.3	8.7	5.5	H	DM
13,200	N223 E177	100.1-100.0	SW	TP	8.5	4.1	2.9	8.5	4.1		DM

Groundstone/Hammerstone

One complete mano made from a basalt cobble was found in Block B Cultural Level 2. The specimen was carefully shaped with use wear on both faces. A hammerstone made of a small basalt cobble was also recovered. The piece measures 66.59 mm in length, 55.01 mm in width, and 41.47 mm in thickness and has multiple impact scars along one edge.

Bone Tools

Two bone awl fragments were recovered from Block B Cultural Level 2 (Figure 7-21). Specimen 13,115 is a burned distal awl, near-tip midsection fragment that is 13.3 mm long. It is round in cross section and measures 4.2 mm in diameter. The fragment is weathered, but retains polish. Specimen 14,993 is the distal shaft portion of a burned awl with the extreme tip broken. It measures 13.3 mm long. It is ovate in cross section with a maximum diameter of 4.5 mm. Numerous striations run both longitudinally with and diagonally along to the long axis of the awl.

Faunal Remains

A total of 4,523 pieces of bone and 554 pieces of tooth enamel were recovered from Block B Cultural Level 2 (Tables 7-12 and 7-13). Of these, the majority (n=4,967, 97.8%) is comprised of unidentifiable bone fragments. Identifiable species include bighorn sheep (n=24), mule deer (n=1), beaver (n=2), porcupine (n=1), river otter (n=1), mustelid (n=1) and fossorial rodent (n=1). Another 81 pieces of bone were identified as medium artiodactyl and likely represent bighorn sheep remains. There are at least two bighorn sheep represented in the assemblage based on 2nd phalanges. The remaining identified species are each represented by a minimum of one individual.

Table 7-12 Faunal remains recovered from Block B Cultural level 2.

Species	Element	Portion	Side	NISP
bighorn sheep	1st phalange	complete	R	1
bighorn sheep	1st phalange	distal	UN	1
bighorn sheep	1st phalange	distal	R	2
bighorn sheep	2nd phalange	complete	L	1
bighorn sheep	2nd phalange	complete	R	1
bighorn sheep	2nd phalange	complete	UN	1
bighorn sheep	3rd phalange	complete	UN	1
bighorn sheep	atlas	complete	axial	1
bighorn sheep	axis	complete	axial	1
bighorn sheep	distal sesamoid	complete	UN	1
bighorn sheep	humerus	fragment	R	1
bighorn sheep	mandible	fragment	R	1
bighorn sheep	metacarpal	proximal	R	2
bighorn sheep	metapodial	proximal	R	1
bighorn sheep	radius	distal	R	1
bighorn sheep	radius	proximal	R	2
bighorn sheep	radius	fragment	L	3
bighorn sheep	radius/ulna	fragment	L	1
bighorn sheep	radius/ulna	shaft	R	1
mule deer	scapula	fragment	L	1
m. artiodactyl	distal sesamoid	complete	UN	1
m. artiodactyl	femur	fragment	UN	2
m. artiodactyl	long bone	shaft	UN	51
m. artiodactyl	metapodial	fragment	R	1
m. artiodactyl	metapodial	proximal	UN	1
m. artiodactyl	metapodial	fragment	UN	3
m. artiodactyl	phalange	distal	UN	2
m. artiodactyl	phalange	proximal	UN	3
m. artiodactyl	radius	distal	L	1
m. artiodactyl	radius	fragment	L	1
m. artiodactyl	rib	fragment	R	1
m. artiodactyl	scapula	fragment	R	1
m. artiodactyl	tibia	fragment	L	1
m. artiodactyl	tooth	complete	UN	1
m. artiodactyl	tooth	distal	UN	2
m. artiodactyl	tooth	proximal	UN	2

Table 7-12 Faunal remains recovered from Block B Cultural level 2.

Species	Element	Portion	Side	NISP
m. artiodactyl	ulna	fragment	R	1
m. artiodactyl	unknown	shaft	UN	4
m. artiodactyl	vertebra	proximal	UN	1
beaver	tooth	complete	L	1
beaver	tooth	distal	R	1
porcupine	radius	proximal	UN	1
river otter	rib	fragment	L	1
mustelid sp.	metapodial	distal	UN	1
unidentified	cranium	fragment	UN	2
unidentified	femur	proximal	UN	1
unidentified	femur	fragment	UN	1
unidentified	innominate	fragment	UN	1
unidentified	long bone	fragment	UN	1
unidentified	long bone	shaft	UN	35
unidentified	metapodial	proximal	UN	1
unidentified	tooth	fragment		547
unidentified	unknown	fragment		4,377
intrusive rodent	maxilla	fragment	axial	1
Total				5,077

There is abundant evidence for human modification of the faunal assemblage (Table 7-13). Of the total sample, 75 pieces exhibit spiral fractures. These include 11 bighorn sheep, 51 medium artiodactyl bones and 13 unidentified specimens. Six specimens exhibit impact fractures. A total of 3,093 specimens show evidence of burning. This include one bighorn sheep 28 medium artiodactyl bones, one beaver tooth, one mustelid one river otter and, 3,060 pieces of unidentified bone or tooth fragments.

The faunal assemblage from this component is composed of highly fractured and burned bone suggestive of intensive processing. The high number of unidentified specimens might indicate that longbones were crushed in order to obtain additional nutrients through boiling. Subsistence appeared to have focused on medium sized animals such as deer and sheep, but included smaller animals such as beaver, porcupine, river otter, and mustelids. Given the large proportion of bighorn sheep remains it is likely that most of the medium artiodactyl bone is sheep. If this assumption is correct, then bighorn sheep were clearly the target species.

Table 7-13 Breakage type, presence of cut/impact marks and burning in the faunal assemblage from Block B Cultural Level 2.

Species	**Break Pattern**	**Cut/Impact**	**Burned**	**NISP**
bighorn sheep				1
bighorn sheep	dry			4
bighorn sheep	dry		X	1
bighorn sheep	green			11
bighorn sheep	na			7
mule deer				1
m. artiodactyl				1
m. artiodactyl	dry			13
m. artiodactyl	dry		X	15
m. artiodactyl	green			5
m. artiodactyl	green			31
m. artiodactyl	green		X	12
m. artiodactyl	green	X		3
m. artiodactyl	na		X	1
beaver	dry		X	1
beaver	na			1
porcupine	dry			1
river otter	dry		X	1
mustelid sp.	dry		X	1
intrusive rodent	dry			1
unidentified				1,855
unidentified			X	3,047
unidentified	dry			40
unidentified	dry		X	9
unidentified	green			9
unidentified	green		X	3
unidentified	green	X		1
unidentified	na			1
Total				5,077

Features

Six features (6, 7, 8, 10, 11, and 13) were recorded in Block B Cultural Level 2. Features 6, 7, and 8 were located in the southern portion of the block while Features 10, 11, and 13 were located in the northern portion of the block (Figure 7-22). The elevation of the features ranged from 100.15 m (105 cmbs) to 99.98 m (122 cmbs), but much of the variation can be explained by the natural slope of the landform. Features 10, 11 and 13 are upslope of Features 6, 7 and 8 and therefore have a slightly higher elevation. However, it is likely that the two Cultural Level 2 occupations (2a and 2b) identified in Block A are also present in Block B. The stratigraphy in Block B was more compressed than that found in Block A suggesting a lower depositional rate. This resulted in compressed stratigraphy. Post-depositional disturbances, such as rodent burrowing, occupational trampling and erosion then mixed the components. Thus, it is likely that not all of the features date to the same occupation.

Feature 6 was an unlined hearth located in N224 E177 and N224 E178 (Figures 7-22 and 7-23). It was originally recognized as a roughly 60 cm circular, mottled, stained and oxidized area. The basin of the hearth was smaller and circular in outline. The top of the hearth was exposed at approximately 100.0 m elevation (~50 cmbs). It was roughly 38 cm in diameter north-south, 40 cm in diameter east-west, and 13 cm deep. The feature fill was observed to be darker than the surrounding sediments. The fill contained a small number of charcoal flecks but no fire cracked rock or oxidation inside the basin was noted. The fill was not collected for flotation and no macrofloral remains, including charcoal, were recovered.

Feature 7 was a concentration of apparently unburned rock located adjacent to and southeast of Feature 6 in the southwestern portion of N224 E178 and extending west into N224 E177 (Figures 7-22 and 7-24). The top of the feature was exposed at 99.98 m (~52 cmbs). The feature measured 53 cm north-south, 58 cm east-west. It is unclear whether the rocks were placed in an excavated basin or simply placed in a pile on the existing ground surface. The purpose of the feature is unknown. None of the rocks were fire-cracked. One cobble was located to the northeast of the cluster and was described as exhibiting battering. In the cluster, rock 3, also was reported as exhibiting battering. Neither of the battered rocks was collected. Rocks 5 and 6 were about one centimeter apart and refit, which suggests no major post depositional disturbance in that area. No oxidized sediments or charcoal staining was associated with the rocks. The fill from the feature was not collected for flotation due to the absence of organically stained sediments. No photographs were taken of Feature 7.

Feature 8 was a hearth clean out that was small, ovoid shaped, and shallow with an uneven bottom located in the center of unit N225 E176 (Figures 7-22 and 7-25). It was about 25 cm northwest-southeast by 20 cm northeast-southwest and five centimeters deep. The top of the feature was exposed at about 100.09 m (~41 cmbs). The feature fill was stained with some charcoal flecking and one

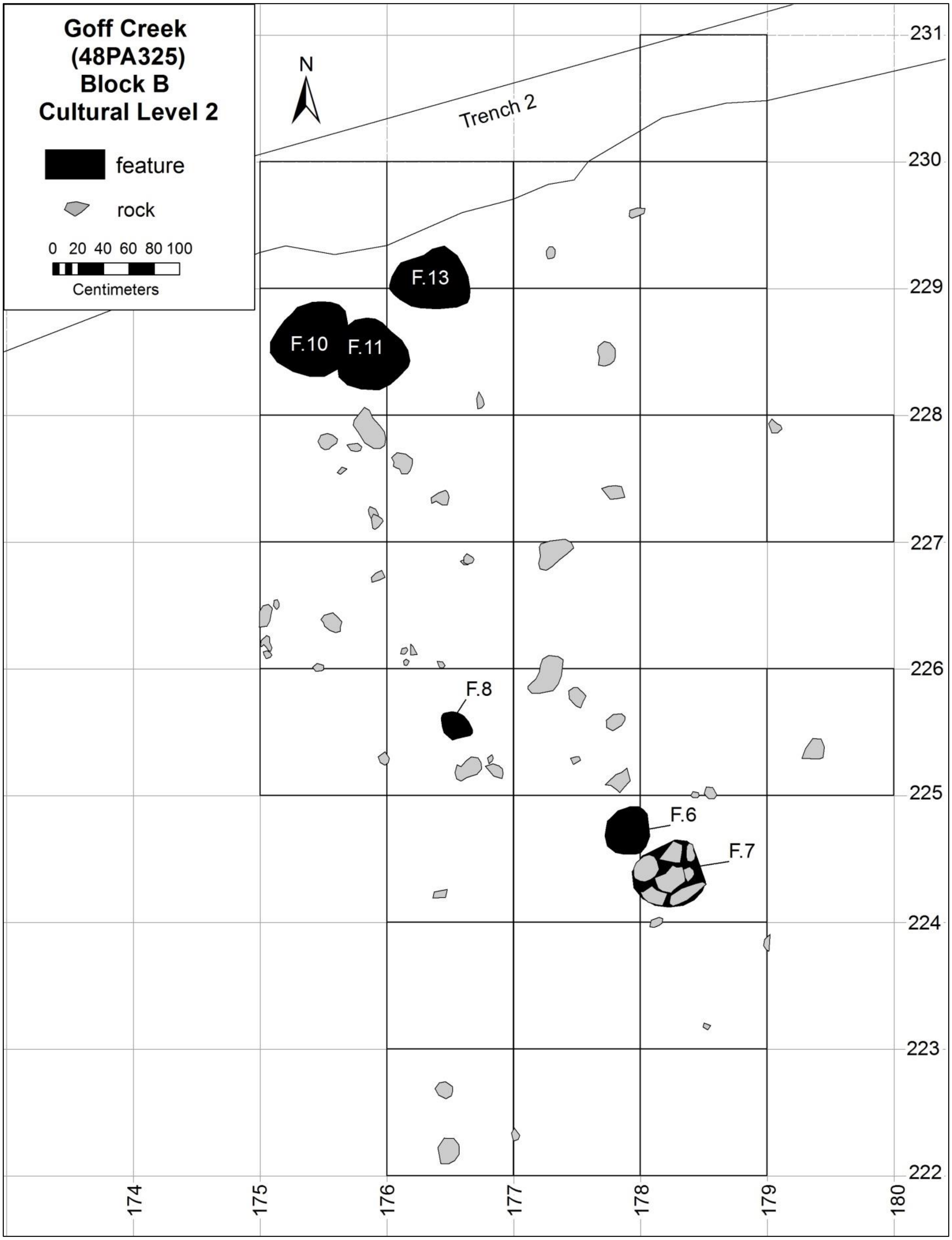


Figure 7-22 Plan view map of Block B Cultural Level 2 showing location of features.

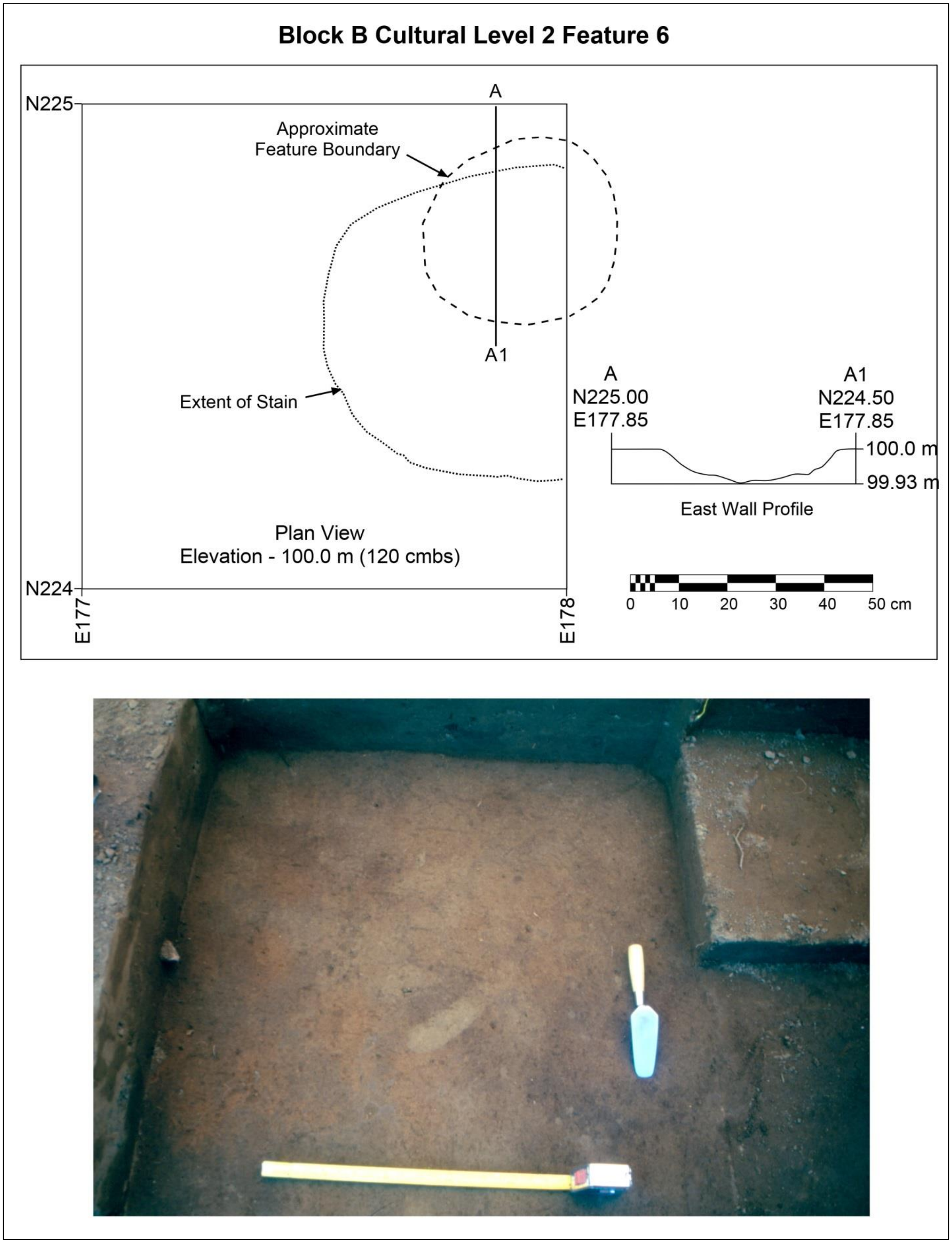


Figure 7-23 Photograph and illustration of Feature 6, Block B Cultural Level 2

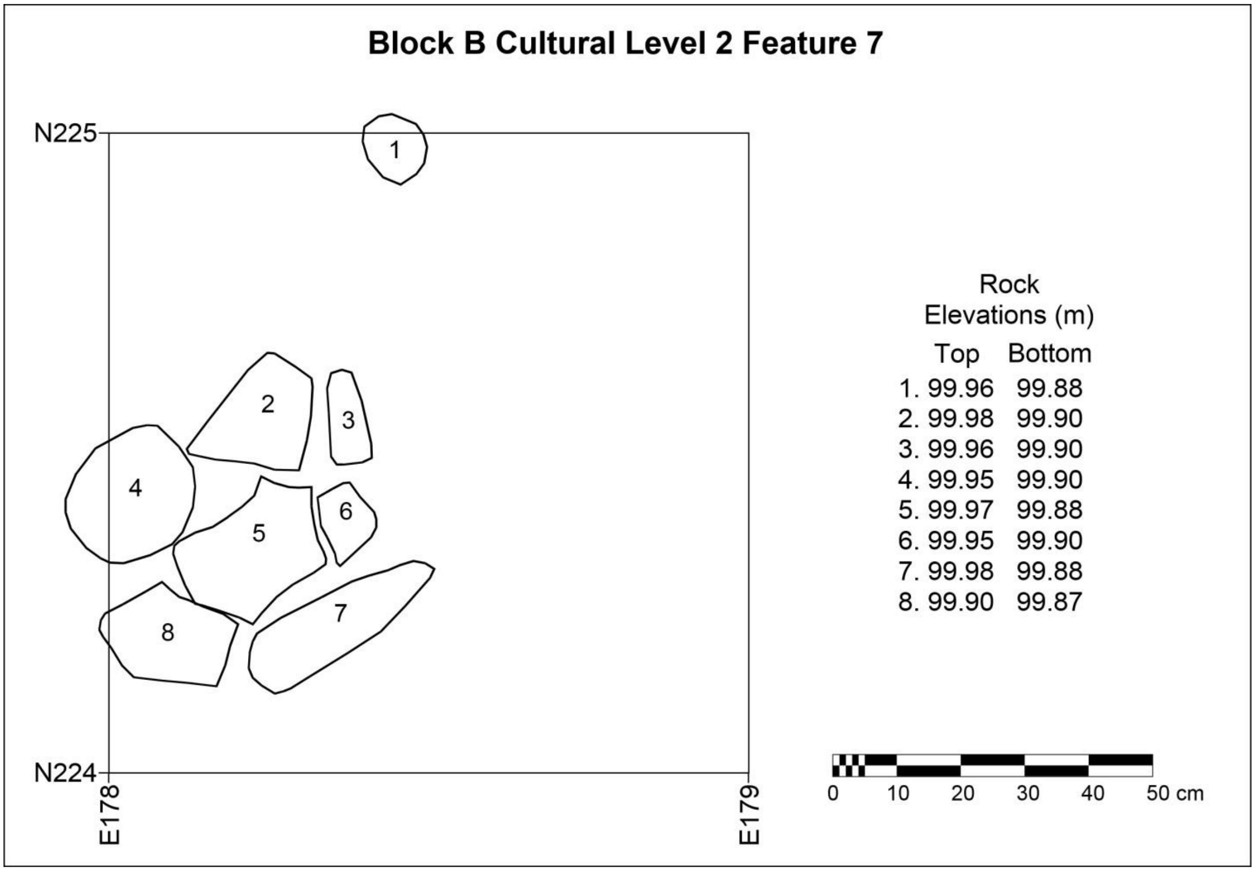


Figure 7-24 Illustration of Feature 7, Block B Cultural Level 2.

mapped piece of fire-cracked rock. The fill also contained a concentration of debitage (some burned), one piece of partially burned bone, and flecks of red ochre. Three non-cultural rocks were mapped to the southeast of the feature. The feature fill was collected for flotation. The light fraction of the fill yielded several pieces of carbonized potentially edible starchy tuber. Charcoal was also present but the pieces were too small for positive identification (Appendix C).

Features 10 and 11 overlapped each other in N228 E175 (Figures 7-22, 7-26 through 7-28). Both features were first identified at 100.15 m. Feature10 was a roughly circular stained area, probably hearth clean out, that measured almost 60 cm north-south by 62 cm east-west and at least 5 cm deep. The maximum depth was not recorded. The fill was mottled dark brown stained sediment that contained a large quantity of small bone fragments. A mano (#14,952) and a manuport were also located within the feature boundary. The plan view became more ovoid with depth. No profile was drawn of Feature 10. The fill from Feature 10 was not processed using flotation for recovery of macro-botanical remains.

Feature 11 was located on the eastern side of Feature 10 and extended east into N228 E176. At elevation 100.15 m, Feature 11 was a roughly oval heavily oxidized red stain, possibly a hearth, that measured approximately 70 cm east-west by 50 cm north-south and 10 cm deep. The feature became

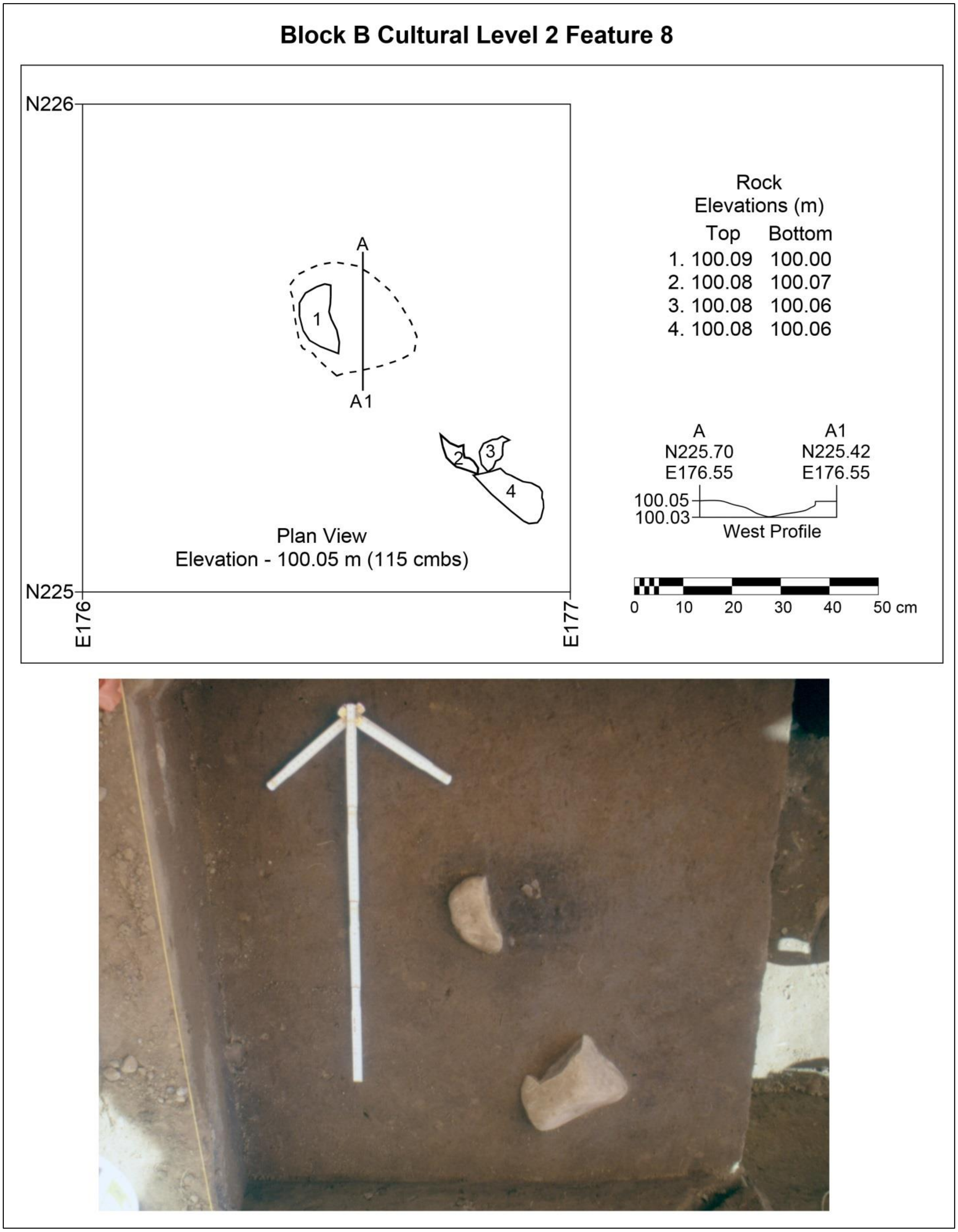


Figure 7-25 Photograph and illustration of Feature 8, Block B Cultural Level 2.

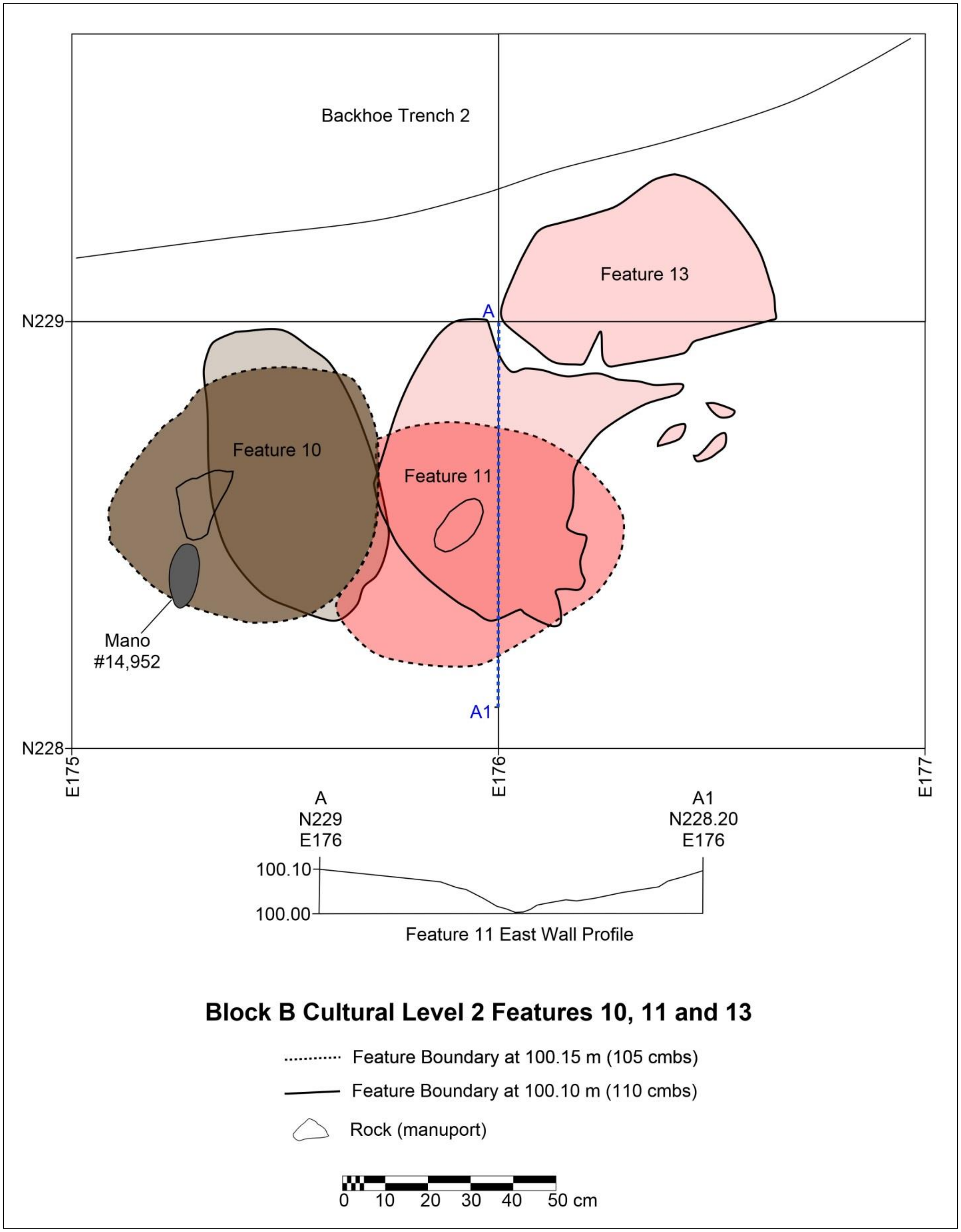


Figure 7-26 Illustration of Features 10, 11 and 13, Block B Cultural Level 2.

Figure 7-27 Photograph of Feature 10, unit N228 E175, view to the south.

Figure 7-28 Photograph of Feature 11, unit N228 E176, view to the north.

more amorphous and discontinuous with depth. The fill was dark reddish brown in color. No charcoal, bone, or fire-cracked rock was recorded in the fill. A few flakes, and one unmodified manuport cobble was mapped within the feature. None of the fill was collected for flotation.

Feature 13 was an irregular concentration of oxidized sediment that was roughly basin-shaped in profile. The feature was located just northeast of Feature 11 (Figures 7-22 and 7-26). Precise dimensions are not available because the southern portion of Feature 13 was not initially recognized during the excavation of unit N228 E176. The feature is estimated to have measured 60 cm east-west by 45 cm north-south and was only a few centimeters thick. The fill was dark reddish brown and contained some debitage and small bone fragments. No charcoal or fire-cracked rock were noted. It is unclear whether Feature 13 represents a discreet firing event, or is merely a dump of hearth waste from Feature 11.

Spatial Analysis

Cultural Level 2 contains two, possibly three, discreet hearth-centered activity areas (Figures 7-22 and 7-29). These activity areas are stratigraphically indistinct. Thus, it is unclear whether the two represent a single occupation or multiple components. There are no stone alignments, or clear boundaries in artifact density that would indicate that any of the activity areas were enclosed within a structure, but this does not preclude the existence of a lightly-constructed temporary shelter.

In the southern half of Block B there is a dense concentration of debitage centered on Feature 6. There are two more chipped stone concentrations, one about three meters to the southwest and another approximately a meter southeast of Feature 7. There was a dense concentration of bone about one meter west of the Features 6 and 7 as well. Numerous flake tools several scrapers and bifaces, a drill and two cores were also found scattered around Features 6 and 7. The assemblage reflects a wide range of activities including food and hide processing and tool production and maintenance.

The second activity area is at the north end of the block around Features 10, 11 and 13. There is a dense concentration of chipped stone and bone east of Feature 13. This artifact cluster likely represents a refuse dump or hearth clean-out episode since bone, chipped stone and oxidized sediment are all mixed and concentrated in a small area. The concentration of chipped stone southeast of Feature 11 likely represents a single episode of tool production and/or maintenance. Scattered around the features are numerous flake tools, projectile points, bifaces, a scraper, a mano and a couple cores, which again evidences a range of activities.

There are small concentrations of chipped stone and bone around Feature 8. Given the mixed nature of the artifacts and the presence of oxidized sediment, it is probable that Feature 8 and the artifacts clustered around it are the result of a hearth cleaning episode.

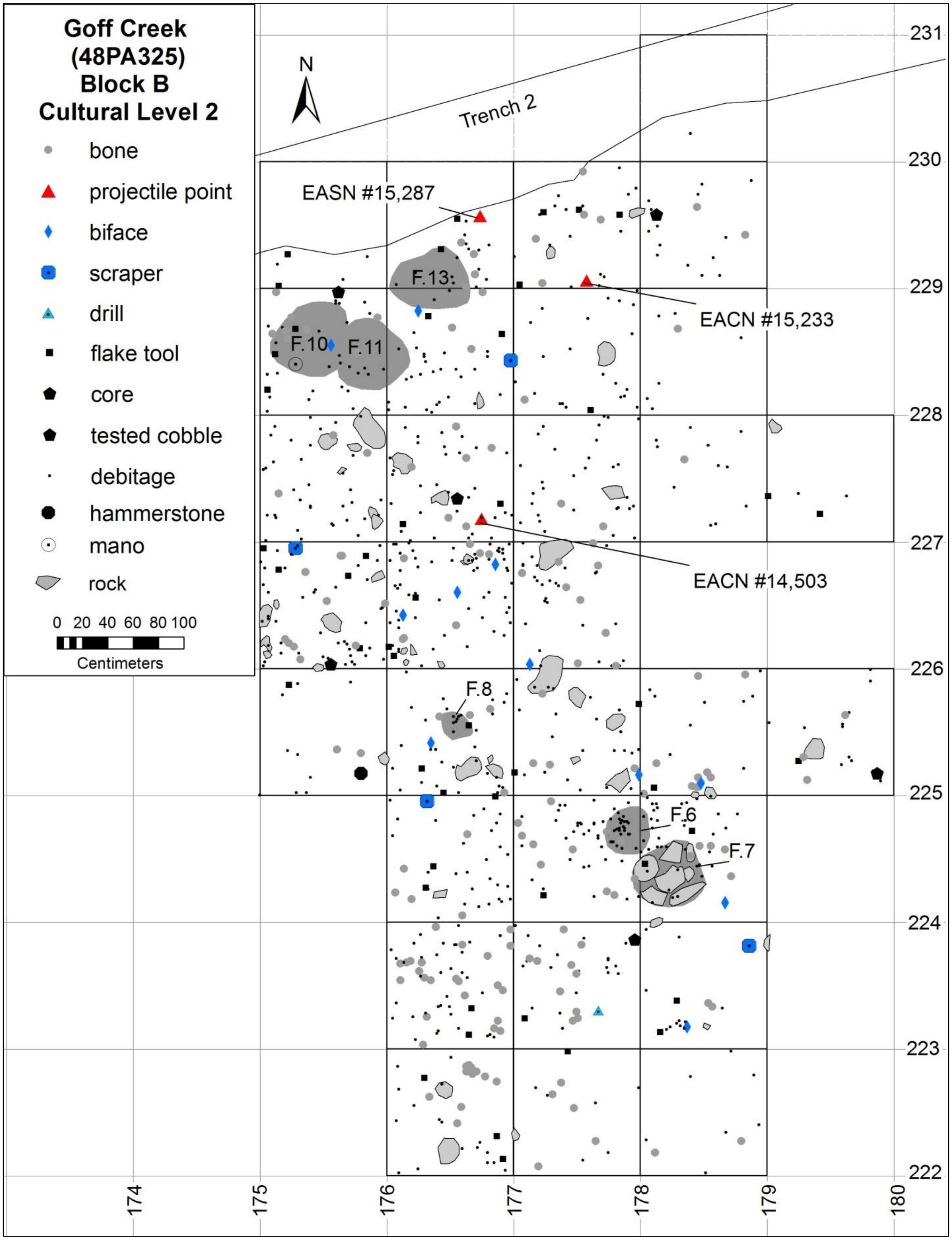


Figure 7-29 Plan view map of Block B Cultural Level 2 showing piece-plotted artifacts and features.

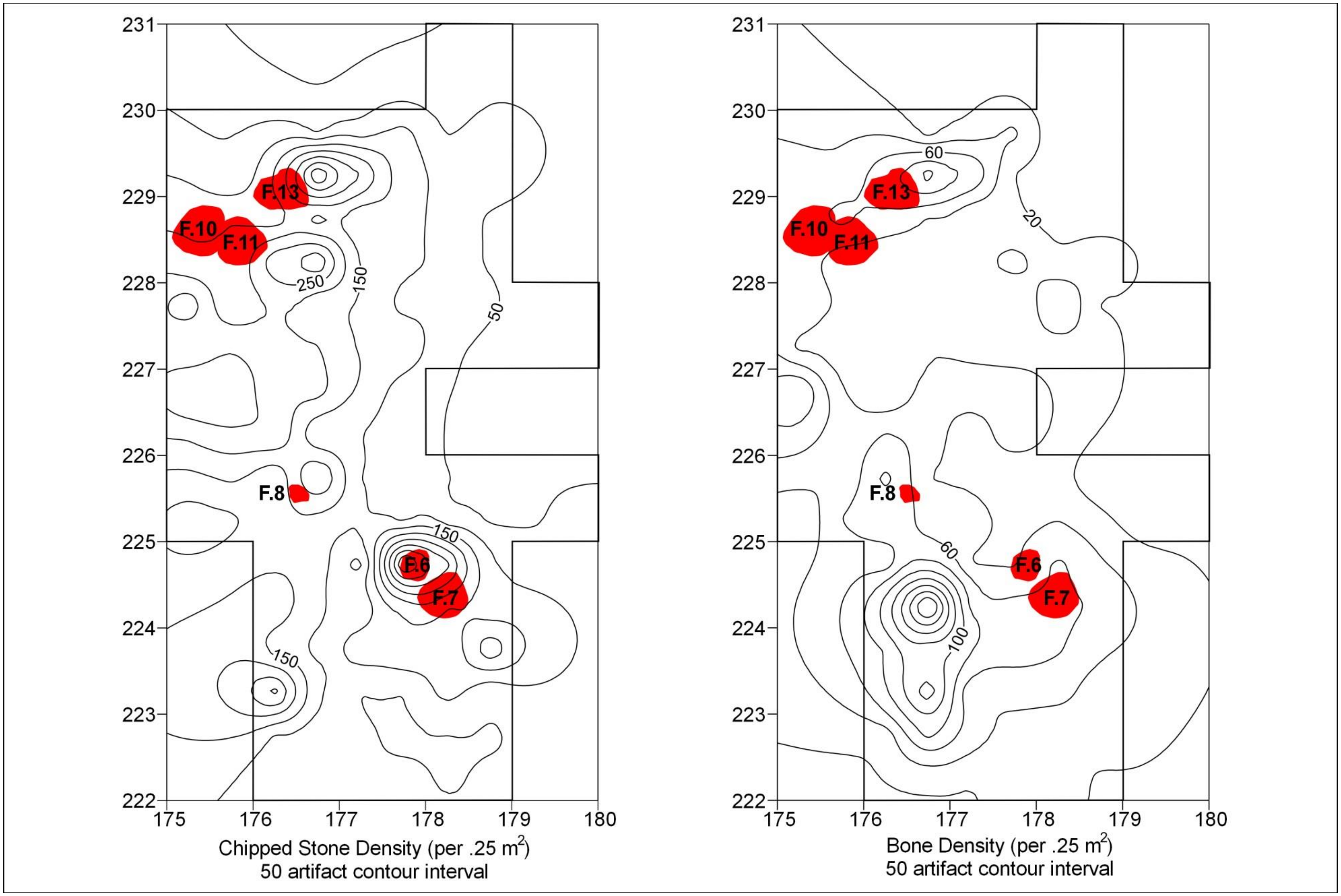


Figure 7-30 Map showing the interpolated artifact densities in Block B Cultural Level 2.

Summary and Discussion

Block B contained portions of Cultural Levels 1 and 2 that were also documented in Area A. Unlike Area A, Cultural Level 1 in Block B produced dense concentrations of artifacts and several features. The data from this level clearly demonstrate that Stratum II, in which Cultural Level 1 is situated, accumulated slowly over a long period of time. Three radiocarbon dates from features in Cultural Level 1 span 1000 radiocarbon years (5700-6700 BP). Moreover, a Cody Complex point fragment was found at about the same elevation as several side and corner-notched Early Archaic dart points. Be that as it may, it would appear that most of the artifacts are associated with the Early Archaic occupation(s). Spatial analysis reveals that most of the artifacts from Cultural Level 2 were found in direct association with Features 3, 5, 9, 12 and 14. The composition of the assemblage overall reflects a wide range of camp activities likely centered on bighorn sheep procurement.

Cultural Level 2 in Block B was particularly productive with large chipped stone tool and faunal assemblages and six features that form two discernible activity areas. There may be more than one occupation represented in Cultural Level 2. Yet, unlike Area A no clear stratigraphic clustering is apparent. Temporally diagnostic artifacts include a small assemblage of side and corner-notched dart points assignable to the Early Archaic period. No radiocarbon dates are available from Block B, but the occupation(s) likely date to the same period as Cultural Level 2 in Area A, circa 5700-5270 BP. As in the other levels, the stone tool assemblage suggests that a wide range of domestic activities were carried out at the site including food and hide processing and tool production and maintenance. Many of these activities show spatial patterning indicative of hearth centered use of space. Hunting of bighorn sheep again appears to have been the primary focus of subsistence activities. However, the presence of a mano indicates that intensive plant processing, likely small seeds, was also conducted at the site.

CHAPTER 8
RESULTS OF EXCAVATION: AREA C

Michael Page, Carmen Clayton, Dale Wedel and Brian Waitkus

Area C includes Block C, two isolated units south of the block (N212 E245 and N217 E242) and one isolated unit six meters north of Block C (N230 E238). Block C consists of 12 contiguous 1 m x 1 m units located approximately 40 m southeast of the highway (Figure 8-1). Two units in Block C were intersected by a previous test unit. The remaining 10 units are complete. Backhoe Trench 8 was excavated northwest of the block. The excavation of Block C was initiated following the discovery of a buried cultural component in Backhoe Trench 8 excavated in 1995. The block excavations were conducted in July, August, September, and October of that year.

Seven of the units had between three and four levels, 10-cm thick, removed reaching depths of 30-40 cmbs (elevation of 99.1 m to 99.0 m [Figures 8-1 through 8-5]). Unit N222 E239 was only excavated to 25 cmbs (99.15 m). The remaining four units had between 10 and 13 10-cm thick levels removed, reaching a total depth of 98.35 m to 98.16 m (100-130 cmbs). The two isolated units south of Block C were excavated to 98.3 m (95 cmbs). Only two 10-cm thick levels were excavated from N230 E238) reaching a maximum depth of 99.45 m (20 cmbs). Three 10 cm levels (3, 5 and 6) from unit N212 E245 were inadvertently mixed. The artifacts from these levels, including 302 pieces of chipped stone and 17 pieces of bone, cannot be assigned to either cultural level and are not discussed further.

Stratigraphy

The stratigraphy of Area C differed in several respects from Areas A and B. In Area C, strata VII, VI and V were not mechanically stripped prior to excavations as they were in Areas A and B. Moreover, strata IV and III were absent from Area C. According to Eckerle (Chapter 5) strata IV and III pinch-out to the west. In Area C stratum IIa is conformably overlain by stratum Va. Stratum Va began to aggrade no earlier than circa 5000 BP and therefore post-dates Cultural Levels 1 and 2 identified in Areas A and B.

The vertical distribution of artifacts indicates that two cultural levels were present in the area (Figures 8-2 through 8-6). However, these levels do not correlate with Cultural Levels 1 and 2 identified in Area A and B. Very few artifacts were found in stratum IIa, which is where any Early Archaic-aged deposits would have been located. The lower cultural level is about 20 cm in thickness and occurs roughly 75 cmbs within a paleosol in the bottom of Stratum Va. Stratum Va is a slightly pebbly sandy silt overbank flood deposit. No radiocarbon dates are available from this cultural level or stratum within Block C. In Block D, however, there is a standard radiometric date of 4070±70 BP (Beta-97540) from an organic sediment sample taken from Stratum Va. Therefore, the lower cultural level probably dates to the Middle Archaic period (ca. 5200-3200 BP). This level is therefore designated Cultural Level 3 The

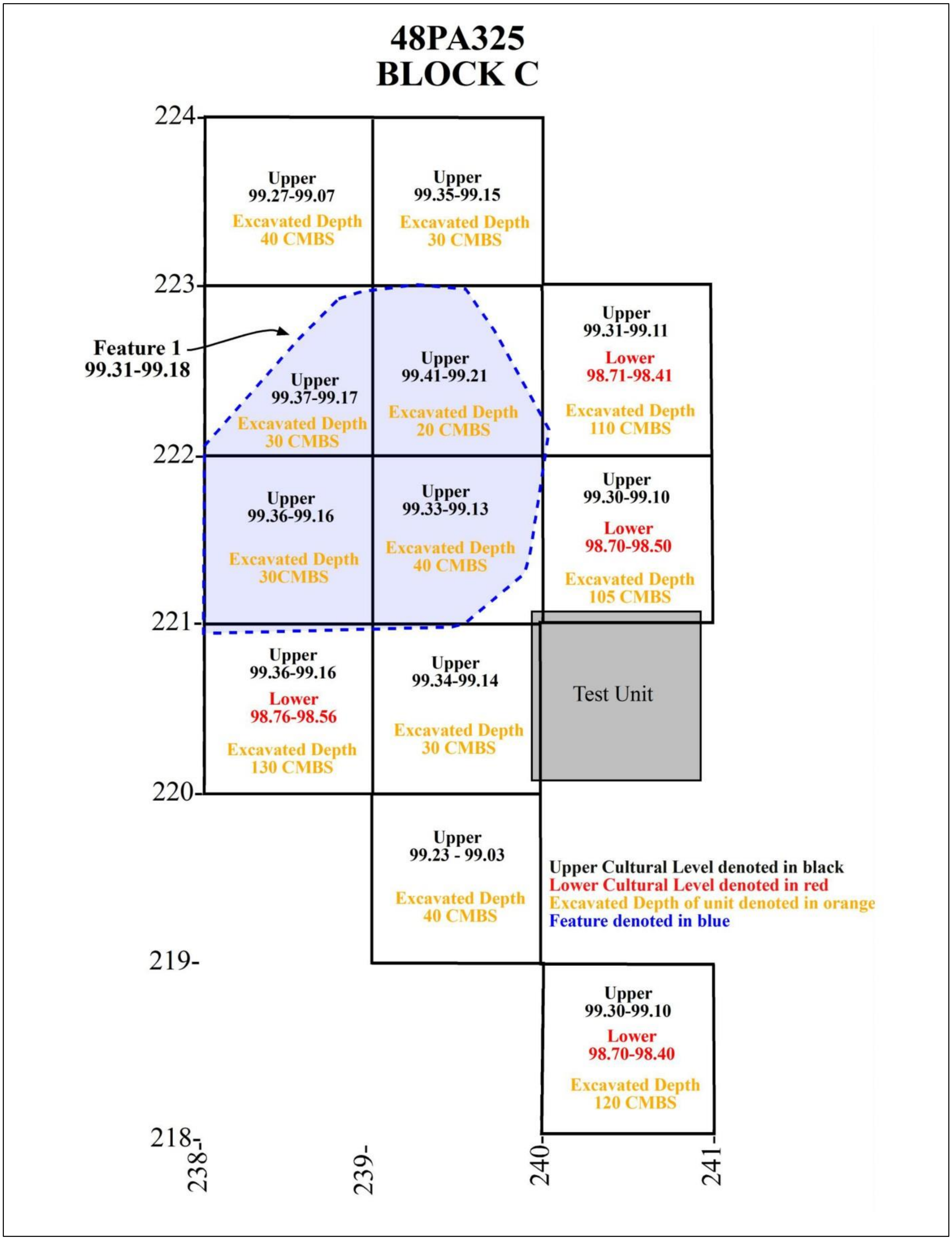


Figure 8-1 Plan view schematic of Block C.

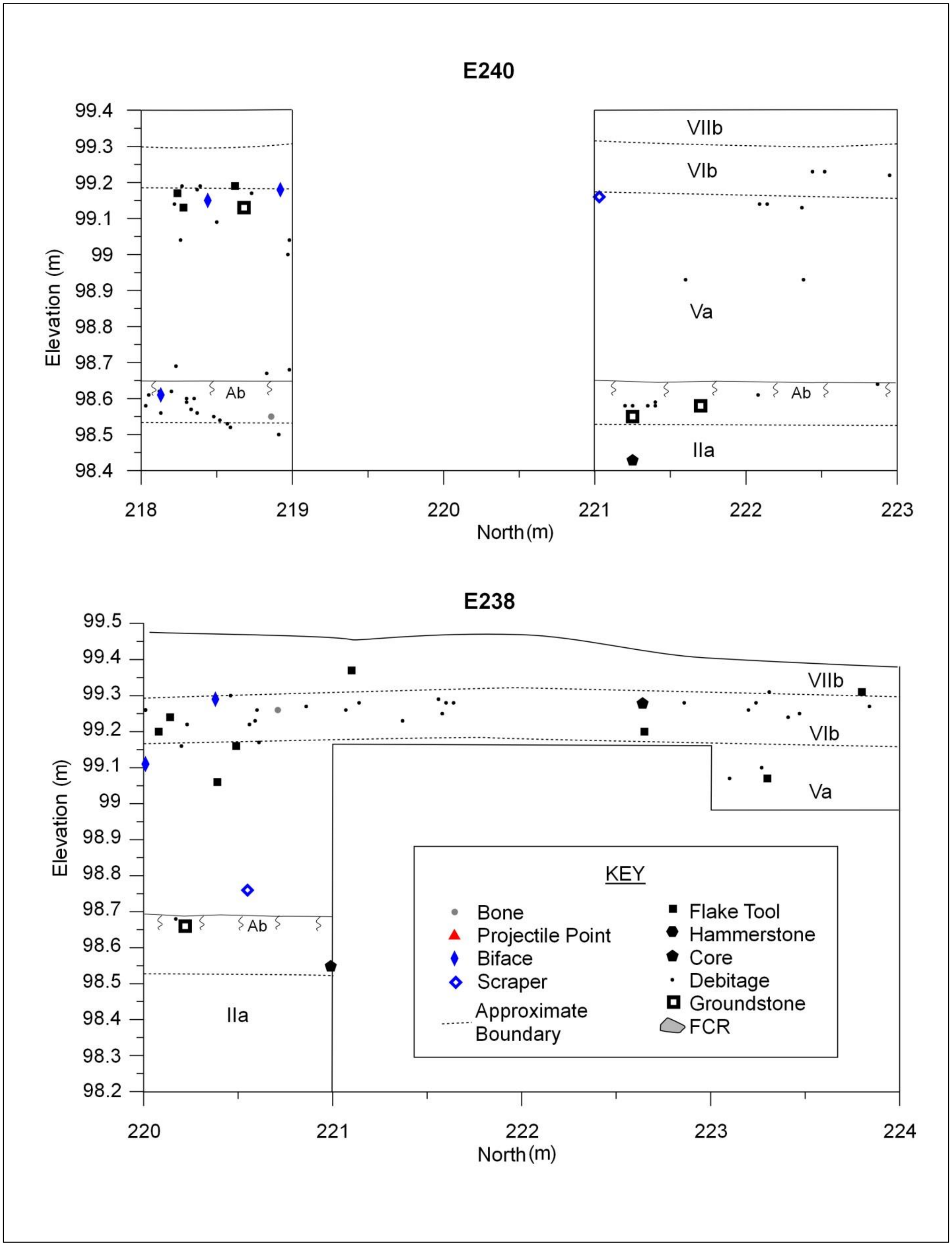


Figure 8-2 Backplots of point plotted artifacts for Block C lines E238 and 239.

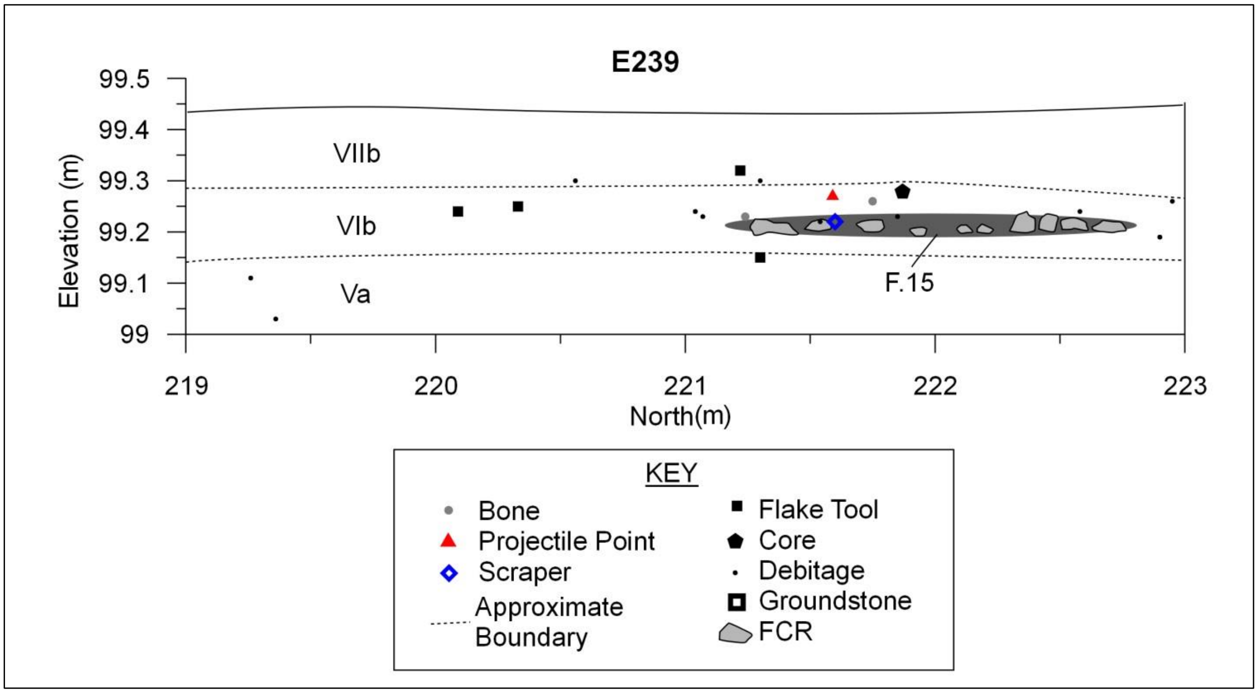


Figure 8-3 Backplots of point plotted artifacts from Block C line E240.

evidence suggests that the Area C Cultural Level 3 occupation is related to the component identified in Areas E and F (Chapter 10) and dated to 4310±30 BP (Beta-406662).

The upper cultural component, designated Cultural Level 4, was approximately 20 cm thick and shallowly (10-35 cmbs) buried. Most of the cultural material was recovered from stratum VIb, but diffuse scatters of cultural material were also found in the upper 5-10 cm of stratum Va and the lower 5-10 cm of stratum VIIb. Stratum VIb is a sandy-silt slope wash alluvium unit that was dated to circa 2600±60 BP (Beta-87105) using a bulk organic soil sample and standard radiometric processing. This date is in line with the Late Archaic (ca. 3200-1500 BP) diagnostic artifacts recovered from the associated cultural level in Blocks C, D, E and F. Since Cultural Level 4 was so shallowly buried it is highly probable that one or more Late Prehistoric (ca. 1500-250 BP) components are mixed with the Late Archaic component. However, no evidence of stratified occupation levels was found in Area C Cultural Level 4.

Cultural Level 3

Cultural Level 3 contained a scatter of lithics and bone that likely date to the Middle Archaic period. Only four units were excavated to the depth of the component, but this cultural level was present in all four units. No features were identified. The lower component produced 4,676 chipped stone artifacts, three pieces of groundstone and 869 bone fragments.

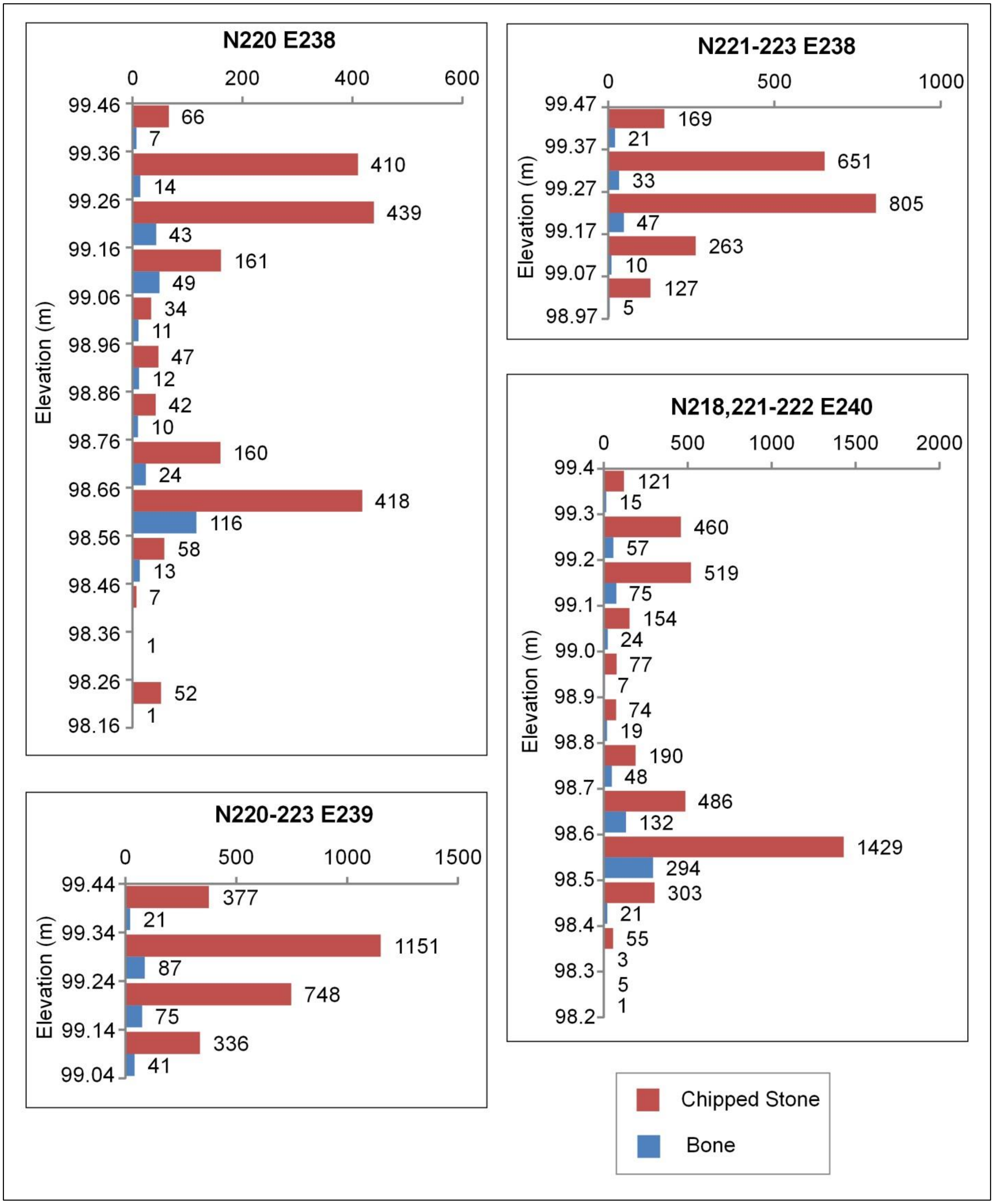


Figure 8-4 Graph showing the frequencies of chipped stone and bone by depth for Block C.

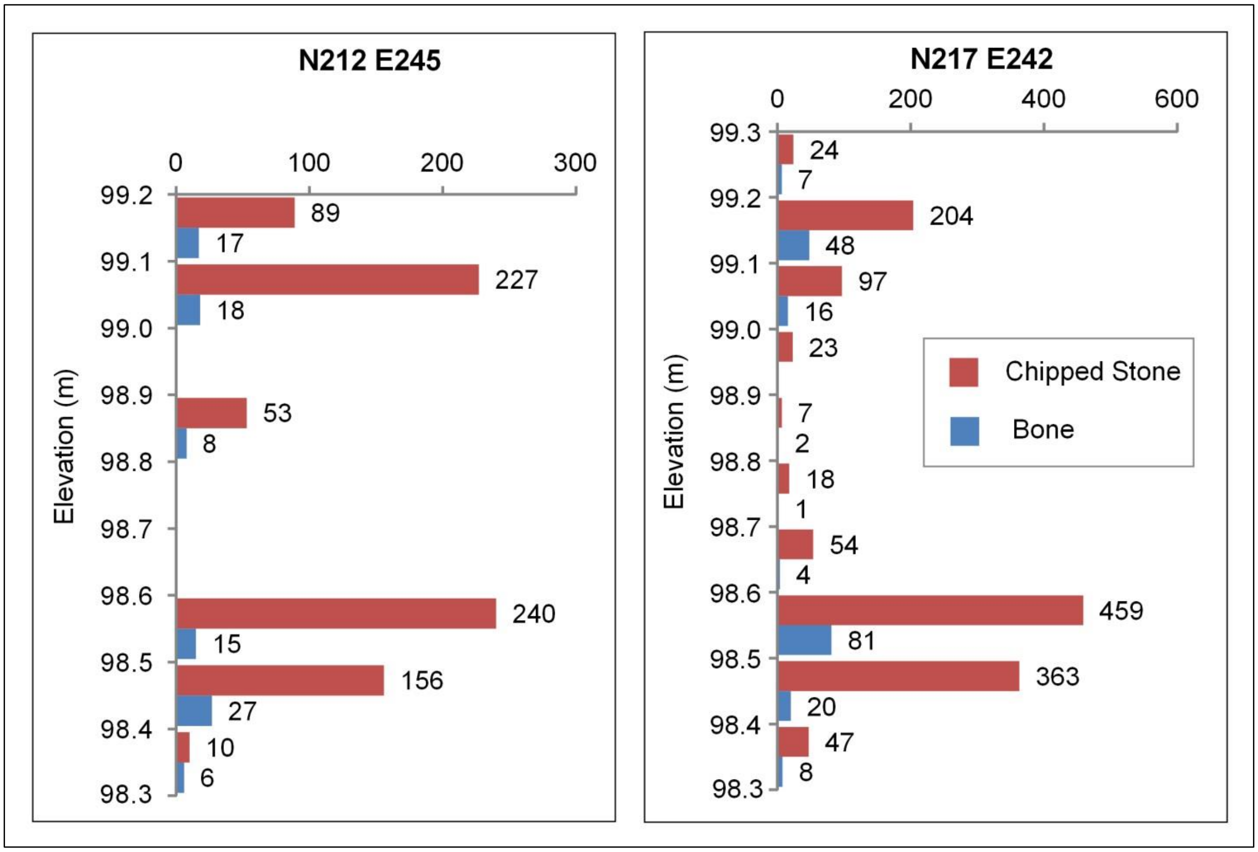


Figure 8-5 Frequencies of chipped stone and bone by depth for Area C units N212 E245 and N217 E242.

Lithic Raw Material Utilization

A total of 4,654 pieces of debitage and 20 chipped stone tools were recovered from Cultural Level 3 (Table 8-1). Again, the majority of the debitage is composed of locally available chert (62.3%) and silicified wood (14.1%). There is significantly more obsidian (12.0%) and non-local chert (10.3%) in the Cultural Level 3 debitage assemblage than in Cultural Levels 1 and 2 in Blocks A and B. The remaining material types are rare and combined account for only 1.2 percent of the debitage assemblage. Obsidian is also highly represented in the chipped stone tool assemblage (30%) from this cultural level. The high proportions of obsidian debitage and stone tools may suggest that the occupants of Cultural Level 3 in Area C had recently been in the Yellowstone Plateau where obsidian is the most commonly available tool stone. This pattern may also reflect a change from Early Archaic mobility patterns in the scheduling of site use or a change to the core and peripheral territories of the site's occupants.

Debitage

Lithic analysis reveals that flake fragments (55%) are the most common artifact type with broken flakes (20.5%), debris (10.1%), and complete flakes (14.4%) composing the rest of the sample (Table 8.1 and Figure 8.8 C). Thus, the tool maintenance/manufacture category comprises over 90% of the

Table 8-1 Area C Cultural Level 3 chipped stone artifacts by raw material type.

MATERIAL	ARTIFACT TYPE									
	Projectile Point	**Biface**	**Drill**	**Scraper**	**Retouched Flake**	**Utilized Flake**	**Tools Total**	**Core**	**Debitage**	**Material Total**
Local Chert	**1**	**1**	**1**	**1**	**3**	**4**	**11**		**2,899**	**2,910**
% of artifact	100	12.5	100	100	75	80	55		62.3	62.2
% of material	<0.1	<0.1	<0.1	<0.1	0.1	0.1	0.4		99.6	100
Silicified Wood		**3**					**3**	**2**	**657**	**662**
% of artifact		37.5					15	100	14.1	14.2
% of material		0.5					0.5	0.3	99.2	100
Obsidian		**4**			**1**	**1**	**6**		**559**	**565**
% of artifact		50.0			25	20	30		12.0	12.1
% of material		0.7			0.2	0.2	1.1		98.9	100
Non-local Chert									**484**	**484**
% of artifact									10.4	10.4
% of material									100.0	100
Misc. QTZ									**38**	**38**
% of artifact									0.8	0.8
% of material									100	100
Morrison QTZ									**13**	**13**
% of artifact									0.3	0.3
% of material									100	100
Unknown Chert									**3**	**3**
% of artifact									0.1	0.1
% of material									100	100
C-grained QTZ									**1**	**1**
% of artifact									<0.1	<0.1
% of material									100	100
Artifact Total	**1**	**8**	**1**	**1**	**4**	**5**	**20**	**2**	**4,654**	**4,676**

assemblage. Of the complete flakes (n=531), only 71 (13.4%) retain evidence of cortex. This indicates that, although late stage tool production and maintenance are the primary activities reflected in the assemblage, some early stage core and/or biface reduction also occurred. Moreover, the presence of two silicified wood cores also indicate that some core reduction occurred during the Cultural Level 3 occupation.

Projectile Point

Only one projectile point (#4,262) was recovered from Block C Cultural Level 3 (Figure 8-6) in unit N221 E240 between 98.6 m and 98.5 m (80-90 cmbs). The complete specimen is made from brown Eocene chert. The point was crafted from a flake blank and still retains the original ventral and dorsal flake scars at the center of both surfaces. The point is 26.7 mm in length, with a 16 mm wide blade, and a maximum thickness of 3.2 mm. The blade length is 24.4 mm, the base width is 7.9 mm, and the haft width is 7 mm. The margins of the slightly concave base are ground. The convex blade margins show use wear along their entire length consisting of rounding, polish, and small scalar scars indicating the cutting of a soft material. This specimen does not closely resemble any named point types, but somewhat similar stemmed points, known as Duncan, are commonly recovered from Middle Archaic-aged McKean complex sites.

Bifaces

Eight bifaces were found in Block C Cultural Level 3 (Table 8-2, Figure 8-6). Half of the bifaces were made from locally occurring materials, and four were made from obsidian (Table 8-1). All of the bifaces were in the middle to late stages of production and appear to have broken during reduction. Generally speaking, the late stage reduction of bifaces conforms to the debitage analysis that identified tool production and maintenance as primary activities. Several of the bifaces showed evidence of use wear indicative of cutting soft material or scraping a semi-hard material such as wood or antler. The latter use wear interpretation may also be the result of grinding platform edges with an antler baton, which is a technique commonly used by modern flint knappers to prepare platforms (Alan Denoyer, personal communication 2013).

Table 8-2 Attributes of bifaces recovered from Area C Cultural Level 3.

Cat#	**Unit**	**Elevation (m)**	**Portion**	**Material**	**Stage**	**Length**	**Width**	**Thickness**	**Use 1**	**Material**	**Use 2**	**Material**
1556	N218 E240	98.61	UN	Silic Wood	III	37.4	29.4	9.7	SC	SH	SC	SH
998	N212 E245	98.46	PR	Obsidian	III	31.6	37.7	8.3				
1542	N218 E240	98.8-98.7	DS	Silic Wood	IV	27.2	19.5	6.5	C	S	C	S
1847	N221 E240	98.6-98.5	DS	Silic Wood	IV	47.4	20.3	5.8	C	S	C	S
993	N212 E245	98.45	DS	Eocene Chert	IV	35	27	8.6	C	S	C	S
1846	N221 E240	98.6-98.5	DS	Obsidian	IV	11	12.6	3.7				
1575	N218 E240	98.6-98.5	UN	Obsidian	V	4.9	3.4	1.6				
1397	N217 E242	98.5-98.4	UN	Obsidian	V	22.8	15	5.5				

Abbreviations; UN-unspecified, PR-proximal, DS-distal, SC-scrape, C-cut, SH-semi-hard, S-soft

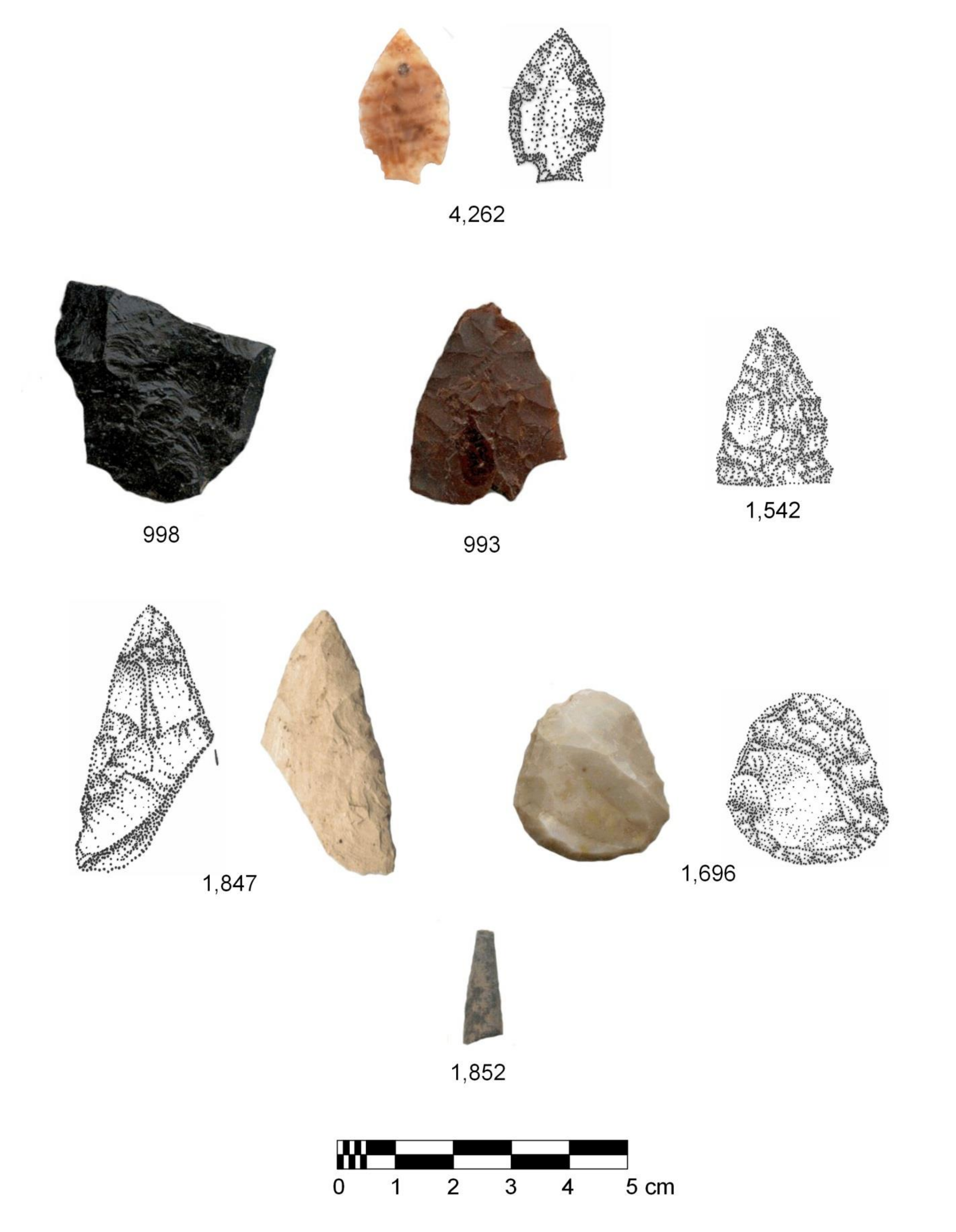


Figure 8-6 Photographs of chipped stone and bone tools recovered from Area C Cultural Level 3.

Drill

One drill (not illustrated) was recovered from Cultural Level 3 in Area A (Appendix B). Specimen #1,584 is a small (18.2 x 10.2 x 4.9 mm) gray Eocene chert distal tip fragment displaying a severe bend break. The drill fragment is diamond shaped in cross section with rounding and blunting use wear, and small step fractures on the opposing sides. The drill tip was also rounded and blunted suggesting the possible drilling of semi-hard material such as wood. The drill fragment was located in N218 E240 between 98.55 m and 98.45 m (80-90 cmbs).

Scraper

One complete end scraper (#1,696) was found in unit N220 E238 in Clock C at 98.76 m (69 cmbs [Figure 8-6, Appendix B]). The scraper is made of locally available Eocene chert and is 29.3 mm in length, 27.1 mm in width and 7.7 mm in thickness. No discernible use wear was present on the specimen, but given its length, it had likely been heavily utilized and probably exhausted.

Utilized and Retouched Flakes

Nine expedient flake tools were found in Area C Cultural Level 3. These include four retouched flakes and five utilized flakes (Appendix B). Most of the specimens are made of locally available chert, but one retouched flake and one utilized flake were made of obsidian. All but one of the tools showed use wear on only one edge indicating limited curation. The flake tools were used for both cutting and scraping soft, semi-hard and hard materials (Appendix B).

Groundstone

One complete mano and two metate fragments were present in Area C Cultural Level 3 (Figure 8-7). Specimen #1,703, found in unit N220 E238 at 98.66 m elevation (69 cmbs), is a sandstone metate fragment that is 9.7 cm by 7.2 cm in maximum dimensions with a variable thickness of around 3.5 cm. The mano (#1,839), also made from sandstone, was found in unit N221 E240 at 98.55 m (80 cmbs). The specimen is 14.2 cm in length and 8.8 cm in width with a maximum thickness of 6 cm. Only one surface of the mano shows significant use. Specimen #1,840 is a basalt metate fragment recovered from unit N221 E240 at 98.58 m (77 cmbs). It is 14.5 cm long and 10.8 cm wide with a maximum thickness of 7.6 cm. Although these artifacts were not processed for extraction of pollen, they were left unwashed to allow future analysis. As will be further discussed in the coming chapters, there is comparatively more groundstone in Cultural Level 3 than any other cultural level at Goff Creek. This may reflect an increased contribution of small seeds and other plant resources to the subsistence base during the Middle Archaic period.

Bone Tool

A bone awl fragment (#1,852) was found in unitN221 E240 between 98.7 m and 98.6 m (65-75 cmbs [Figure 8-6]). The artifact consists of a burned distal shaft fragment with the extreme distal tip missing. It is triangular in cross section. The remaining length is 19.8 mm. It is 6.6 mm wide and 3.3 mm thick. The entire remaining portion has striations running completely around the shaft perpendicular to the long axis. The use wear probably came from working hide or leather.

Faunal Remains

A total of 744 bone and 125 pieces of tooth enamel were recovered from Area C Cultural Level 3 (Table 8-3). Of these, the majority (n=866, 99.7%) is comprised of fragments that could not be identified to species or body class size. Only one bone was identifiable to species. It was a complete bighorn sheep proximal sesamoid that exhibited no fracturing, burning or gnawing. A medium artiodactyl long bone shaft fragment that exhibits cut-marks and green bone fracture patterns was also found. A slight majority (53.5%) of the unidentified specimens show some evidence of burning.

The faunal assemblage from this component is composed primarily of highly fractured bone, and 59% has been burned. Both types of modification suggest intensive processing. The comparatively high number of unidentified specimens might indicate that long bones were crushed in order to retrieve additional nutrients through boiling.

Table 8-3 Faunal remains recovered from Area C Cultural Level 3.

Species	Element	Portion	Side	Count
medium artiodactyl	long bone	long bone shaft	UN	1
bighorn sheep	proximal sesamoid	complete	UN	1
rodent	5th metacarpal	complete	UN	1
unidentified	Bone			741
unidentified	Tooth			125
total				869

Table 8-4 Breakage type, presence of cut marks and burning in the faunal assemblage from Area C Cultural Level 3.

Species	Element	Breakage	Cut/Impact	Burned	Count
bighorn sheep	proximal sesamoid	NA			1
medium artiodactyl	long bone	Green	X		1
rodent	5th metacarpal	NA			1
unidentified	bone	UN		X	435
unidentified	bone	UN			306
unidentified	tooth	UN		X	28
unidentified	tooth	UN			97

Spatial Analysis

Cultural Level 3 consists of a scatter of lithics and bone. Of the 5,548 combined total artifacts recovered from Cultural Level 3, 56 were point plotted, while the remaining were recovered from 1/8 inch screen. The density plots of debitage and faunal remains suggest an activity area centered around N221 E240 (Figure 8-7). Two of the three pieces of groundstone from the component were found in this unit.

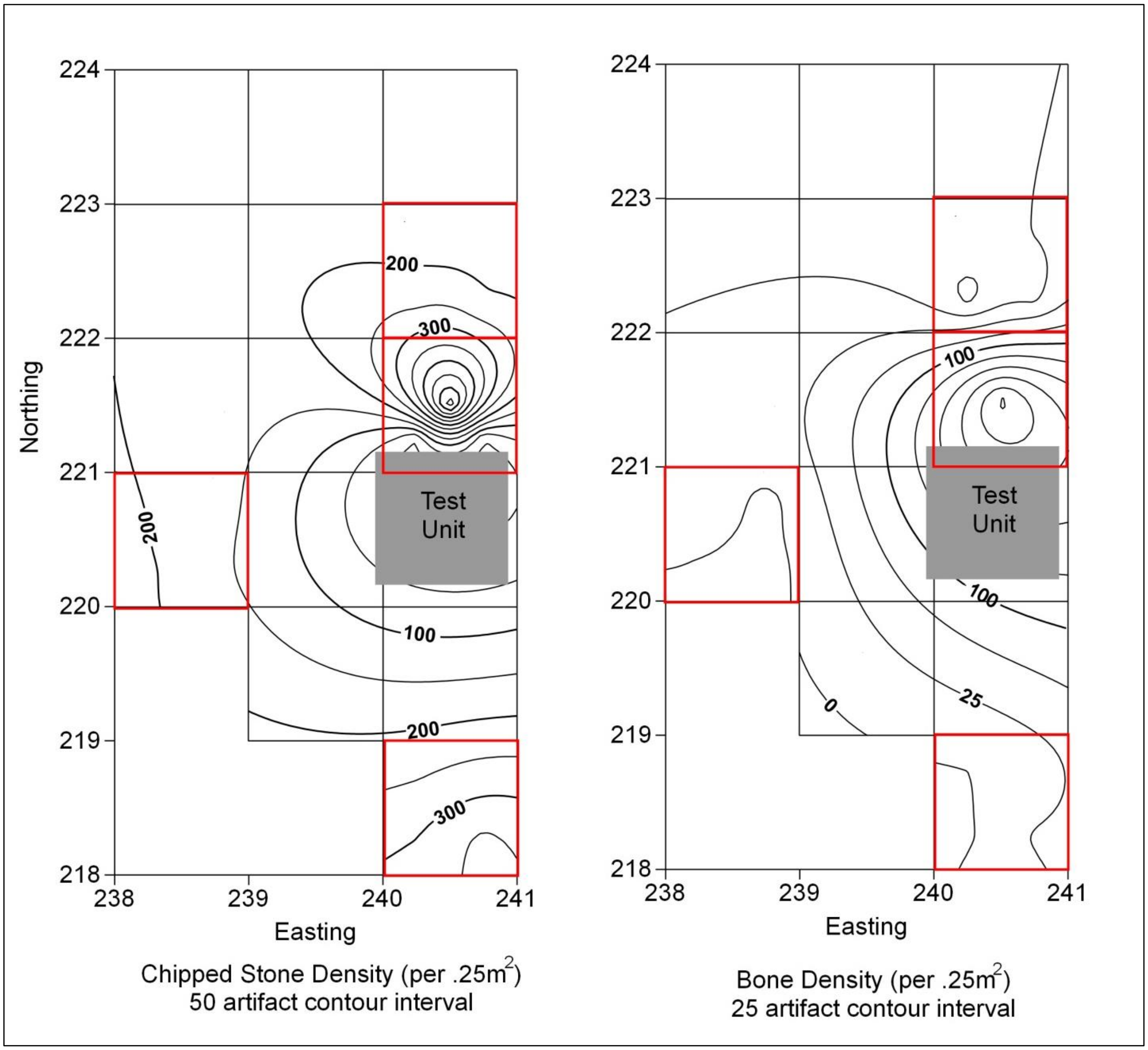


Figure 8-7 Map showing the interpolated artifact densities for Block C Cultural Level 3.

Debitage was generally composed of local material of a size and type that indicate tool maintenance and production, rather than primary reduction. Bone fragments were also generally small and unidentifiable with over half exhibiting heat exposure, suggesting intensive processing. No features and very few rocks were present in the cultural component, hindering identification of possible eroded thermal features. Most of the burned bone was recovered from units N221 E240 and N220 E238, which may evidence the presence of an eroded thermal feature that was not identified during excavation (Figure 8-7). Alternatively, it is possible that a nearby, unexcavated hearth was cleaned and dumped in unit N221 E 240 given the density and mixed nature of the artifacts. Since only four units were excavated in Block C it is difficult to fully assess the use of space.

Cultural Level 4

Cultural Level 4 occurred in every unit of Area. Most of the artifacts were recovered between 99.25 m and 99.0 m (10 cm to 35 cmbs). Cultural Level 4 contained 8,043 chipped stone artifacts, 794 faunal remains bone fragments and one groundstone fragment, as well as Feature 15. A small assemblage of diagnostic artifacts was recovered that indicate a Late Archaic age of the component. However, it is likely that at least some of the artifacts date to the Late Prehistoric period because several small corner and side-notched arrow points were found in strata VII and VI in the surrounding area. No evidence for stratified cultural components was found.

Lithic Raw Material Utilization

Locally procured Eocene chert (60.2%) and silicified wood (8.7%) dominate the debitage assemblage (Table 8-5). However, the proportion of local to non-local materials in Cultural Level 4 differs markedly from older cultural levels. Obsidian is even more abundant in Cultural Level 4 than it was in Cultural Level 3, comprising 18.4 percent of the debitage. Likewise, non-local cherts were also relatively common in the debitage assemblage (10.1%). Similarly, approximately 25 percent of the chipped stone tools were made from non-local materials, most notably obsidian (Table 8-5). Cultural Level 4 chipped stone assemblages in Areas E, F and probably G likewise contain high percentages of obsidian. The high frequency of obsidian and non-local materials in both the tool and debitage assemblage indicates that occupants of Cultural Level 4 had recently been to the Yellowstone Plateau. Again this may reflect a change in mobility patterns and/or territory of hunter gatherers in the area during the Late Archaic.

Debitage

Lithic analysis reveals that flake fragments (60.0%) are the most common artifact type with broken flakes (18.6%), debris (9.8%), and complete flakes (11.6%) composing the rest of the sample. Thus, the tool maintenance/manufacture category comprises almost 90% of the assemblage. Of the complete flakes (n=935), 122 (13%) retain some degree of cortex, much less than would be expected if lithic raw material procurement was a primary site activity (Francis 1997). The overall assemblage then indicates that on-site primary lithic reduction is not the main activity indicated by the assemblage.

Table 8-5 Area C Cultural Level 4 chipped stone artifacts by raw material type.

MATERIAL	ARTIFACT TYPE										
	Projectile Point	**Biface**	**Drill**	**Scraper**	**Retouched Flake**	**Utilized Flake**	**Tools Total**	**Core**	**Tested Cobble**	**Debitage**	**Material Total**
Local Chert	**5**	**6**	**1**		**12**	**22**	**46**		**2**	**4,785**	**4,833**
% of artifact	71.4	28.6	25.0		70.6	66.7	54.8		66.7	60.2	60.1
% of material	0.1	0.1	0.0		0.2	0.5	1.0		0.0	99.0	100
Obsidian	**2**	**10**	**2**			**2**	**16**			**1,466**	**1,482**
% of artifact	28.6	47.6	50.			6.1	19.0			18.4	18.4
% of material	0.1	0.7	0.1			0.1	1.1			98.9	100
Non-Local Chert		**2**	**1**		**2**		**5**			**803**	**808**
% of artifact		9.5	25.0		11.8		6.0			10.1	10.0
% of material		0.2	0.1		0.2		0.6			99.4	100
Silicified Wood		**3**		**2**	**3**	**8**	**16**	**2**	**1**	**695**	**714**
% of artifact		14.3		100	17.6	24.2	19.0	100	33.3	8.7	8.9
% of material		0.4		0.3	0.4	1.1	2.2	0.3	0.1	97.3	100
Misc. Qtz										**177**	**177**
% of artifact										2.2	2.2
% of material										100	100
Basalt										**10**	**10**
% of artifact										0.1	0.1
% of material										100	100
Morrison QTZ										**10**	**10**
% of artifact										0.1	0.1
% of material										100	100
Unknown chert						**1**	**1**			**4**	**5**
% of artifact						3.0	1.2			0.1	0.1
% of material						20.0	20.0			80.0	100
C-grained QTZ										**4**	**4**
% of artifact										0.1	<0.1
% of material										100	100
Artifact Total	**7**	**21**	**4**	**2**	**17**	**33**	**84**	**2**	**3**	**7,954**	**8,043**

It appears that most debitage within Cultural Level 4 was produced from finished or nearly finished tools. This is generally supported by the high percentage (69.9%) of debitage in the 1/8”-1/4” size grade. According to Sullivan and Rosen (1985) high percentages of broken and non-cortical flakes are indicative of tool manufacture and maintenance rather than core reduction. Be that as it may, some core reduction, probably for the production of expedient flake tools, also occurred on site during the Cultural Level 4 occupation(s) because two silicified wood cores and three tested cobbles were also recovered from the level. Generally speaking, the Cultural Level 4 lithic assemblage was created predominantly through the late stage production of bifacial tools and general tool maintenance using both locally available and exotic materials.

Projectile Points

Seven projectile point fragments were recovered from Cultural Level 4 in Area C (Table 8-6, Figure 8-8). Two corner-notched darts are nearly complete, and a third retains most of its base and midsection (Figure 8-8). None of the points exhibit any evidence of haft grinding. Two have concave bases, and one has a nearly straight base. All three appear to have been manufactured from flake blanks using pressure flaking that was only partially invasive leaving a portion of the original ventral surface intact. These dart points closely resemble the Late Archaic-aged Pelican Lake type that dates to circa 3200-1000 BP (Kornfeld et al. 2010).

One small base fragment (#1,339) was identified as a Late Prehistoric corner-notched arrow point, but the specimen is too small and fragmentary for a positive identification. The three remaining artifacts are only small ear or barb fragments and cannot be assigned to a point type with any degree of confidence.

Table 8-6 Attributes of projectile points from Area C Cultural Level 4.

Catalog #	Unit	Elevation	Portion	Material Type	Haft Type	Length	Thickness	Blade Width	Base Width	Base Length	Haft Width	Notch Angle	Notch Depth	Notch Width
1888	N223 E239	99.35-99.25	MS	Obsidian		14.2	3.6							
1781	N221 E239	99.27	BMS	Eocene Chert	C	19.1	3.9	20.1		5.7	12.2	105		
957	N212 E245	99.06	NC	Eocene Chert	C	25.9	3.7	20.5	14.7	5.9	10.3	118	3.9	4.7
1823	N221 E238	99.36-99.26	NC	Eocene Chert	C	26.7	3.3	20.5	16.3	5.5	12.3	129	3.4	4.4
1795	N221 E239	99.33-99.23	BRB	Obsidian		9	2.7							
1339	N217 E242	99.30-99.20	BA	Eocene Chert	C	10.8	2.5			7.7		134	2.3	3.4
2032	N222 E238	99.37-99.27	ER	Eocene Chert		6	1.2						1.8	3.5

Abbreviations; C-corner-notched MS-midsection, BMS base and midsection, NC-nearly complete, BRB-barb, BA-base, ER-ear

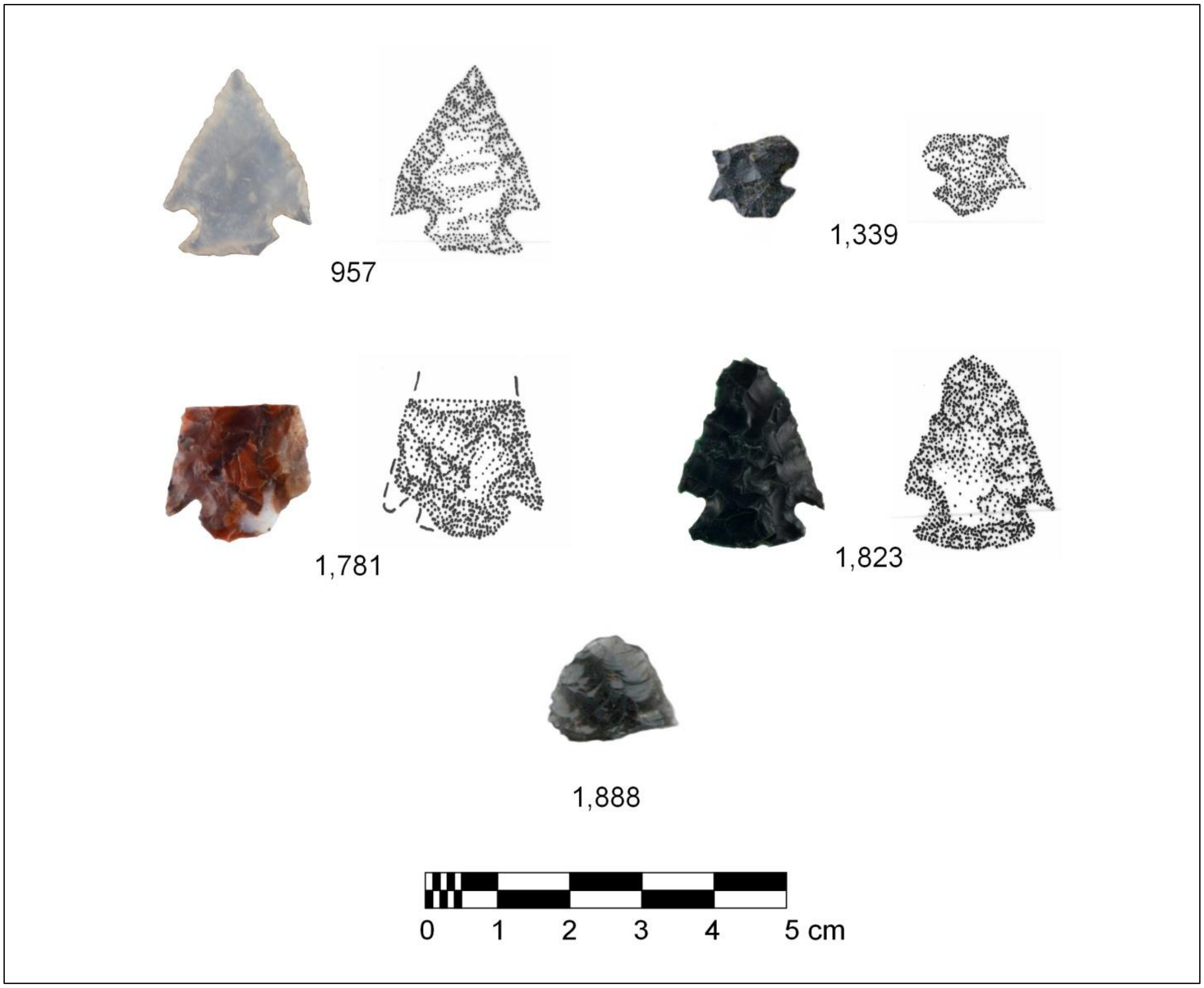


Figure 8-8 Photographs of projectile points recovered from Area C Cultural Level 4.

Bifaces

Area C Cultural Level 4 produced two complete and 19 fragmentary bifaces (Table 8-7, Appendix B). Slightly more than half of the bifaces were made of obsidian and non-local Phosphoria chert (Table 8-5). Examples of stage II, III, IV and V bifaces were found. Several of the stage V bifaces were identified as possible projectile point fragments. Most of the early to middle stage bifaces are made from local stone, and most of late stage V specimens are made of obsidian or Paleozoic-aged Phosphoria chert. However, the only Stage II specimen, which may also have served as a bifacial core, is obsidian. The differing representation of materials by stage of reduction further bolsters the interpretation that occupants of Cultural Level 4 had recently arrived at Goff Creek from the Yellowstone Plateau. Yet, the presence of sizeable quantities of Phosphoria chert, which is primarily available east of the site in the Bighorn Basin, also suggests movement of people from the east. These data might indicate a mixture of multiple occupations of people who were moving west into the mountains, perhaps in the spring or early summer, and another by people moving east out of the mountains in late summer or fall. Use-wear analysis conducted on the bifaces disclosed no identifiable use on 15 specimens. The remaining six specimens were used to cut, scrape or plane soft, semi-hard or hard materials.

Table 8-7 Attributes of bifaces recovered from Area C Cultural Level 4.

Cat#	Unit	Elevation	Portion	Material	Stage	Length	Width	Thickness	Use	Material Worked
1860	N222 E239	99.41-99.31	UN	Obsidian	II	34.5	16.5	8.4		
940	N212 E245	99.20-99.10	MD	Eocene Chert	III	22.3	23.1	5.5		
972	N212 E245	98.90-98.80	CO	Silic Wood	III	39.8	32.1	10.4		
1367	N217 E242	99.10-99.00	CO	Silic Wood	III	66.8	42.6	16.8	SC	H
1499	N218 E240	99.20-99.10	UN	Eocene Chert	III	22.2	9.2	6.6	C	SH
1503	N218 E240	99.20-99.10	UN	Silic Wood	III	21.9	34.7	8.5		
1636	N220 E238	99.36-99.26	MD	Eocene Chert	III	29	39	10.3	P	H
2206	N223 E238	99.37-99.27	LT	Obsidian	III	23.3	32.2	6.4	C	S
2252	N230 E238	99.65-99.55	LT	Obsidian	III	51.9	14.3	7.8	C	SH
1480	N218 E240	99.30-99.20	UN	Eocene Chert	IV	29.5	30	6.9	C	S
1884	N223 E239	99.35-99.25	UN	Obsidian	IV	11.5	3.9	2.8		
2026	N222 E238	99.47-99.37	DS	Eocene Chert	IV	7.8	11.8	5.4		
950	N212 E245	99.10-99.00	LT	Eocene Chert	V	5	3.3	2.3		
1481	N218 E240	99.30-99.20	DS	Paleozoic Chert	V	15.8	12.3	3.8		
1497	N218 E240	99.20-99.10	LT	Paleozoic Chert	V	7.6	3.1	2.1		
1509	N218 E240	99.20-99.10	UN	Obsidian	V	5.6	2.9	1.6		
1657	N220 E238	99.26-99.16	UN	Obsidian	V	5.1	5.7	2.4		
1669	N220 E238	99.16-99.06	PR	Obsidian	V	23.6	24.2	4.3		
1794	N221 E239	99.33-99.23	UN	Obsidian	V	10.8	7.8	3.4		
2065	N222 E240	99.31-99.21	LT	Obsidian	V	7	11	3.3		
2237	N223 E238	99.17-99.07	UN	Obsidian	V	9	5.4	3.8		

Abbreviations; UN-unknown, MD-medial, CO-complete, LT-lateral, DS-distal, PR-proximal, SC-scrape, C-cut, P-plane, H-hard, SH-semi-hard, S-soft

Drills

Four distal drill fragments were found in Area C Cultural Level 4 (Table 8-8, Figure 8-10, Appendix B). Specimen #2,228 is made of a clear Eocene chert, the only drill made of locally available material. The fragment displays a medial bend break. Use wear on the lateral edges consists of rounding and small step fractures. The tool is described as a heavy drill, or reamer, that was possibly used for boring into hard or semi-hard material such as wood. Drills #1,744 and #2,205 are made of obsidian and

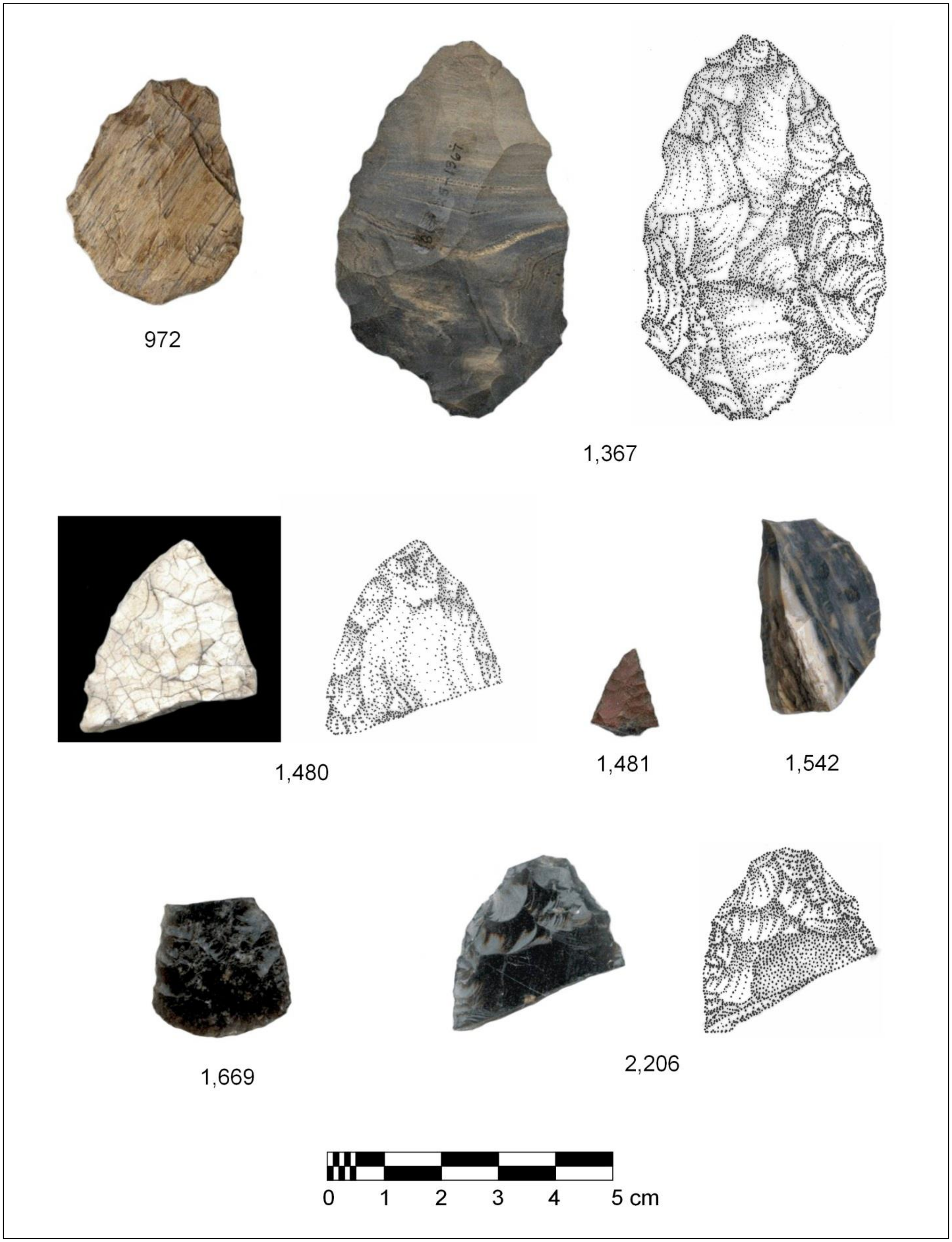


Figure 8-9 Photographs of bifaces from Area C Cultural Level 4.

Table 8-8 Attributes of drills recovered from Area C, Cultural Level 4.

Cat#	Unit	Elevation (m)	Material	Portion	Max Length (mm)	Max Width (mm)	Max Thick. (mm)	Bit Length (mm)	Bit Width (mm)	Mat Worked	Cross-Section
1517	N218 E240	99.10-99.00	MOQ	Tip	10.9	9.2	3.3	10.9	9.2	SH	diamond
1744	N220 E239	99.44-99.34	OB	Tip	15.8	5.5	2	15.8	5.5	S	ovate
2205	N223 E238	99.37-99.27	OB	Tip	5.9	4.7	1.6	5.9	4.7	S	ovate
2228	N223 E238	99.17-99.07	EC	Tip	11.9	7.6	4.4	11.9	7.6	SH	diamond

both have bits that are ovate in cross section and were apparently used to work a soft material such as leather. Drill #1,517 is made of Morrison chert. The specimen is diamond-shaped in cross section and was used to work a semi-hard material.

The two obsidian drills were likely used as awls in clothing manufacture and maintenance. This interpretation is based on the narrow width of the bits (4.7-5.5 mm) and the needle-like tips on each. Moreover, obsidian is brittle and not well suited to working hard materials. The chert drills, on the other hand, were likely used as borers or reamers in woodworking. One obvious, though speculative, use of these drills was to create socketed atlatl foreshafts, many of which have been found in Late Archaic contexts in the area (Husted and Edgar 2002).

Scrapers

Three tools classified as scrapers were recovered Area C Cultural Level 4 (Table 8-5, Figure 8-10, Appendix B). All of the specimens were manufactured from locally occurring silicified wood. The first of these tools, #2,001, is a gray silicified wood end scraper made from a primary flake. The 75° bit angle displays rounding, polish step fractures, with some undercutting. The use wear indicates the scraper was utilized on a hard material. It measures 54.58 mm high, 40.37 wide, and 33.21 mm thick. The bit width is 35.01 mm. Scraper #2,824 is a silicified wood end scraper. The 64° bit angle displays large step fractures and undercutting. The use wear indicated the scraper was utilized on a hard material. It measures 46.82 mm high, 33.31 mm wide and 12.55 cm thick. The bit width is 30.67 mm. Scraper #1,696 is made of locally available Eocene chert. The specimen is complete, but probably exhausted since its overall length is only 29.3 mm, just slightly longer than its width of 27.1 mm. Unlike the other scrapers, #1,696 is rather thin (7.7 mm). No use wear was observed on the 64° angled bit.

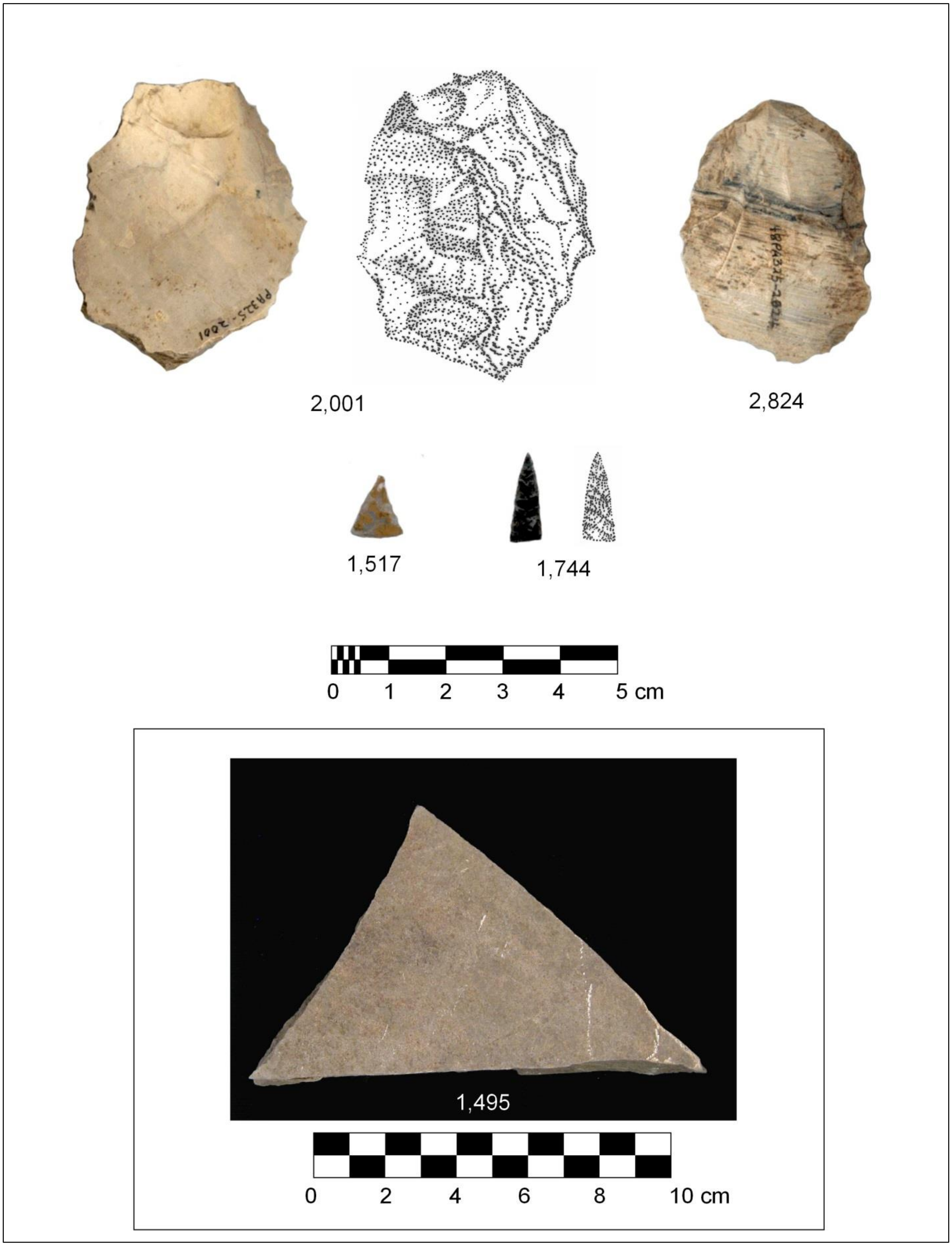


Figure 8-10 Photographs of scrapers, drills and groundstone from Area C Cultural Level 4.

Expedient Flake Tools

Expedient flake tools were the most common class of chipped stone tool in the Cultural Level 4 assemblage (Appendix B). Seventeen retouched flakes were recovered, all but two of which were manufactured from locally occurring raw materials (Table 8-5). Use-wear analysis indicates that most (58.9%) of the retouched flakes were used to scrape semi-hard, and hard materials. The remaining specimens appear to have been used to cut soft materials or showed no use-wear whatsoever (Appendix B).

The remaining 33 artifacts are utilized flakes. Again, most were manufactured from local raw materials (Table 8-5). Use-wear analysis of these tools indicates that most were used to cut soft materials, probably associated with plant or animal processing. About 1/3 of the utilized flakes were used to scrape semi-hard and hard materials, probably wood. One utilized flake was used to plane semi-hard material, and one more was used to groove a semi-hard material.

Groundstone

One metate fragment (#1,495) was found in unit N218 E240 at 99.13 m (22 cmbs) [Figure 8-10]). The specimen is made from a light yellowish-brown, medium-grained sandstone. The fragment is approximately 12.7 cm x 8.4 cm with a maximum thickness of about 4.7 cm.

Faunal Remains

A total of 600 pieces of bone and 197 pieces of tooth enamel were recovered from Area C Cultural Level 4 (Table 8-9). Of these, the majority (98.2%) is comprised of unidentifiable bone or tooth fragments. Identifiable species include domestic cow (n=2), bison (n=1), bighorn sheep (n=1) and intrusive fossorial rodent (n=4). Six bone fragments from of medium artiodactyl size class that include a distal first phalange and two distal second phalanges were also found.

At least one bison and one bighorn sheep are present in the assemblage. The overall size of the Cultural Level 4 faunal assemblage is quite small compared to that recovered from Cultural Level 2. Nevertheless, the Cultural Level 4 assemblage is less diverse, but also contains bison, which was undocumented in the earlier assemblages.

There was almost no evidence of breakage (Table 8-10). Only five pieces exhibited dry bone breaks. They include the bighorn sheep metacarpal fragment and all four medium artiodactyl phalanges. The sawed modern bovine bone was intrusive to the component. A total of 234 specimens showed evidence of burning, all of which were unidentified bone and tooth fragments.

The faunal assemblage from this component is composed of highly fractured and burned bone suggestive of intensive processing. The high number of unidentified specimens might indicate that longbones were crushed in order to obtain additional nutrients through boiling.

Table 8-9 Faunal specimens recovered from Area C Cultural Level 4.

Species	**Element**	**Portion**	**Side**	**NISP**
bos tarus	lumbar vertebra	anterior epiphysis	axial	1
bos tarus	lumbar vertebra	atlas:centrum, wings	axial	1
bison bison	mandible	tooth row	left	1
bighorn sheep	metacarpal	proximal end, <1/2 shaft	left	1
m. artiodactyl	1st phalange	distal end, >1/2 shaft	right	1
m. artiodactyl	2nd phalange	distal end	not sided	2
m. artiodactyl	humerus	long bone shaft	not sided	1
m. artiodactyl	radius-ulna	long bone shaft	right	1
m. artiodactyl	Rib	proximal end	right	1
rodent	5th metacarpal	complete	not sided	2
rodent	femur	proximal end, >1/2 shaft	left	1
rodent	metacarpal	complete	not sided	1
unidentified	bone frag.	unidentified		1
unidentified	bone frag.	unidentified		585
unidentified	tooth frag.	unidentified		194
Total				794

Table 8-10 Breakage patterns presence of cut marks and burning on the faunal remains from Area C Cultural Level 4.

Species	**Breakage**	**Cut/Impact**	**Burned**	**NISP**
bison bison	dry	X		1
bos tarus	NA	sawing		2
bighorn sheep	dry			1
m. artiodactyl	dry			4
m. artiodactyl	green			2
Rodent	NA			4
unidentified bone frag	UN		X	210
unidentified bone frag	UN			376
unidentified tooth frag	UN		X	24
unidentified tooth frag	UN			170

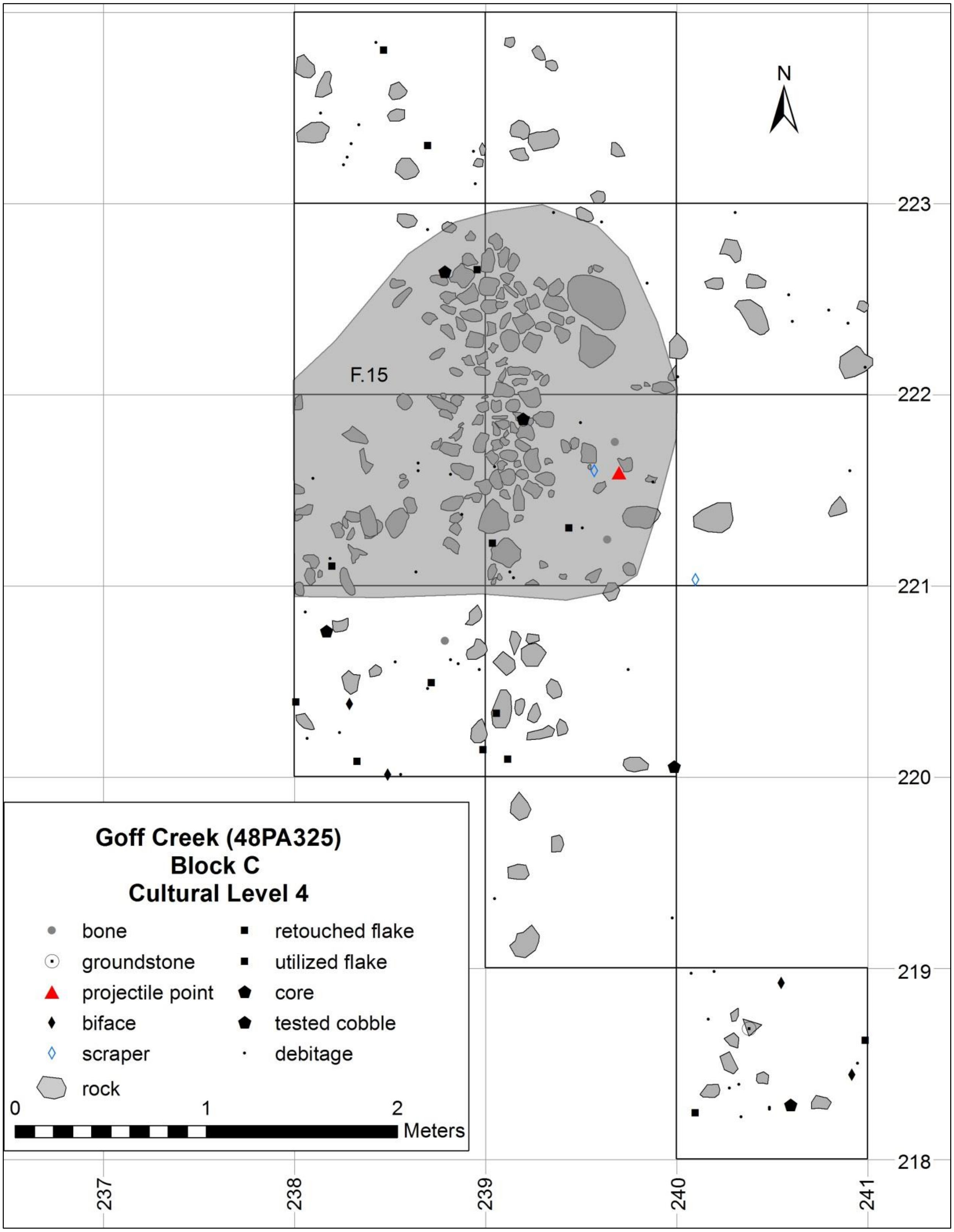


Figure 8-11 Plan view map of Block C Cultural Level 4 showing Feature 15.

Feature 15

Feature 15 is a fairly large fire-cracked rock concentration located in the north central portion of the block (Figures 8-11 and 8-12). The feature measures about 175 cm N-S and 120 cm E-W. It is rather shallowly buried, with the tops of the upper rocks being about 15 cm below the ground surface. The feature contained both fire-cracked and apparently unaltered river cobbles. The rocks in the feature are about 15 cm deep, making the base of the feature about 30 centimeters below the ground surface. Based on the plan view map, the feature appears to contain rocks up to about 35 cm in diameter. The total number of rocks is about 160, weighing an estimated 45- 50 kilograms. No organic or carbon staining was noted and the sediment within the feature was identical to that found outside of it. Although undated, the feature presumably dates to the Late Archaic period. A 15 x 50 cm trench was excavated into unit N221 E239 in an attempt to get a profile for the feature. Nothing was found, and it appears that the rocks are on an old surface and were not in any type of prepared pit. This concentration of fire-cracked and unaltered river cobbles may be a dump from the cleaning of a nearby but undiscovered roasting pit. It is also possible that the concentration represents a badly eroded (deflated) roasting pit. Another possibility is that it is the remains of a roasting platform, which according to Wright (1984:11) "consisted of a single to double layer of cobbles . . . up to 29 m^2 in area."

Figure 8-12 Photograph of Feature 15, Block C Cultural Level 4. Trowel points north.

Spatial Analysis

The upper cultural component consists of several concentrations of debitage and bone in Block C as well as considerable materials from the isolated units. In Block C there are dense concentrations of chipped stone south and north of Feature 15. The concentration south of the feature is associated with three clusters of bone. The clustering of artifacts resembles the hearth-centered activity areas identified in Block B Cultural Level 2. Yet it is also possible that the occupants were merely avoiding a pile of rocks. There is a concentration of chipped stone tools south of Feature 15 as well (Figure 8-12). Included in this cluster are over a dozen flake tools, four projectile points, four bifaces all three scrapers and a drill.

A second activity area is can be inferred from the concentration of stone tools in the southernmost unit, N218 E241. The unit contains 16 tools, including six bifaces and the only piece of groundstone in the upper component. However, there was much less debitage in this area than in the previously discussed activity areas which suggests that tool production was not the primary activity represented.

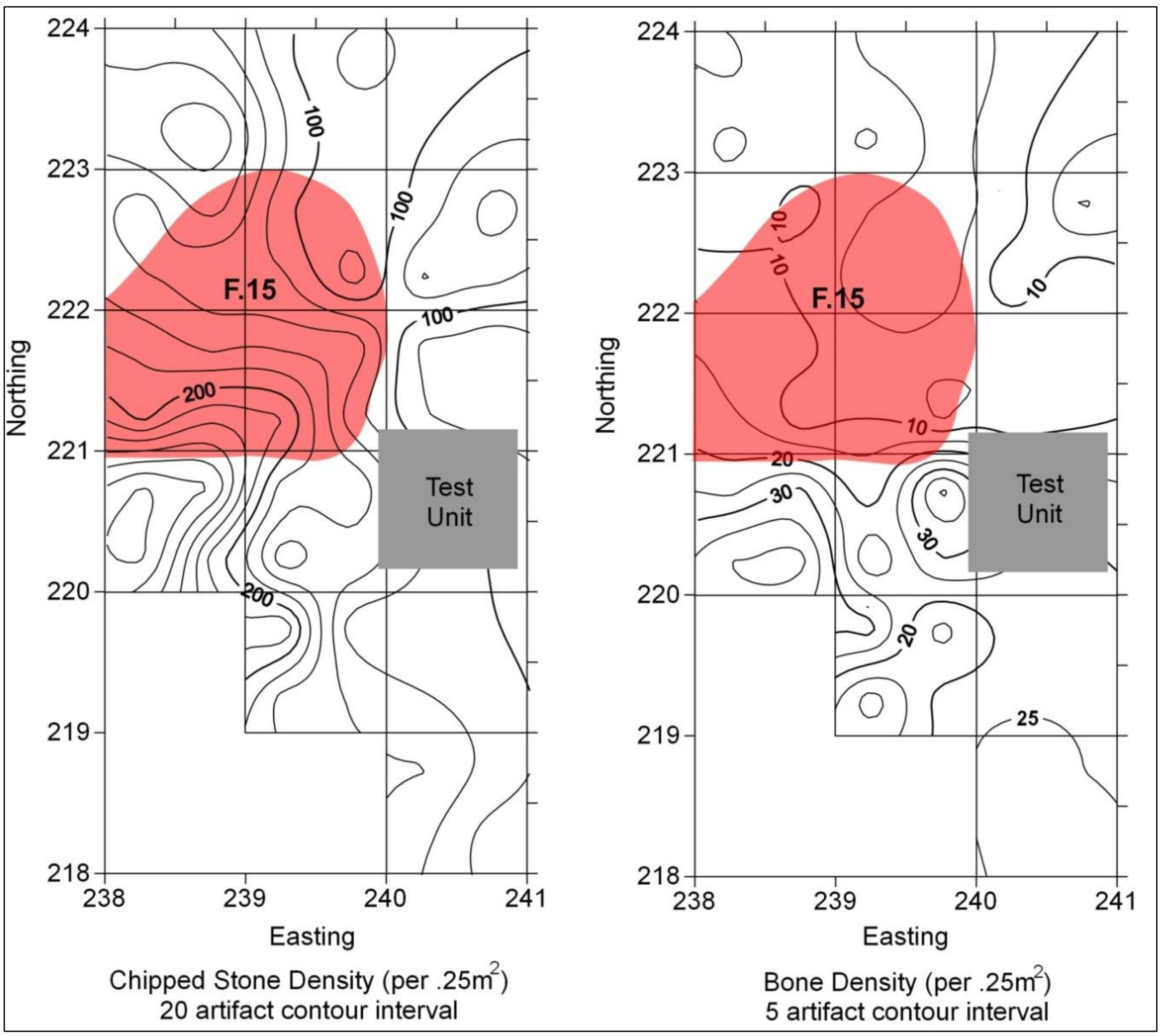


Figure 8-13 Map showing the interpolated artifact densities for Block C Cultural Level 4.

There are no spatial patterns in the distribution of tools by use-wear or functional categories. Tools used for both cutting and scraping of soft, semi-hard and hard materials are mixed in both of the stone tool concentrations. Hunting, tool production and/or maintenance, plant and animal processing and perhaps clothing and/or shelter manufacturing or maintenance can all be inferred from the tools in both concentrations as well. The faunal assemblage was relatively small and highly fragmentary. The high incidence of burned specimens is a strong indication that intensive processing of fauna for bone grease production occurred during the occupation, but it is unclear whether Feature 15 was used in this process.

Summary and Discussion

Area C produced evidence of two occupations. The earlier of these, Cultural Level 3, was found near the base of Stratum Va in a buried soil horizon. No radiocarbon dates are available for Cultural Level 3 in Area C, but a bulk organic soil sample collected from Stratum Va in Block D returned an age estimate of 4070±70 BP (Beta-97540). The evidence therefore suggests that Cultural level 3 dates to the Middle Archaic period (ca. 5200-3200 BP). Only four units in Block C and two isolated units south of the block were excavated into Cultural Level 3, resulting in relatively small sample. Fortunately, Cultural Level 3 was also documented in Blocks E and F (Chapter 10). The only projectile point found in the level, a complete small stemmed dart, is rather crudely made and does not closely resemble any named type.

Despite the limited sample, the Area C Cultural Level 3 assemblage contained is informative. Of particular note is the relatively high frequency of groundstone tools, roughly one tool per 2 m^2. The same number of groundstone tools was found in Cultural Level 2, but the density was only one specimen per 27.3 m^2. There was also far fewer faunal remains in this level than in Cultural Levels 1 or 2 and a lower diversity of species. As limited as these data are, it may be possible to detect a change in subsistence with a greater importance of plant resources such as small seeds that require grinding and/or roots and tubers that requiring roasting. Husted and Edgar (2002) report similar findings at Mummy Cave where no groundstone was found in any of the levels predating Layers 28 and 30 that date to the period 5255±140 BP to 4090±140 BP, or roughly contemporaneous with Cultural Levels 2 and 3. Additional evidence for the increased contribution of plant resources was collected from Blocks E and F.

Cultural Level 4, the upper cultural component in Area C, predominantly occurred in Stratum VIb at about 20-30 cm below the surface. The sample is much larger for Cultural Level 4 than in the previous level. All of the units in Block C and each of the isolated units produced artifacts from Cultural Level 4. Although, no radiocarbon dates were taken from Area C, a bulk sediment sample from Trench 1/2 produced a date of 2600±60 BP (Beta-87105). The three projectile points are all stereotypical Late Archaic corner-notched darts of the Pelican Lake type. Pelican Lake points have been recovered from many sites in the region dated to roughly 3200-1200 BP (Eakin 1989, 2011; Husted and Edgar 2002;

Kornfeld et al. 2010; Page 2015).

Groundstone was less frequent in Cultural Level 4 than the underlying level, but the presence of a fire-cracked rock concentration (Feature 15) may reflect intensive root crop processing either directly on the feature that served as roasting platform, or as rubbish from a nearby roasting pit that was not encountered in the excavations. The faunal assemblage is rather small, but as in Cultural Level 3 it is less diverse than the Early Archaic components in Areas A and B. Bison remains make their first definitive appearance at the site in this level, perhaps suggesting a change in hunting focus. Medium artiodactyl remains continue to dominate the assemblage, but this may have more to do with local bighorn sheep populations than a dedicated intensive hunting strategy.

CHAPTER 9
RESULTS OF EXCAVATION: AREA D

Michael Page, Carmen Clayton, Dale Wedel and Brian Waitkus

Area D consists entirely of Block D, a 34 m^2 area located approximately 40 m southeast of the highway (Figure 9-1). Thirty two units are complete and two are partial. The partial units were located along Backhoe Trench Lower 4. Most of the units had between eight and 15 10-cm thick levels excavated, reaching a total depth 105 cmbs to 135 cmbs (98.1 m to 97.8 m elevation [Figures 9-2 through 9-5]). The south-easternmost unit, N229 E256, was only excavated to a depth of 86 cmbs (98.29 m).

Stratigraphy

The stratigraphy of Block D was similar to that recorded in Block C. Stratum IIa was conformably overlain by strata IIb, Va and VIIa. A thin layer of stratum VIa was observed at the eastern edge of the block. Stratum III, which contained Cultural Level 2 in Area A and B is absent from Block D. It appears that stratum IIa remained unburied for at least a thousand years longer than in Areas A and B resulting in highly compressed stratigraphy. The vertical distribution of artifacts indicates two stratified cultural levels – Cultural Levels 1 and 4 (Figures 9-2 through 9-5). Cultural Level 1 was largely confined to stratum IIa between 98.35 m and 98.1 m elevation (70-95 cmbs). Cultural Level 1 likely contains artifacts deposited during several Paleoindian and Early Archaic occupations documented in Cultural Levels 1 and 2 in Areas A and B. Some cultural material recovered from the overlying Stratum Va may either be the result of artifact displacement from the underlying Cultural Level 1, or a sparse scatter of artifacts related to the Middle Archaic-aged Cultural Level 3 occupation that was documented in Area C. A bulk soil sample taken from Feature 17 in Cultural Level 1 produced an age estimate of 5000±70 BP (Beta-97538) using standard radiometric methods. Artifacts diagnostic of the Late Paleoindian and Early Archaic periods were found within Cultural Level 1 of Block D. Therefore, Cultural Level 1 appears to represent a palimpsest of multiple occupations spanning several thousand years.

Cultural Level 4 was identified within Stratum VIIa at approximately 98.85 m elevation (20 cmbs). The occupations in this level likely correspond with those documented in Area C Cultural Level 4. Artifacts within this component were found within a 20-30 cm thick zone. Charred material from Feature 16 in Cultural Level 4 returned a standard radiocarbon date of 920±70 BP (Beta-97537). Most of the diagnostic artifacts recovered from Cultural Level 4 were affiliated with the Late Archaic Pelican Lake complex, but several Late Prehistoric arrow points were also found. Thus, it would appear that Cultural Level 4 contains a mixture of Late Archaic and Late Prehistoric aged artifacts.

View to the southwest

View to the east

Figure 9-1 Photographs of Block D at the conclusion of excavations.

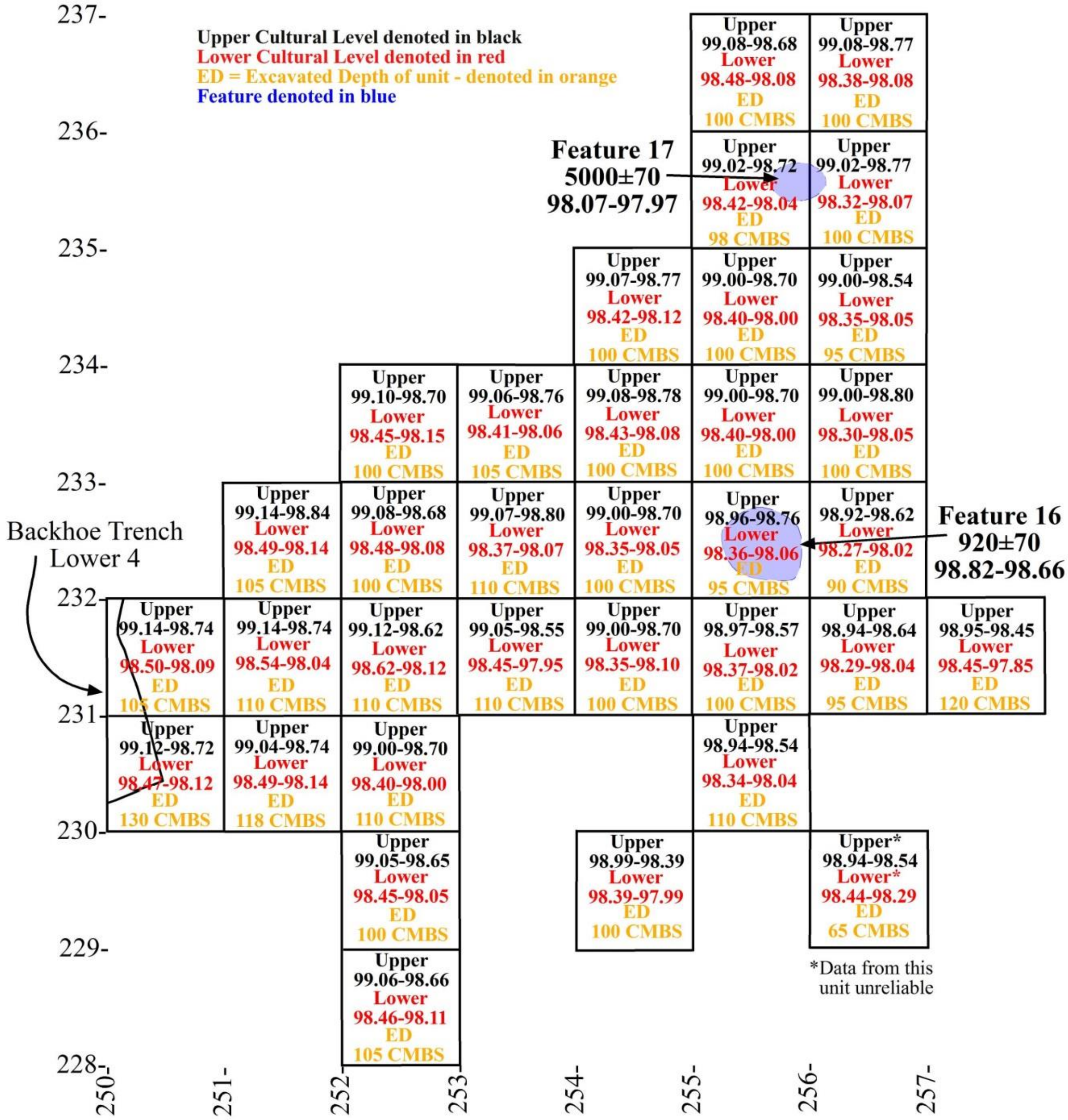


Figure 9-2 Block D plan view schematic.

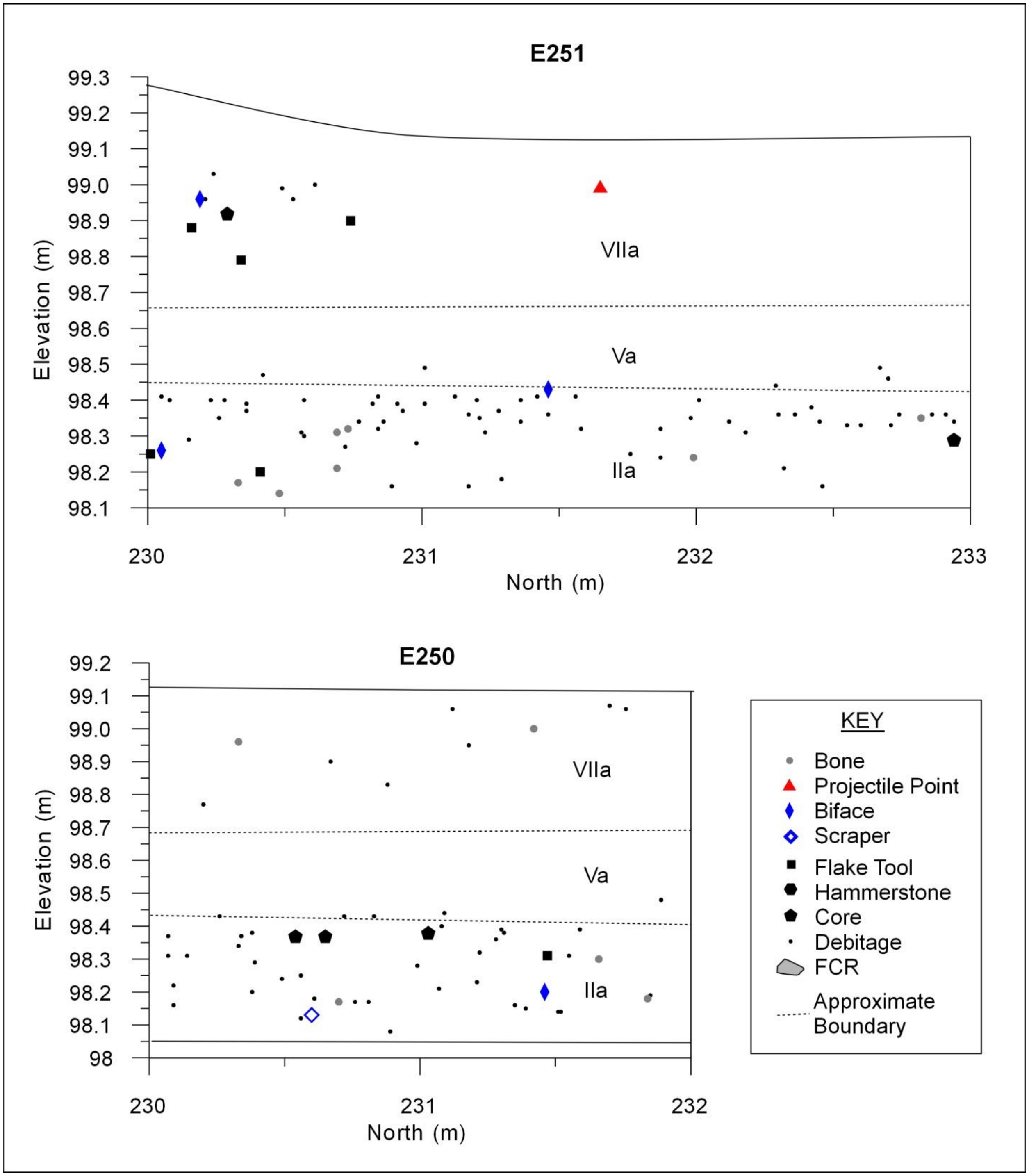


Figure 9-3 Backplots from Block D from the E250 and E251 lines.

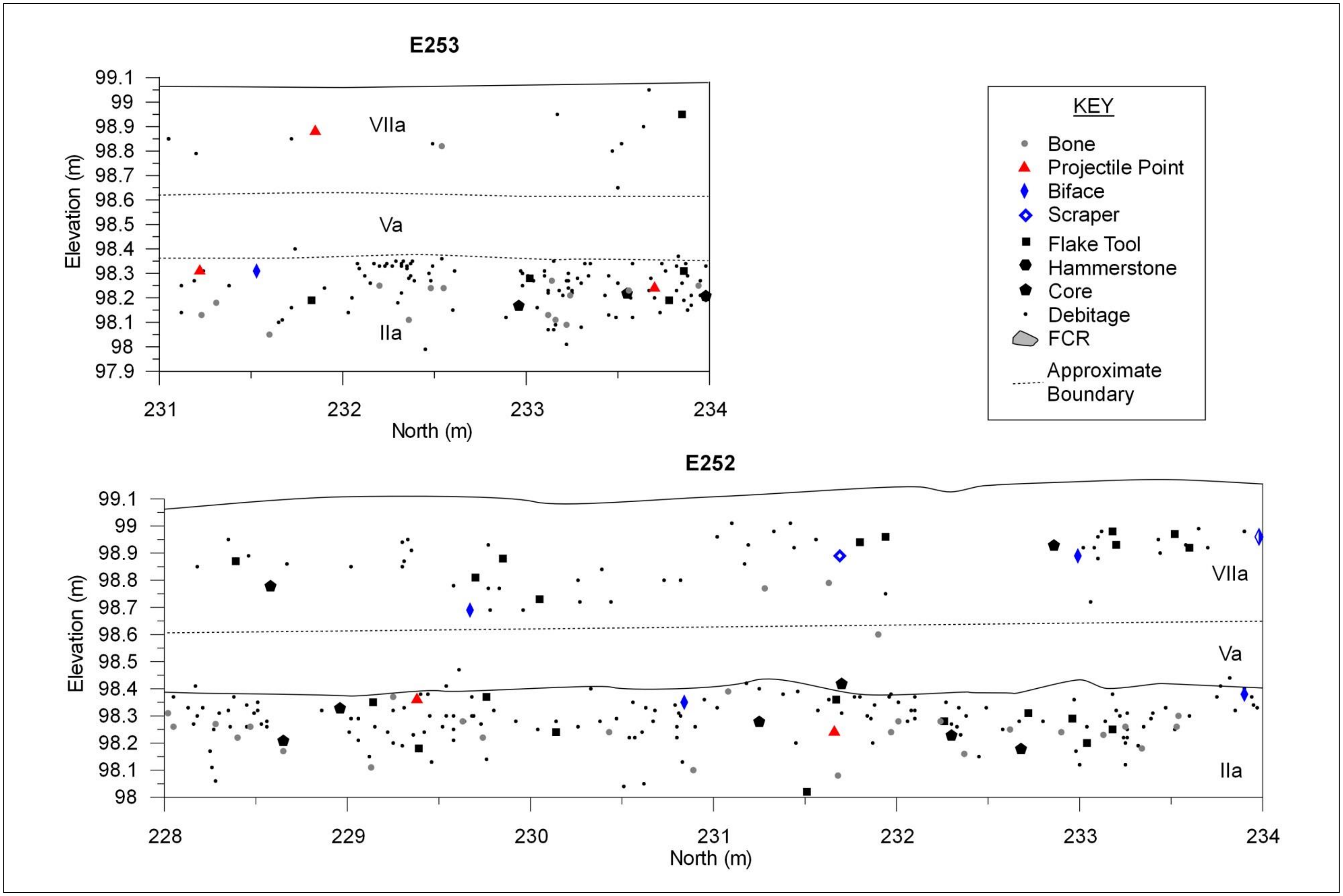


Figure 9-4 Backplots from Block D lines E252 and E253.

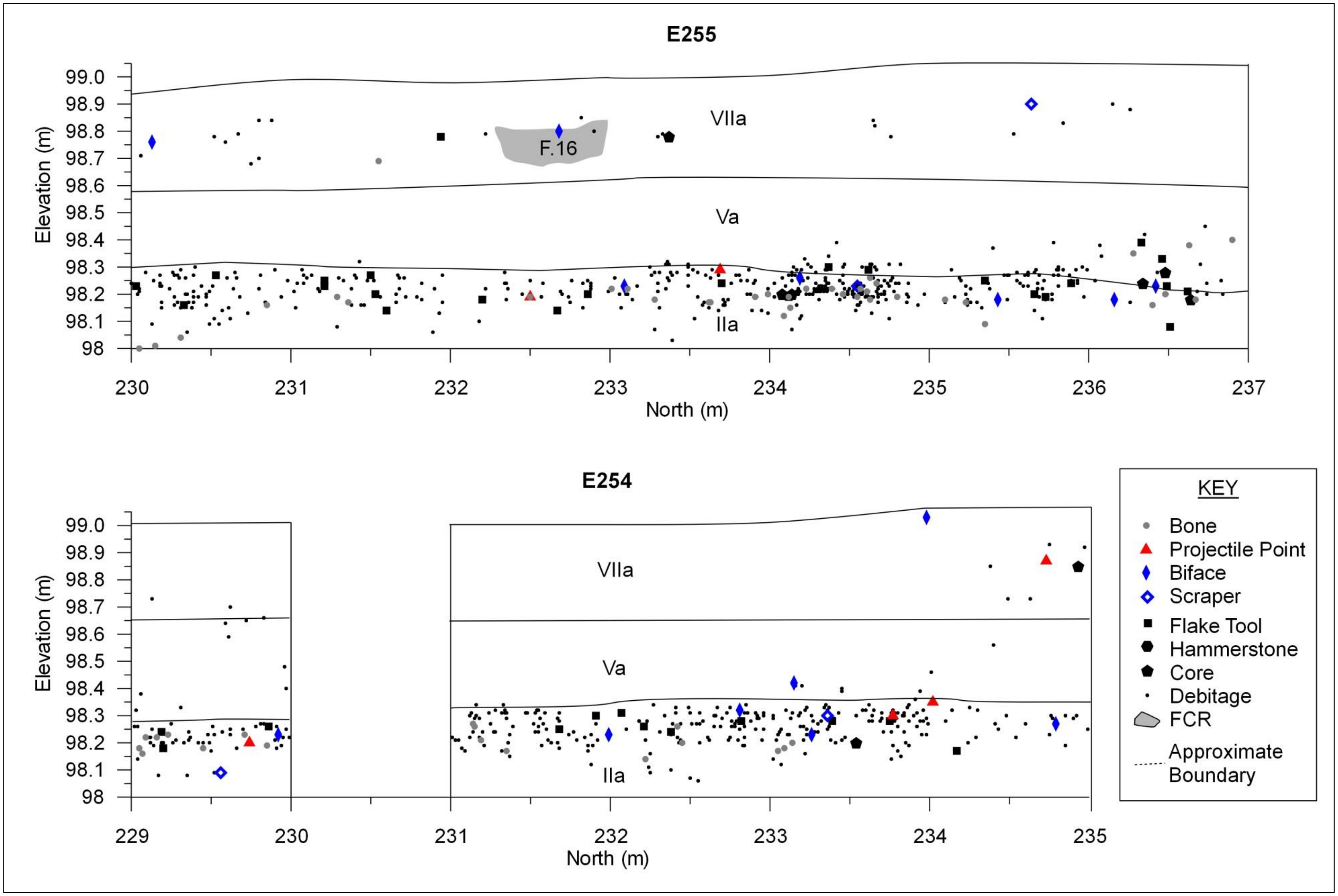


Figure 9-5 Backplots from Block D lines E254 and E255.

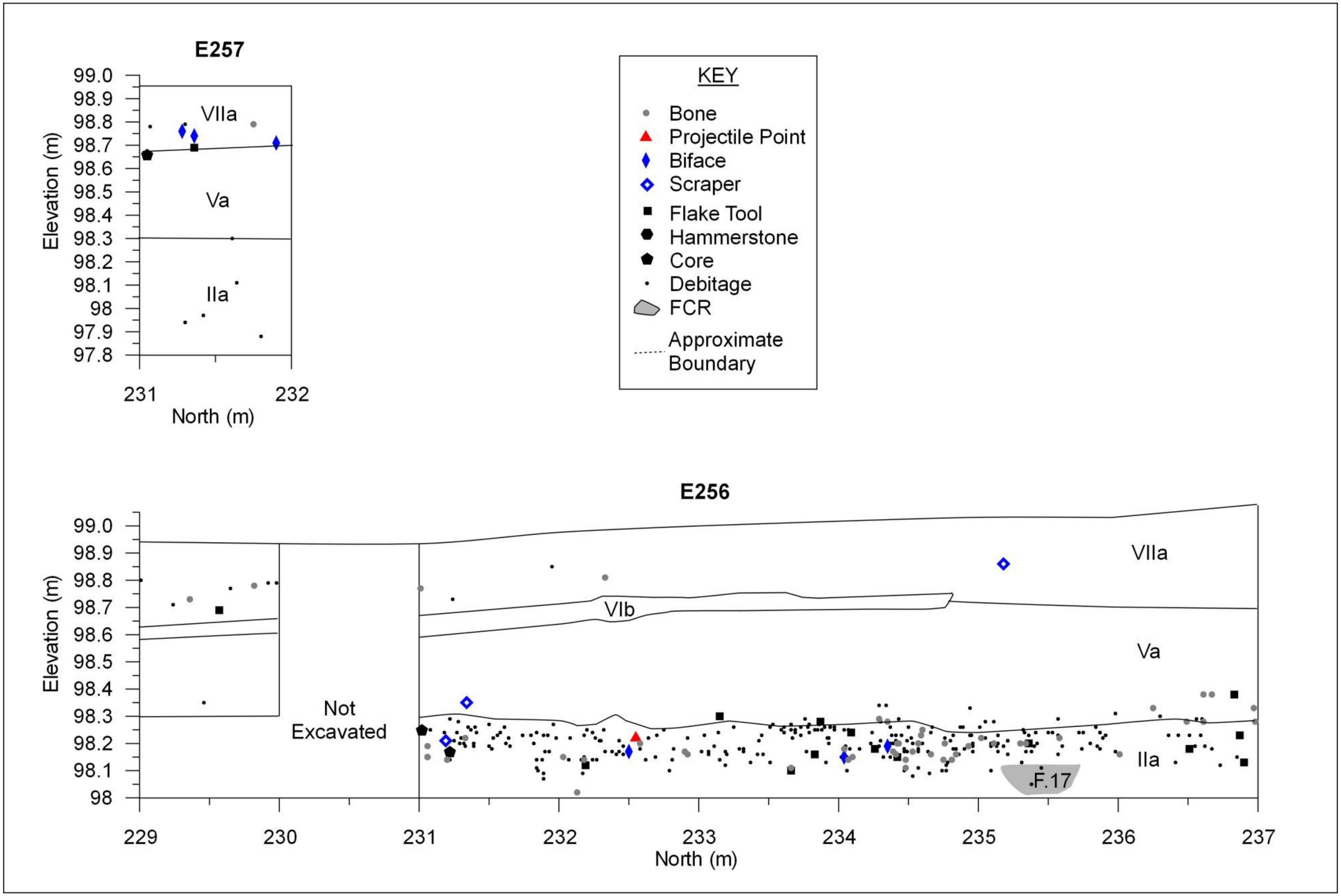


Figure 9-6 Backplots from Block D lines E256 and E257.

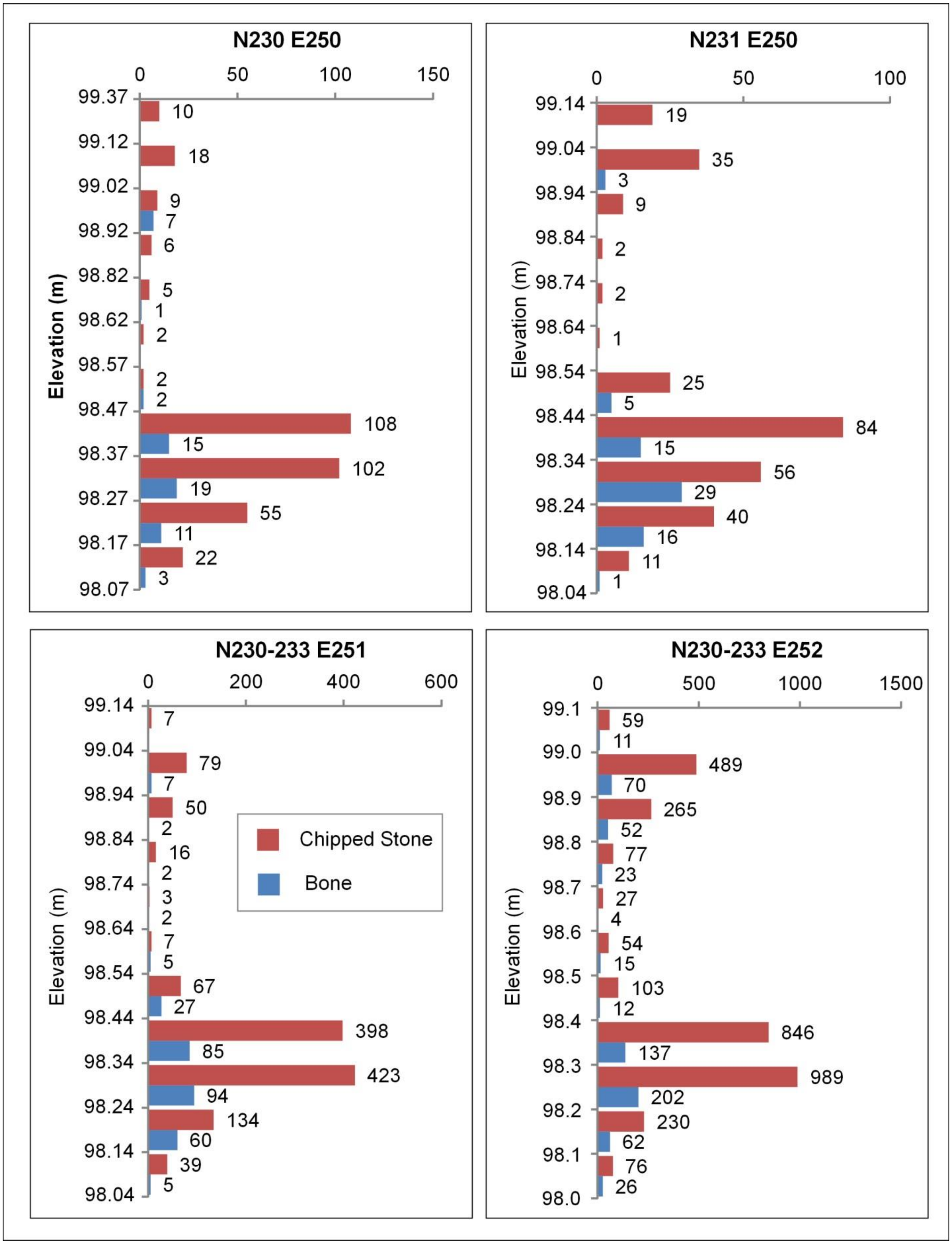


Figure 9-7 Graphs of the artifact frequencies by depth from Block D E250 through E252.

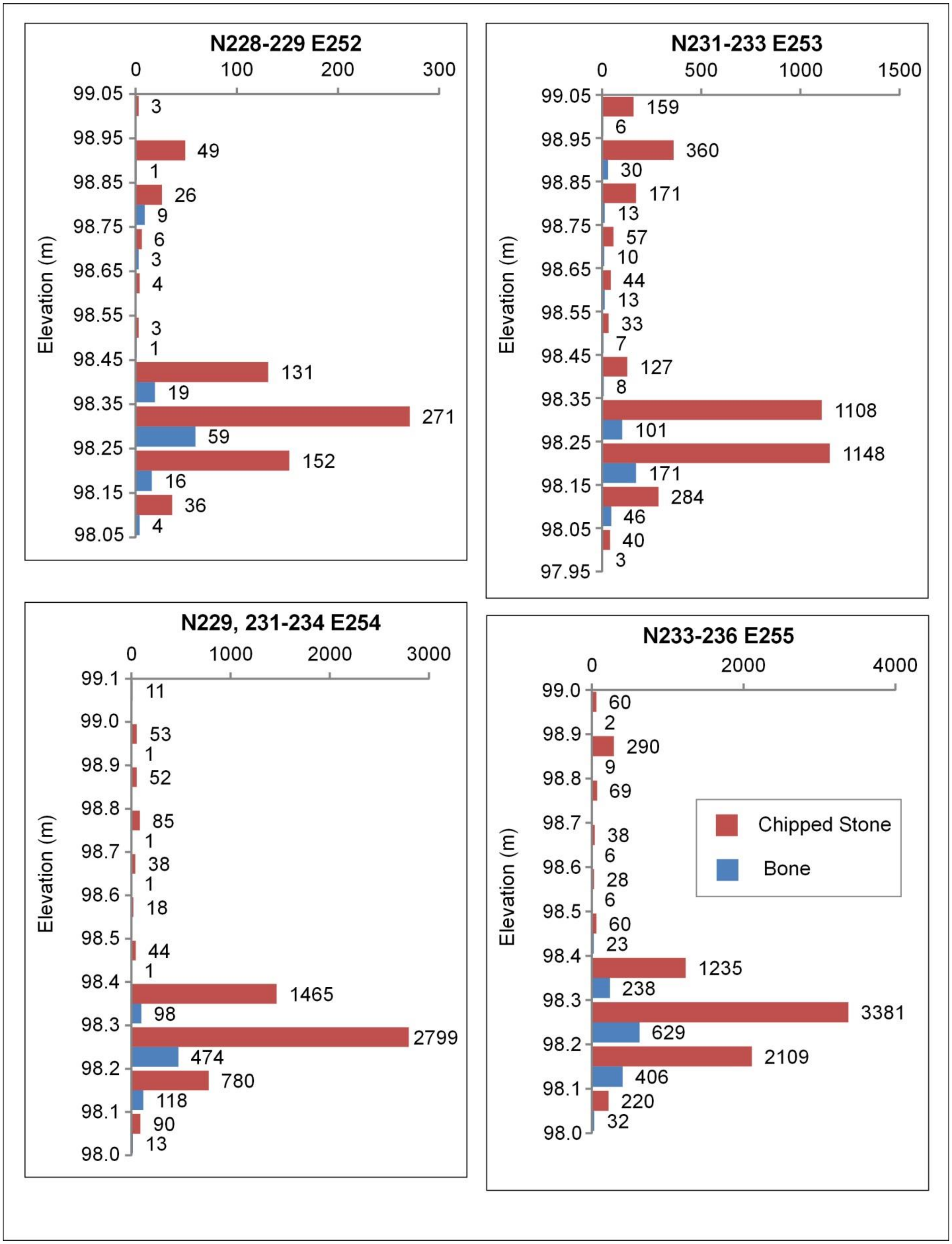


Figure 9-8 Graph of the artifact frequencies by depth from Block D, E252 through E255.

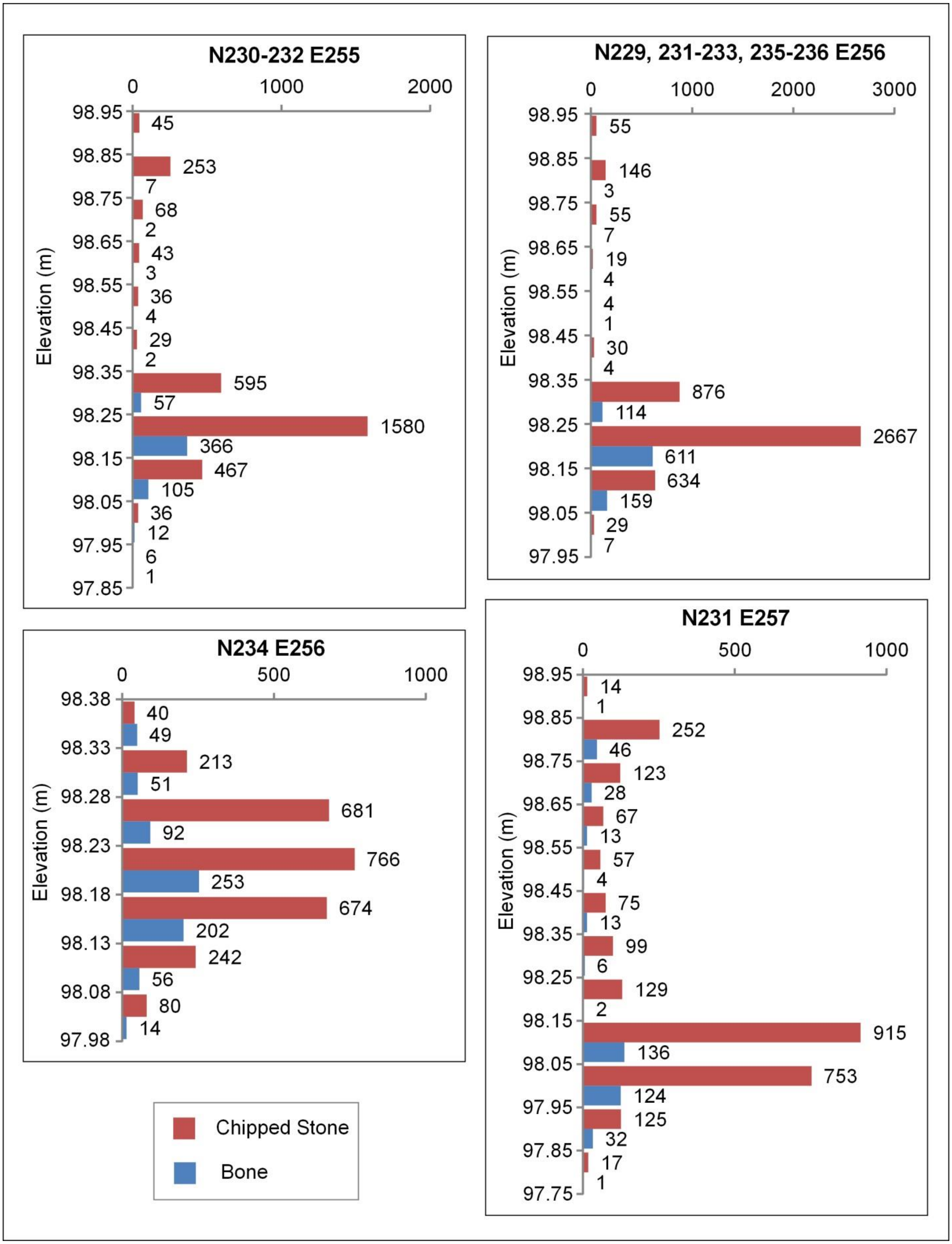


Figure 9-9 Graph of the artifact frequencies by depth from Block D, E255 through E257.

Cultural Level 1

Cultural Level 1 in Block D contained a dense layer of chipped stone, butchered bone and one feature. In all, Cultural Level 1 produced 31,166 chipped stone artifacts, including 22 projectile points, 46 bifaces, one drill, eight scrapers and 93 expedient flake tools, one hammerstone, one antler tool, one bone tool, 5,802 faunal specimens and one feature, Feature 17.

Lithic Raw Material Utilization

A total of 30,973 pieces of debitage, 23 cores or tested cobbles and 170 chipped stone tools were recovered from Block D Cultural Level 1 (Table 9-1). Like the Cultural Level 1 assemblages from Blocks A and B, the majority of the debitage was made of locally available chert (44%) and silicified wood (36.3%). However, the Block D assemblage differs from Blocks A and B in that there are higher percentages of obsidian/ignimbrite (9.4%) and non-local chert (7.7%) and lower percentages of miscellaneous quartzite (1.3%) and Morrison quartzite (0.8%) in the debitage assemblage. Basalt (0.1%) and unidentified chert (0.08%) contributed very little to the debitage assemblage.

The use of raw material in the tool assemblage diverges from the pattern observed in the debitage. The formal tools in Cultural Level 1 are disproportionally made of non-local materials. Over half of the projectile points, 30 percent of the bifaces, and 37 percent of the scrapers were made of non-local stone, especially obsidian and non-local chert. Many of the expedient flake tools were also made of non-local material. This pattern suggests that one or more of the components represented in Cultural Level 1 was deposited by people who arrived at Goff Creek with toolkits stocked with curated tools and/or tool blanks.

Debitage

Lithic analysis reveals that flake fragments (53.5%) are the most common artifact type with broken flakes (26.7%), debris (10.1%), and complete flakes (9.7%) composing the rest of the sample. According to Sullivan and Rosen (1985), assemblages dominated by flake fragments and broken flakes are indicative of tool maintenance and manufacturing activities. This interpretation is somewhat supported by the infrequent incidence of cortical debitage which comprise only 8.2% of the complete flakes. Although late stage manufacturing and maintenance of stone tools was the primary activity represented in the assemblage, the presence of 10 cores and 13 tested cobbles, all made of local stone, clearly indicates that early stage core reduction and/or production of expedient flake tools did take place. Moreover, most of the tools made from non-local stone were fragmentary which suggests that broken or expended tools were actively being replaced with locally manufactured items.

Table 9-1 Block D Cultural Level 1 chipped stone artifacts by raw material type.

MATERIAL	**ARTIFACT TYPE**											
	Projectile Point	**Biface**	**Drill**	**Scraper**	**Chopper**	**Retouched Flake**	**Utilized Flake**	**Tools Total**	**Core**	**Tested Cobble**	**debitage**	**Material Total**
Local Chert	**7**	**21**	**1**	**5**		**30**	**10**	**74**	**2**	**3**	**13,642**	**13,721**
% of artifact	31.8	45.7	100	62.5		45.5	38.5	43.5	20.0	23.1	44.0	44.0
% of material	0.1	0.2	<0.1	<0.1		0.2	0.1	0.5	<0.1	<0.1	99.4	100.0
Silic. Wood	**2**	**11**				**22**	**10**	**45**	**8**	**10**	**11,234**	**11,297**
% of artifact	9.1	23.9				33.3	38.5	26.5	80.0	76.9	36.3	36.2
% of material	<0.1	0.1				0.2	0.1	0.4	0.1	0.1	99.4	100
Obsidian	**9**	**10**				**2**		**21**			**2,930**	**2,951**
% of artifact	40.9	21.7				3.0		12.4			9.5	9.5
% of material	0.3	0.3				0.1		0.7			99.3	100
Non-local Chert	**1**	**1**		**2**		**3**	**2**	**9**			**2,400**	**2,409**
% of artifact	4.5	2.2		25.0		4.5	7.7	5.3			7.7	7.7
% of material	0.0	<0.1		0.1		0.1	0.1	0.4			99.6	100
Misc. QTZ	**1**	**2**				**3**	**1**	**7**			**410**	**417**
% of artifact	4.5	4.3				4.5	3.8	4.1			1.3	1.3
% of material	0.2	0.5				0.7	0.2	1.7			98.3	100
Morrison QTZ	**1**	**1**		**1**		**4**	**1**	**8**			**251**	**259**
% of artifact	4.5	2.2		12.5		6.1	3.8	4.7			0.8	0.8
% of material	0.4	0.4		0.4		1.5	0.4	3.1			96.9	100
C-grained QTZ								**0**			**50**	**50**
% of artifact											0.2	0.2
% of material											100	100
Basalt	**1**						**1**	**2**			**32**	**34**
% of artifact	4.5						3.8	1.2			0.1	0.1
% of material	2.9						2.9	5.9			94.1	100
Unknown Chert					**1**	**2**	**1**	**4**			**24**	**28**
% of artifact					100	3.0	3.8	2.4			0.1	0.1
% of material					3.6	7.1	3.6	14.3			85.7	100
Total	**22**	**46**	**1**	**8**	**1**	**66**	**26**	**170**	**10**	**13**	**30,973**	**31,166**

Projectile Points

A large sample of projectile points was recovered from Block D Cultural Level 1 (Table 9-2). Of the 22 specimens found, four are complete or nearly complete, and 15 retain enough of their haft to allow identification of morphology. All but one of the identifiable projectile points appears to be affiliated with the Early Archaic, nine of which are side-notched darts and nine are corner-notched darts. One Late Paleoindian/Foothills-Mountain Paleoindian base and midsection point fragment was also recovered. All of the points were recovered between 98.45 m and 98.14 m. The Paleoindian specimen (#2,683) was found in the western portion of the block (E252), and the Early Archaic points were scattered throughout the block.

Table 9-2 Attributes of projectile points recovered from Block D Cultural Level 1.

Catalog #	Unit	Elevation	Material	Portion	Haft Type	Prox. Shld. Angle	Max. Length	Base Width	Base Length	Haft Width	Max Thickness	Notch Depth	Notch Width	Ground Base	Resharpened
2683	N231 E252	98.24	Basalt	BM	LNC	77	21.9	14.3	21.9	21	7			X	
2868	N231 E253	98.31	Eocene Chert	CO	CN	138	20.7	19.2	9.5	12	5	2.6	6.5	X	X
4058	N229 E254	98.20	Paleozoic Chert	NC	CN	135	31.5	18.2	9.4	13.2	5.7	2.1	5.9	X	X
4093	N229 E254	98.19-98.14	Eocene Chert	ER	SN	150	6				5.2			X	
4572	N229 E252	98.36	Ten Sleep QTZ	BA	SN	144	11.5	19.2		12	4.1	3.6		X	
5202	N230 E252	98.30-98.20	Obsidian	TP			14.2				3.8				
5395	N232 E256	98.22	Eocene Chert	CO	CN	131	18.2	14.5	5.7	11.7	4.1	1.5	4	X	X
5709	N231 E255	98.27-98.22	Eocene Chert	ER	SN	158	9.6				3.2			X	
5869	N231 E256	98.24-98.19	Silic. Wood	MS			18.3				4.7				
5959	N232 E254	98.30-98.25	Eocene Chert	BA	SN	142	10.1	15.3		8.8	4.3	3.6		X	
6108	N232 E252	98.38-98.28	Obsidian	BA	CN	135	14.8		10.2		3.9	4.8	6.2	X	X
6217	N232 E255	98.19	Morrison QTZ	CO	SN	146	28.6	17.8	9.1	12.2	5	2.5	5.6	X	X
6219	N232 E255	98.21-98.16	Obsidian	BA	SN	156	7.6				3.4	5.7		X	
6360	N233 E254	98.38-98.33	Silic. Wood	BA	SN	159	14.3	19.3	10.7	12.1	3.8	3.9	4.3	X	
6397	N233 E254	98.30	Obsidian	BA			11.2		11.2		4.4			X	
6440	N232 E254	98.15-98.10	Eocene Chert	ER	CN	134	11.7			90	3.6			X	
6774	N233 E253	98.26-98.21	Obsidian	BA	CN	128	8.1	19.2		15.4	3.9	2.7		X	
6877	N233 E254	98.23-98.18	Obsidian	BA	CN	139	8.1	17.3			3.9			X	
7026	N233 E256	98.30-98.25	Eocene Chert	ER	CN	137	11.2				4.1				
7271	N233 E255	98.29	Obsidian	BA	SN	143	12.1	19.5		13.2	4.9			X	
8255	N236 E255	98.38-98.33	Obsidian	BA	SN	143	6.4	11.2		7.3	3	1		X	
12421	N236 E255	98.35	Obsidian	BM	CN	130	13.8	19.9	9.4	13.3	4.3	3.9	5.9		

Abbreviations; BA-base, BM-base and midsection, CO-complete, ER-ear, LT-lateral, MS-midsection, TP-distal tip

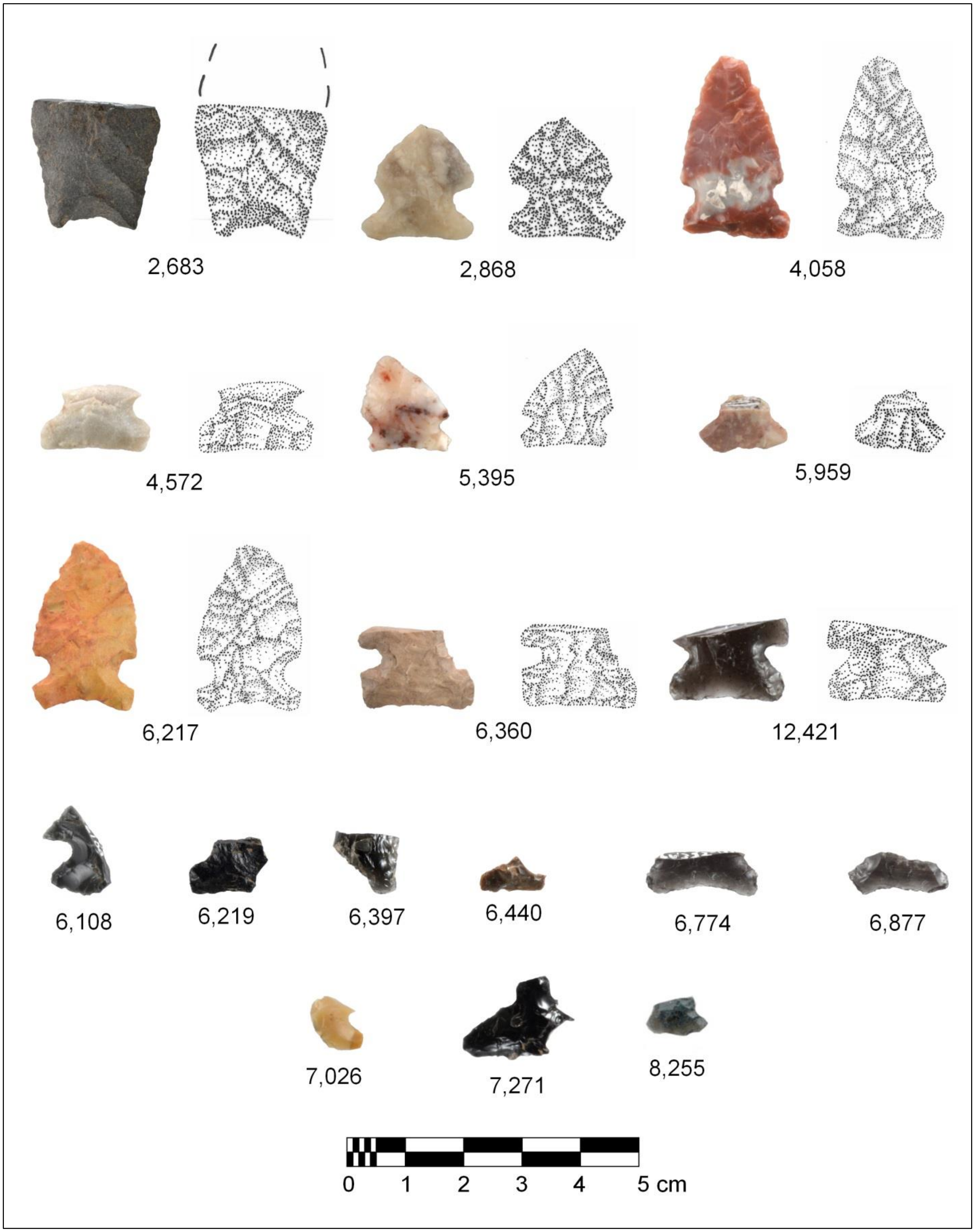


Figure 9-10 Photographs of projectile points recovered from Block D Cultural Level 1.

The Paleoindian point, #2,683, is made of dark gray basalt. It has a contracting stem and is plano-convex in cross section. The concave base and lateral stem margins are heavily ground. One half of one face of the point has a clear parallel-oblique flaking pattern, but the flaking appears random on the rest of the specimen (Figure 9-10). This point closely resembles the Angostura point type (Bradley 2013; Pitblado 2003, 2007) that is also known as the Ruby Valley type of the Alder Complex in western Montana (Davis et al. 1989). Numerous Angostura points were found in Cultural Layers 8-12 at the nearby Mummy Cave site (Husted and Edgar 2002) as well as at the Helen Lookingbill site (Kornfeld et al. 2001). The temporal range of the point type is approximately 9400 BP to 8100 BP (Larson 2013; Pitblado 2003).

There is a wide variety of Early Archaic notched point types, most of which are poorly defined. Husted and Edgar (2002) identified two types of "side-notched" points in Cultural Layers 16-19 at Mummy Cave - Blackwater side-notched and Pahaska side-notched. Of these, Blackwater was found exclusively in the Cultural Layer 16, which also contained three unnamed corner-notched points. However, it is entirely unclear how Husted and Edgar (2002) determined corner versus side-notching. The method used here closely follows that established by Thomas (1981), where the proximal shoulder angle is used to objectively classify points into corner and side-notched varieties. Thomas (1981:18-19) arbitrarily set 150° as the cut-off to demarcate corner (<150°) from side-notched (>150°) points. Yet, Thomas (1981) used data from southern California to devise his system. Holmer (2009) used the same methods as Thomas to define the point types from eastern Idaho, but 142° was used to demarcate corner from side-notched forms. Since Holmer's system was devised to categorize points from the Yellowstone region, the 142° cut-off is used here. When this method is applied to the Mummy Cave Early Archaic assemblage, 25% of the Blackwater side-notched points would be classified as corner-notched. Far fewer (5.9%) of the Pahaska type specimens, recovered mostly from Cultural Layers 17 and 18, have proximal shoulder angles less than 142°. According to Husted and Edgar (2002), the characteristic that distinguishes Blackwater from Pahaska is that the former has shorter bases.

Other Early Archaic point types include Bitterroot side-notched and Northern side-notched, both of which closely conform to Husted and Edgar's (2002) Pahaska side-notched type. Named corner-notched point types that have been linked with the Early Archaic include the Elko type found throughout the Great Basin and Snake River Plain (Holmer 1985, 2009; Justice 2002) and the Mount Albion type identified at numerous sites in the Southern Rocky Mountains (Benedict 1978).

Of the nine corner-notched dart points recovered from Block D Cultural Level 1, four (#2,868, #5,395, #6,440, #6,877) most closely resemble the Blackwater type defined by Husted and Edgar (2002) with short bases and broad notches (Table 9-2, Figure 9-10). Point #4,058 is more similar to the Pahaska/Bitterroot/Northern type with a relatively long base and wide notches. Two points (#6,108 and

#12,421) have barbed blades and proximal shoulder angles that are lower than the previous group and thus more closely resemble the Elko corner-notched type (Holmer 2009; Justice 2002). Two of the corner-notched points (#6,774 and #7,026) are too fragmentary for comparison.

The side-notched points show similar variability to the corner-notched specimens. Three of these (#4,572, #6,219 and #6,360) have long bases and squared ears, which are attributes characteristic of the Pahaska/Bitterroot/Northern types. Point #5,959 has a short base, a lower proximal shoulder angle and pointed ears similar to the Blackwater type (Table 9-2, Figure 9-10). One nearly complete specimen, #6,217, is reminiscent of the Oxbow point type (Kornfeld et al. 2010), which first appeared in cultural Layer 24 at Mummy Cave, and was also found mixed with Middle Archaic McKean Complex materials in Cultural Layer 28 (Husted and Edgar 2002).

Bifaces

Block D Cultural Level 1 yielded 46 bifaces, all but two of which are fragmentary (Table 9-3, Figure 9-11, Appendix B). Most (n=32) of the bifaces reflect the middle stages of reduction (stage III and IV), all but nine of which are made of locally available stone. Two bifaces are stage II, and 12 are stage V. Some of the stage V specimens may be projectile point fragments. The presence of nine bifaces made from non-local materials indicates that many of the specimens were brought to the site in a partially reduced state.

Use wear was identified on 20 of the bifaces. Eleven display use on one edge, and nine show use on two edges. Cutting of semi-hard and soft materials is the most common interpreted use found on 19 utilized working edges (Table 9-3). Scraping of predominantly hard or semi-hard materials was found on eight working edges. One biface was used to cut and/or scrape a semi-hard material. Based on the use wear analysis, it would appear that the bifaces were likely used in woodworking, perhaps in preparation of dart shafts or in manufacture of bone tools.

Drill/Graver

One drill (#8,315) was found in Cultural Level 1 (Appendix B, Figure 9-12). The specimen is made from yellow Eocene chert. The working bit was created through bifacial retouching of the distal end of a thin flake. The drill measures 26.2 mm long, 15.2 mm wide and 2.1 mm thick. The 4.3 mm long tip shows only a slight amount of wear indicating use on a soft material in a clockwise direction. It is ovate in cross-section. It does not appear to have been hafted, but there is bifacial retouch on the platform/bulb of percussion. The drill was found in unit N236 E255, in the central portion of the block between 98.13 m and 98.08 m.

Table 9-3 Attributes of bifaces recovered from Block D Cultural Level 1.

Cat#	Unit	Elevation	Portion	Material	Stage	Length	Width	Thickness	Use 1	Use Mat. 1	Use 2	Use Mat. 2
2497	N231 E257	98.35-98.25	UN	Eocene Chert	V	15.8	13.2	6.1				
2504	N231 E257	98.15-98.05	UN	Ten Sleep QTZ	III	24.8	20.3	5.2				
2505	N231 E257	98.15-98.05	LT	Eocene Chert	V	14.4	7.8	3.2				
2864	N231 E253	98.35-98.25	DS	Silic Wood	III	31.2	33.3	6.6	C	S		
4694	N228 E252	98.26-98.21	UN	Silic Wood	IV	18.8	27.8	5.5				
4796	N229 E254	98.24-98.19	UN	Eocene Chert	II	48	18.2	12.1				
4917	N231 E254	98.25-98.20	LT	Eocene Chert	IV	16.7	7.8	4.8	C	S		
4937	N231 E254	98.25-98.20	PR	Eocene Chert	III	22.8	37.3	8.3				
5019	N229 E252	98.25-98.15	LT	Eocene Chert	III	19.1	7.6	5.1				
5172	N230 E252	98.40-98.30	DS	Silic Wood	II	21.6	30.8	10.2				
5336	N230 E255	98.24-98.14	UN	Eocene Chert	V	8	6	2.4				
5342	N230 E255	98.24-98.14	LT	Obsidian	III	22.3	8.8	7.5				
5399	N232 E256	98.27-98.22	LT	Paleozoic Chert	IV	17.6	12.7	5.5	S	H		
5417	N230 E251	98.29-98.24	UN	Silic Wood	III	19.3	39.4	10.5				
5527	N231 E250	98.24-98.19	UN	Obsidian	V	17	9.2	5.7				
5592	N231 E251	98.44-98.34	UN	Eocene Chert	III	16.7	14.9	5.3				
5611	N231 E251	98.34-98.24	DS	Morrison Qtz	IV	32.7	20	7.5	C	SH	C	SH
5664	N231 E255	98.37-98.32	UN	Eocene Chert	IV	15.2	7.7	5.4				
5940	N232 E254	98.35-98.30	DS	Obsidian	IV	18.5	21.3	5.9	S	SH	S	SH
6000	N232 E254	98.25-98.20	LT	Eocene Chert	V	9	7.5	2.7				
6318	N232 E253	98.27-98.17	LT	Obsidian	V	19.1	6.6	3.4	C	S		
6349	N233 E254	98.43-98.38	UN	Silic Wood	III	51.7	30.3	17.9	S	H		
6439	N232 E254	98.15-98.10	UN	Eocene Chert	V	7.6	5.5	2.3				
6524	N233 E252	98.40-98.35	LT	Silic Wood	III	31.8	12.4	7	S	H		
6618	N232 E256	98.22-98.17	PR	Silic Wood	III	31.7	28.7	8.9				
6632	N232 E256	98.17-98.12	LT	Eocene Chert	V	12.8	6.9	9.3	C	SH		
6789	N233 E253	98.21-98.16	UN	Obsidian	V	9.6	4.7	3				
6832	N233 E254	98.28-98.23	UN	Obsidian	IV	8.6	5.2	3.1				
6854	N233 E254	98.28-98.23	UN	Eocene Chert	III	36.3	28.6	8.8				
6965	N234 E255	98.30-98.20	LT	Obsidian	III	33.2	14.8	12	C	SH		
7038	N233 E256	98.25-98.20	UN	Eocene Chert	V	5.5	3.2	2.2				
7054	N233 E256	98.20-98.15	UN	Eocene Chert	IV	14.8	8.5	3.1	C	S		
7071	N233 E256	98.20-98.15	UN	Silic Wood	IV	8.5	11.3	4.9	S/C	SH	S/C	SH
7284	N233 E255	98.30-98.20	LT	Eocene Chert	III	23.2	16.4	7.3	C	SH		
7621	N234 E254	98.32-98.27	DS	Ten Sleep QTZ	IV	30.2	28.9	5.9	C	S	C	S
7854	N235 E255	98.22-98.17	UN	Eocene Chert	V	6.7	4.6	2.7				
7856	N235 E255	98.22-98.17	PR	Silic Wood	III	42.6	40	9.4	C	SH	C	SH
8022	N234 E256	98.20-98.15	CO	Obsidian	IV	26.5	13.9	4.1	C	S	C	S
8043	N234 E256	98.20-98.15	UN	Silic Wood	III	85.9	47.4	24.3	S	H	S	H
8168	N236 E256	98.13-98.08	UN	Eocene Chert	III	16.1	29.3	6.8				
8226	N236 E255	98.58-98.48	MD	Eocene Chert	IV	18.8	47.6	8.9	C	SH	C	SH
8254	N236 E255	98.38-98.33	PR	Obsidian	V	6	14.1	4.1				
8286	N236 E255	98.23-98.18	UN	Eocene Chert	IV	11.5	21.7	6.1	C	SH	C	S
8288	N236 E255	98.23-98.18	UN	Silic Wood	III	10.3	29	8.6	S	H		
8310	N236 E255	98.18-98.13	UN	Eocene Chert	III	24	11.6	7.3				
8403	N229 E256	98.44-98.34	CO	Eocene Chert	III	73	41.8	15.7				

Abbreviations; CO-complete, DS-distal, LT-lateral, MD-medial, PR-proximal, UN-unknown, C-cut, S-scrape, H-hard, SH-semi-hard, S-soft

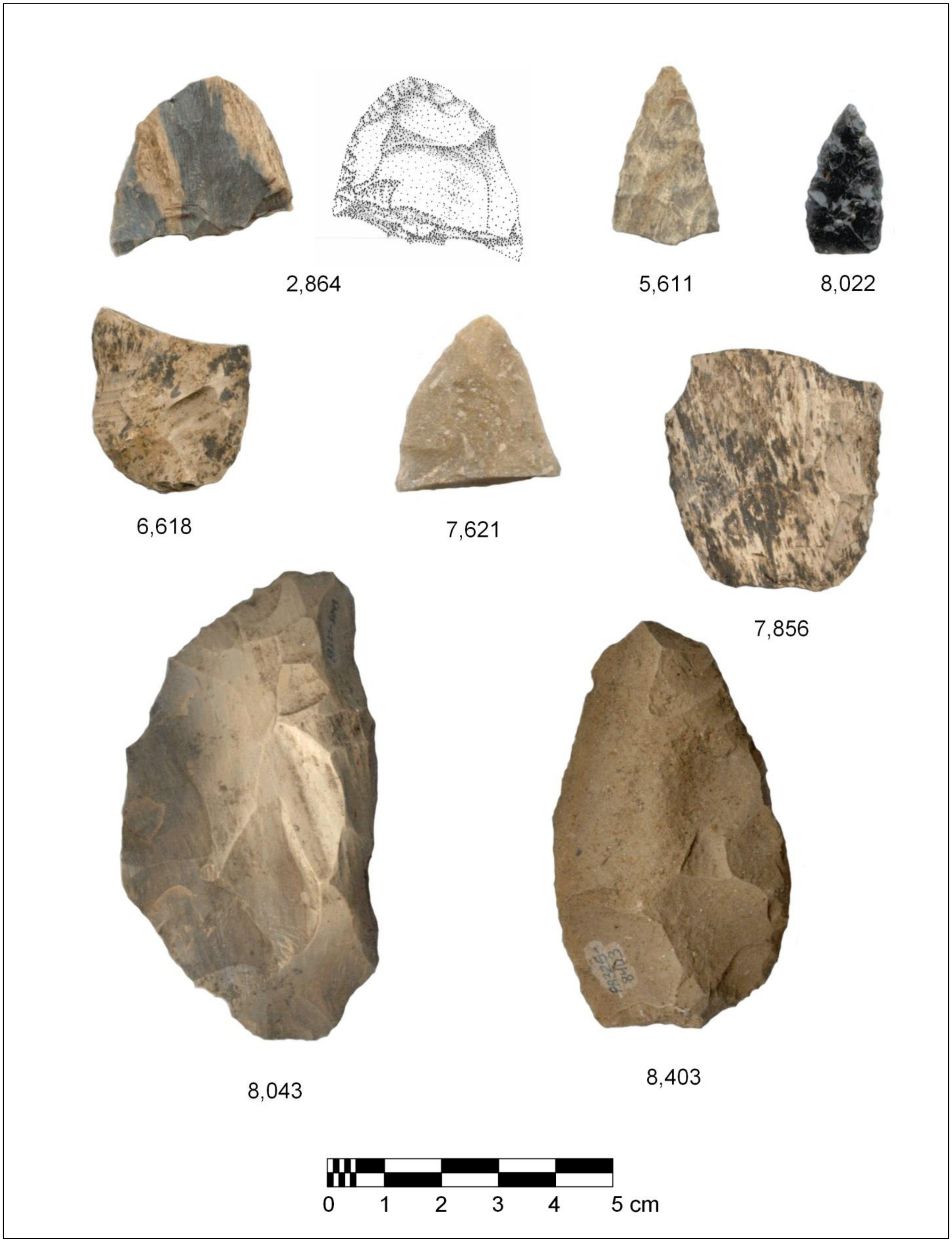


Figure 9-11 Photographs of bifaces recovered from Block D Cultural level 1.

Scrapers

Bock D Cultural Level 1 produced eight end scrapers, six of which are complete and two are distal fragments (Table 9-4, Figure 9-12, Appendix B). Edges of two scrapers showed use wear related to hide scraping. Two exhibited use on hard material, and one was apparently used to scrape green wood. Two of the end scrapers (#4,112 and #5,126) are complete and rather large. The remaining specimens appear to have been exhausted or broken during use.

Table 9-4 Attributes of scrapers recovered from Block D Cultural Level 1.

Cat#	Unit	Elevation	Portion	Material	Length	Width	Thickness	Bit Angle	Bit Width	Use Mat.1	Use Mat.2
4112	N229 E254	98.09-98.04	CO	Morrison QTZ	61.5	32.4	9.0	46	4	HD	
5126	N230 E250	98.17-98.12	CO	Eocene Chert	51.1	37.7	30.7	81	3	HD	HD
5814	N231 E256	98.44-98.34	CO	Eocene Chert	31.1	22.9	10.2	83	3		
5859	N231 E256	98.24-98.19	CO	Eocene Chert	29.7	23.2	13.2	73	3	H	H
6178	N232 E255	98.36-98.26	CO	Non-local Chert	15.6	18.6	5.3	48	2		
6807	N233 E254	98.33-98.28	DS	Madison Chert	34.1	29.5	6.4	0	5	H	H
7445	N234 E255	98.30-98.20	CO	Eocene Chert	36.0	26.7	6.6	62	2	SH	
7658	N235 E256	98.32-98.27	DS	Eocene Chert	28.8	14.8	5.5	62	2		

Abbreviations; CO-complete, DS-distal, H-hard, HD-hide, SH-semi-hard.

Expedient Flake Tools

Block D Cultural Level 1 contained 66 retouched flakes and 26 utilized flakes (Appendix B). Among the retouched flakes, scraping (74.2%) of semi-hard (42%) and hard (24.2%) materials is the dominate type of use wear. Evidence that retouched flakes were used to cut is limited to 17 specimens (25.7%), one (1.5%) of which was used to cut semi-hard material and the remainder (24.2%) were used to cut soft material. Four (6.1%) of the retouched flakes were used to scrape and/or plane semi-hard (75%) and hard materials (25%). Only 15 (22.7%) retouched flakes show evidence of use wear on more than one margin. Most (n=10, 75%) of these specimens showed the same type of use on all worked edges.

Of the 26 utilized flakes, 14 (53.8%) appear to have been used to cut soft (71.4%), semi-hard (14.3%) and hard (14.3%) materials. Evidence of scraping was identified on 10 (38.5%) of the utilized flakes. Of these, seven (70%) were used on a semi-hard material, and three (30%) worked a hard material. One utilized flake was used to scrape and/or plane a semi-hard material and one was used to wedge into semi-hard material. Only two (7.7%) utilized flakes showed use wear on more than one margin.

The use wear analysis reveals that there were a wide range of activities performed with expedient flake tools. Retouched flakes were disproportionately used for scraping and utilized flakes for cutting.

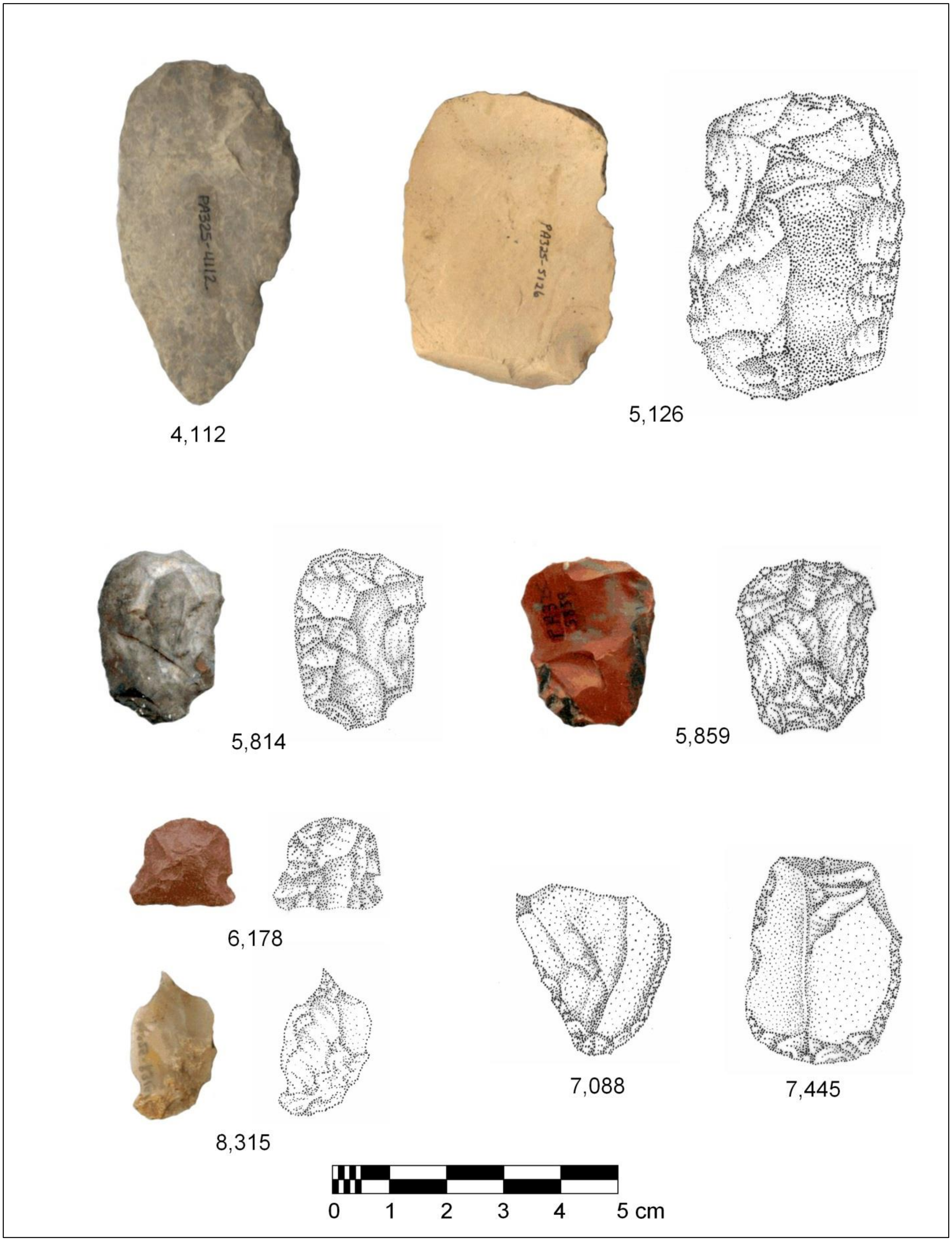


Figure 9-12 Photographs of scrapers and drill recovered from Block D Cultural Level 1.

Woodworking is the likely activity represented by the tools that appear to have scraped or cut a semi-hard surface. Given the large quantity of projectile points also recovered from Cultural Level 1, the maintenance and/or manufacture of weaponry appears to be a reasonable interpretation for the use of the retouched flakes. Utilized flakes could have been used for butchering or plant processing. Flake tools do not appear to have been regularly curated, since only one margin of most of the tools was used.

Hammerstone

One hammerstone, #7,431, was recovered from unit N234 E255 at 98.55 m (80 cmbs). It measures 103.43 cm long, 59.82 mm wide and 36.37 mm thick. It is triangular in cross section and exhibits battering on one end.

Incised Stone

One fragment of stone containing incised lines (#6,097) was recovered from unit N232 E252 at 98.3 m elevation (105 cmbs [Figure 9-13]). It is a brown Eocene porcellanite stone measuring 57.75 mm long, 32.45 mm wide, and 11.15 mm thick. The stone has incising on two surfaces. One surface has four parallel incised lines averaging 6.47 mm apart, beginning along an uneven edge of this face. The parallel lines differ in lengths (24.93 mm to 7.90 mm) but end at the same point. The end locations of the four lines are connected by three concave incised lines. A perpendicular surface of the stone has an additional series of seven short parallel lines running from the one edge of this surface to the other. The uneven thickness of the piece created lines between 8.02 mm and 4.4 mm long.

The purpose of this artifact is unknown. The lines are not deep enough to have served as an abrader for sharpening bone awls. Incised stone artifacts from archaeological contexts are rare in Wyoming (Francis 2007). One example, an incised rock slab, with what is believed to be an image of a medicine bag or bundle, known as the "Medicine Lodge Placquette," was found at the Wet Medicine Lodge No. 2 site (48BH331 [Francis 2007]). The age of the Medicine Lodge Placquette is unknown and its purpose is open to speculation. Francis (2007:278) suggested that the placquette may "have been made by someone wishing to possess a specific bundle and thereby acquire its power through means that may not have been benevolent." The specimen from Goff Creek may be a fragment of a larger object bearing a similar image. Yet, a similar incised stone with multiple narrow and shallow incisions was recovered from Late Archaic contexts at the Medicine Lodge Creek site (Frison 2007). The object may also have served some spiritual or ceremonial purpose since it appears to have been deliberately broken.

Bone/Antler Tools

One bone tool and one antler tool were recovered from Cultural Level 1 (Figure 9-14). The first (#4,197) is the proximal end of a deer antler baton that measures 36.6 mm in length, 34.4 mm in diameter

Figure 9-13 Photograph of incised stone found in Block D Cultural Level 1.

Figure 9-14 Photographs of antler and bone tools recovered from Block D Cultural Level 1.

Table 9-5 Faunal specimens recovered from Block D Cultural Level 1.

Species	Element	Portion	Side	NISP
bighorn sheep	1st phalange	proximal end,<1/2 shaft	R	2
bighorn sheep	2nd phalange	Complete	L	1
bighorn sheep	2nd phalange	Complete	R	1
bighorn sheep	2nd phalange	distal end, <1/2 shaft	L	1
bighorn sheep	Calcaneus	Complete	R	1
bighorn sheep	Mandible	tooth row	L	1
bighorn sheep	Radius	proximal end,<1/2 shaft	L	1
bighorn sheep	Radius	proximal end,<1/2 shaft	R	1
bighorn sheep	radius-ulna	distal end, >1/2 shaft	L	1
bighorn sheep	Tibia	distal end, <1/2 shaft	R	2
bighorn sheep	Tibia	long bone shaft	R	1
bighorn sheep	Ulna	trochlear notch portion	L	1
mule deer	Radius	distal end, <1/2 shaft	L	1
m. artiodactyl	2nd phalange	distal end, <1/2 shaft	L	2
m. artiodactyl	2nd phalange	distal end, <1/2 shaft	R	1
m. artiodactyl	Astragalus	distal end, >1/2 shaft	L	1
m. artiodactyl	axis vertebra	proximal end	axial	1
m. artiodactyl	bone frags from screen	long bone shaft		1
m. artiodactyl	distal sesamoid	Complete		2
m. artiodactyl	Femur	long bone shaft	R	2
m. artiodactyl	Humerus	long bone shaft	L	1
m. artiodactyl	Humerus	long bone shaft		1
m. artiodactyl	Incisor	Complete		2
m. artiodactyl	long bone	distal end, <1/2 shaft		1
m. artiodactyl	long bone	long bone shaft		1
m. artiodactyl	long bone	long bone shaft		63
m. artiodactyl	Metapodial	distal end		1
m. artiodactyl	Metapodial	long bone shaft		1
m. artiodactyl	Metapodial	proximal end,<1/2 shaft	R	1
m. artiodactyl	Rib	Blade		1
m. artiodactyl	Rib	proximal end,<1/2 shaft		1
m. artiodactyl	Tibia	long bone shaft	L	17
m. artiodactyl	Tibia	long bone shaft	R	1
m. artiodactyl	unidentified carpal	Complete		1
m. artiodactyl	unidentified molar	Complete		3
m. artiodactyl	unidentified phalange	distal end, <1/2 shaft		2
canis	maxillary molar	distal end		2
porcupine	mandibular premolar	distal end	L	1
river otter	Cranium	cranium fragments	axial	1
s. mammal	long bone	Diaphysis		1
s. mammal	Rib	Blade		2
unidentified	flat bone	long bone shaft		3
unidentified	flat bone	Unidentified		1
unidentified	long bone	bone flake		1
unidentified	long bone	long bone shaft		19
unidentified	Tibia	proximal epiphysis		1
unidentified	bone frag	Unidentified		4,734
unidentified	bone frag	cranium fragments		3
unidentified	tooth frag	Unidentified		867
intrusive rodent				43
Total				5,802

Table 9-6 Presence and distribution of breakage morphology, cut/impact marks and burning on the Block D Cultural Level 1 faunal assemblage.

Species	**Break**	**Cut/Impact**	**Burned**	**NISP**
canis	Dry			2
medium artiodactyl	Dry		X	5
medium artiodactyl	Dry			38
medium artiodactyl	Green	X	X	2
medium artiodactyl	Green	X		4
medium artiodactyl	Green		X	12
medium artiodactyl	Green			40
medium artiodactyl	Unknown			7
mountain sheep	Dry		X	3
mountain sheep	Dry			3
mountain sheep	Green			5
mountain sheep	Unknown	X		1
mountain sheep	Unknown			2
mule deer	Green			1
porcupine	Dry			1
river otter	Dry			1
rodent	Dry			15
rodent	Green			1
rodent	Unknown			27
small mammal	Dry		X	2
small mammal	Green			1
UN Bone	Dry		X	7
UN Bone	Dry			13
UN Bone	Green		X	4
UN Bone	Green			1
UN Bone	Unknown		X	2739
UN Bone	Unknown			1998
UN Tooth	Dry			1
UN Tooth	Unknown		X	175
UN Tooth	Unknown			691

and weighs 17.4 grams. There is evidence of battering along one side of the proximal end of the object. The second artifact (#4,886) is an unburned bone awl made on a spirally broken bone splinter from a medium artiodactyl metapodial. It is irregular in cross section. It measures 76.7 mm in length and has a maximum width of 13 mm. The distal end measures 13.99 mm, and it is worked into a round, tapering point. The awl displays some diagonal abrasion marks near its tip.

Faunal Remains

A total of 4,927 bones and 875 complete or fragmentary teeth were recovered from Block D Cultural Level 1 (Table 9-5). Of these, the majority is comprised of unidentifiable fragments (n=5,629). Specimens identifiable to species include 14 bighorn sheep elements, two canid elements, and one element each from mule deer, porcupine and river otter. Specimens identifiable only to body size class include 108 medium artiodactyl and two small mammal elements. Much of the medium artiodactyl bone is probably from bighorn sheep, which, based on the presence of two left 2nd phalanges, is represented by a minimum of two individuals. A fairly sizeable number of fossorial rodent bones were also recovered from this level and are thought to be intrusive rather than cultural in origin.

Evidence for butchering and intensive processing is found in the presence of 71 green bone fractures, five of which also show cut or impact marks (Table 9-6). Slightly more than half (50.8%) of the faunal assemblage also appears to have been burned. Therefore, the faunal assemblage from this component is suggestive of intensive processing. The comparatively high number of unidentified specimens might indicate that long bones were crushed in order to retrieve additional nutrients through boiling.

Feature 17

Feature 17 was located in Block D Cultural Level 1 in units N235 E255 and N235 256. The feature consisted of a roughly oval, basin-shaped stain that was probably a hearth (Figures 9-15 and 9-16). The feature measured 40 cm north-south and 65 cm east-west. The top of the feature was identified at approximately 98.07 m or about 85 cm below the surface. The fill was dark gray in color with very little charcoal. Numerous pebbles and cobbles were observed in the fill, but none seemed to be burned or cracked. There was some indication that naturally occurring stream cobbles had been removed from within and around Feature 17 and placed in a ring, roughly 1 m in diameter (Figure 9-15). No oxidation was present, and the base of the feature was excavated into the underlying gravels. Most of the fill from the feature was floated for recovery of macro-botanical remains. Only three small unidentifiable pieces of bone and 69 mg of wood charcoal were recovered during flotation. The rest of the feature fill was submitted in bulk for a standard radiometric determination resulting in an estimated age of 5000±70 BP (Beta 97538). This date is unreliable, however, due to the inherent inaccuracy of bulk organic soil dates.

Spatial Analysis

Spatial analysis reveals that Cultural Level 1 contains four dense concentrations of chipped stone and two clusters of bone in the eastern half of Block D (Figures 9-16 through 9-18). Two of the chipped stone concentrations are within a meter of Feature 17 and probably represent tool production and maintenance around the hearth. Early Archaic dart points were found throughout the block, which indicates that much if not most of the artifacts from Cultural Level 1 are associated with the Early Archaic component(s).

The bone concentrations are 1.5 m to 2 m south of Feature 17. The fragmentary bone was clustered in an area 1.5 m to 2 m south of the unlined hearth (Feature 17) in what appears to be refuse piles. Most of the bone within these clusters consists of small unidentifiable fragments that were collected in the 1/8” screen. Many of these were burned. Larger pieces of bone were scattered throughout the level

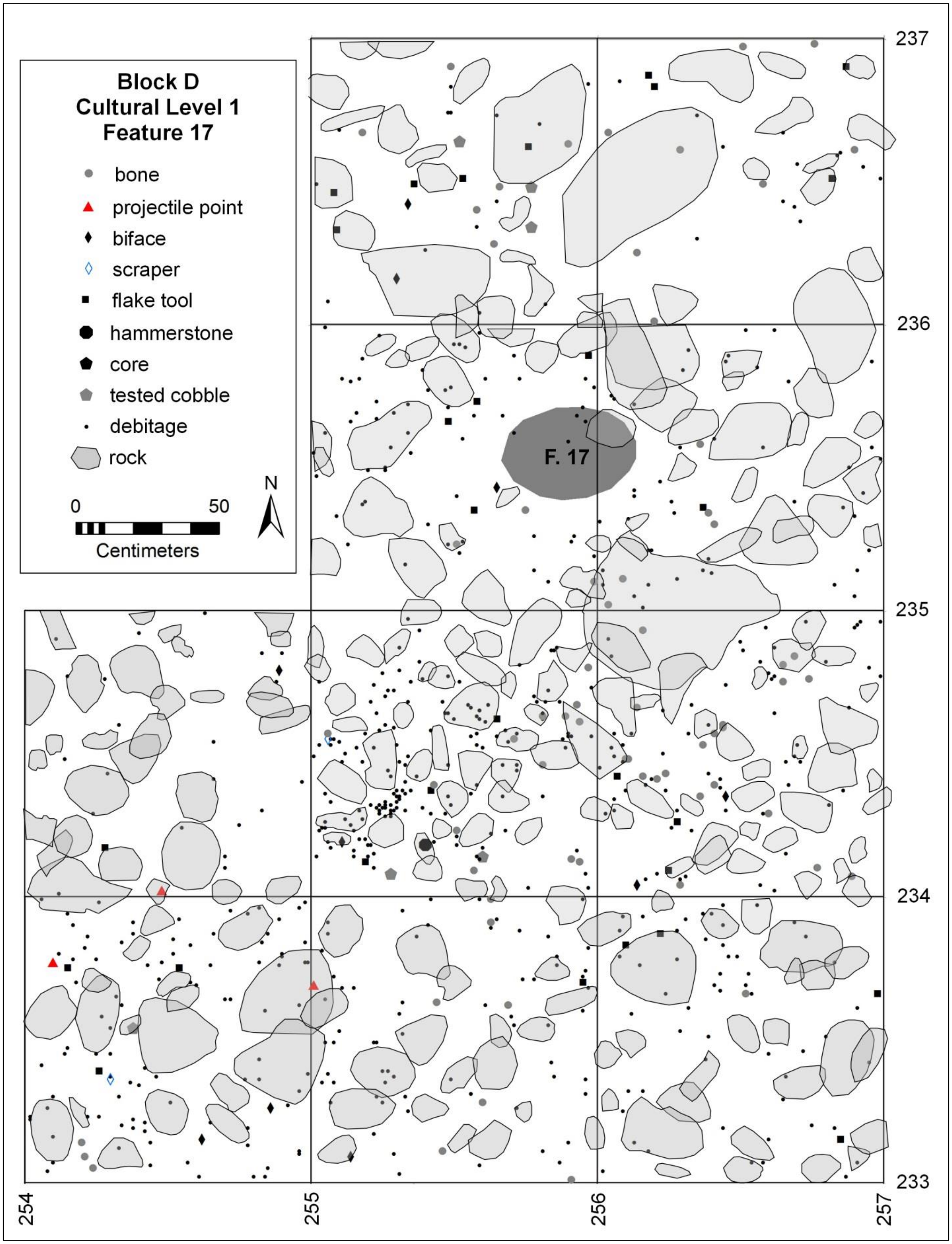


Figure 9-15 Plan view map of Block D Cultural Level 1 Feature 17.

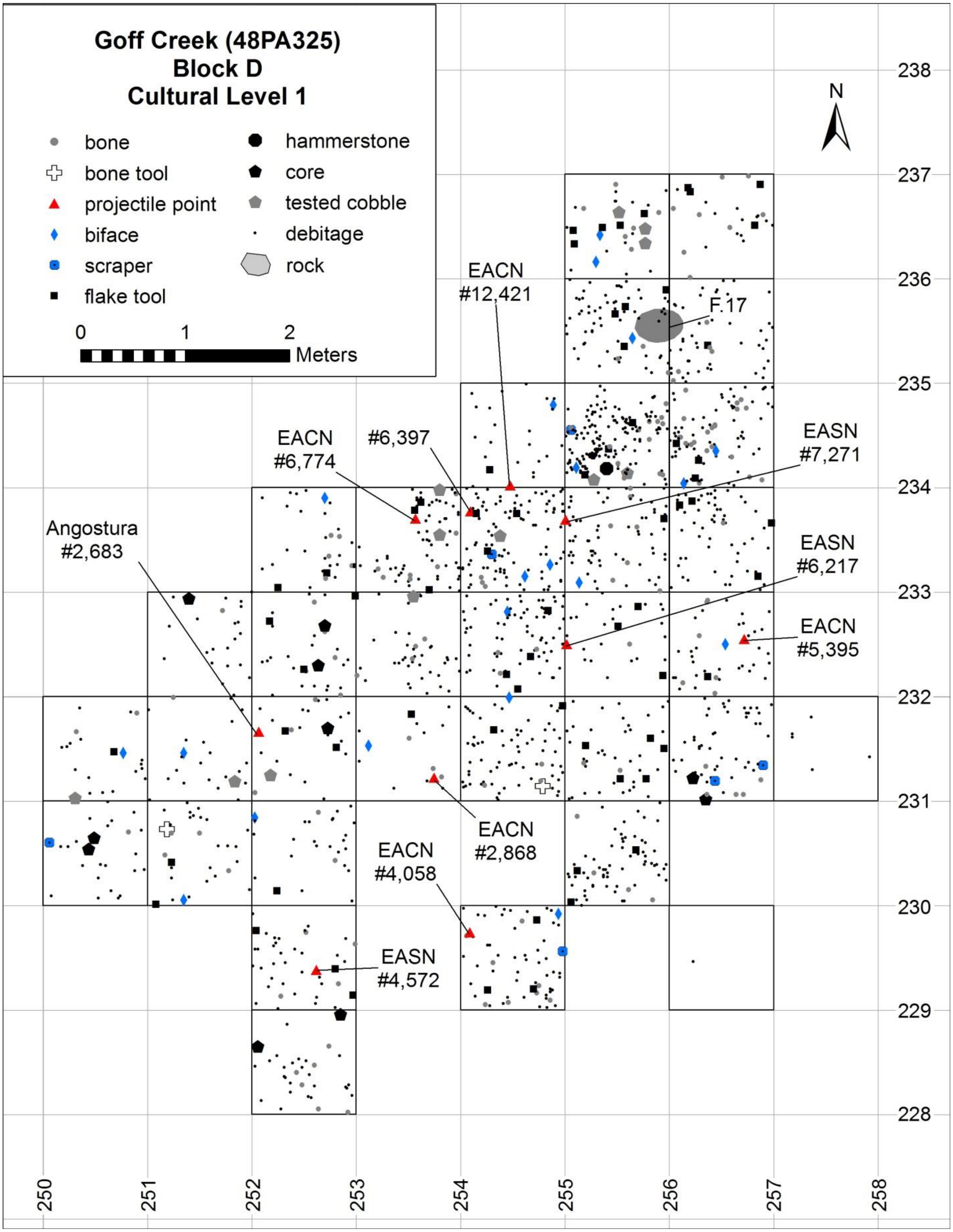


Figure 9-16 Plan view map of Block D Cultural Level 1.

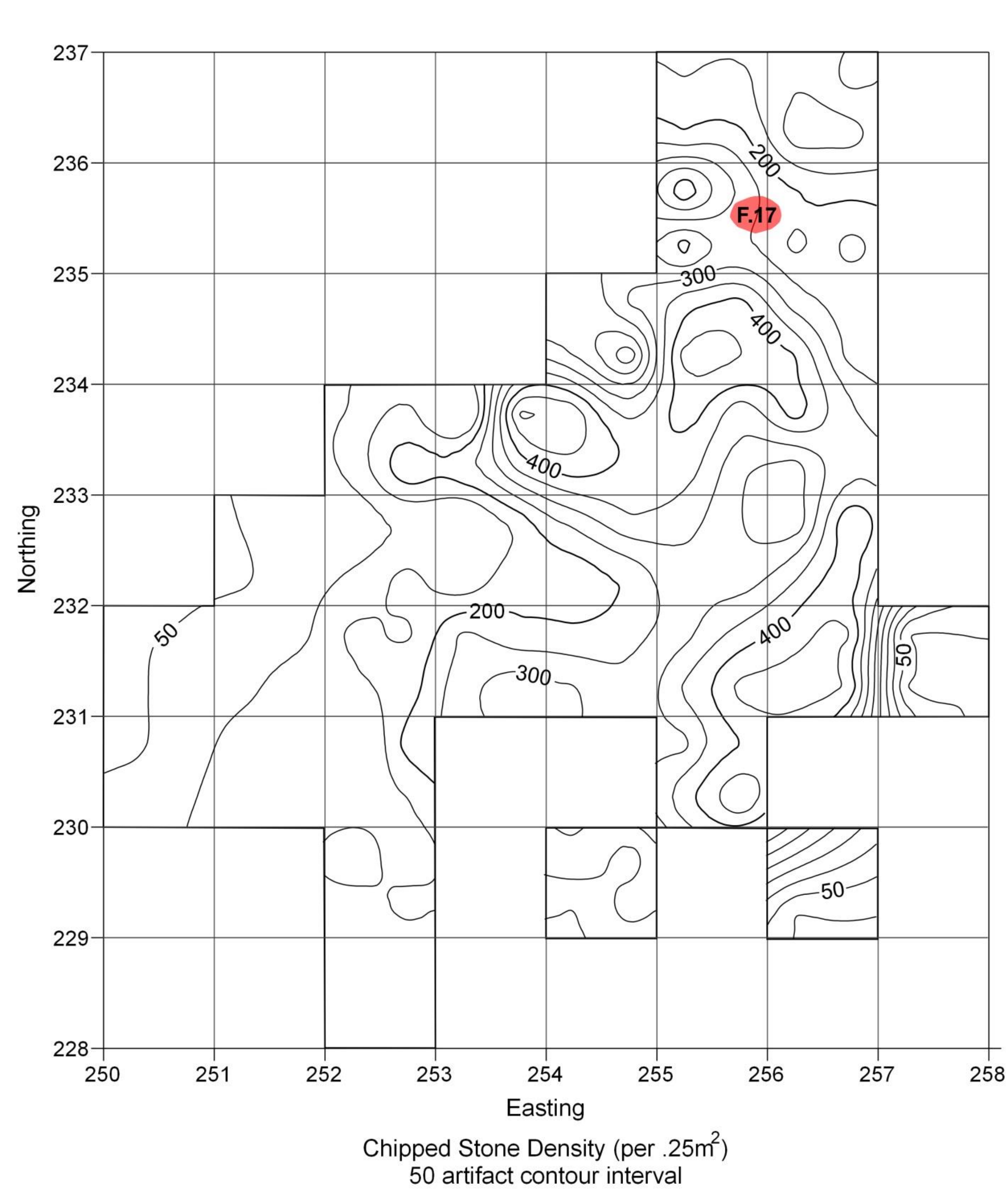


Figure 9-17 Map showing the interpolated chipped stone artifact density from Block D Cultural Level 1.

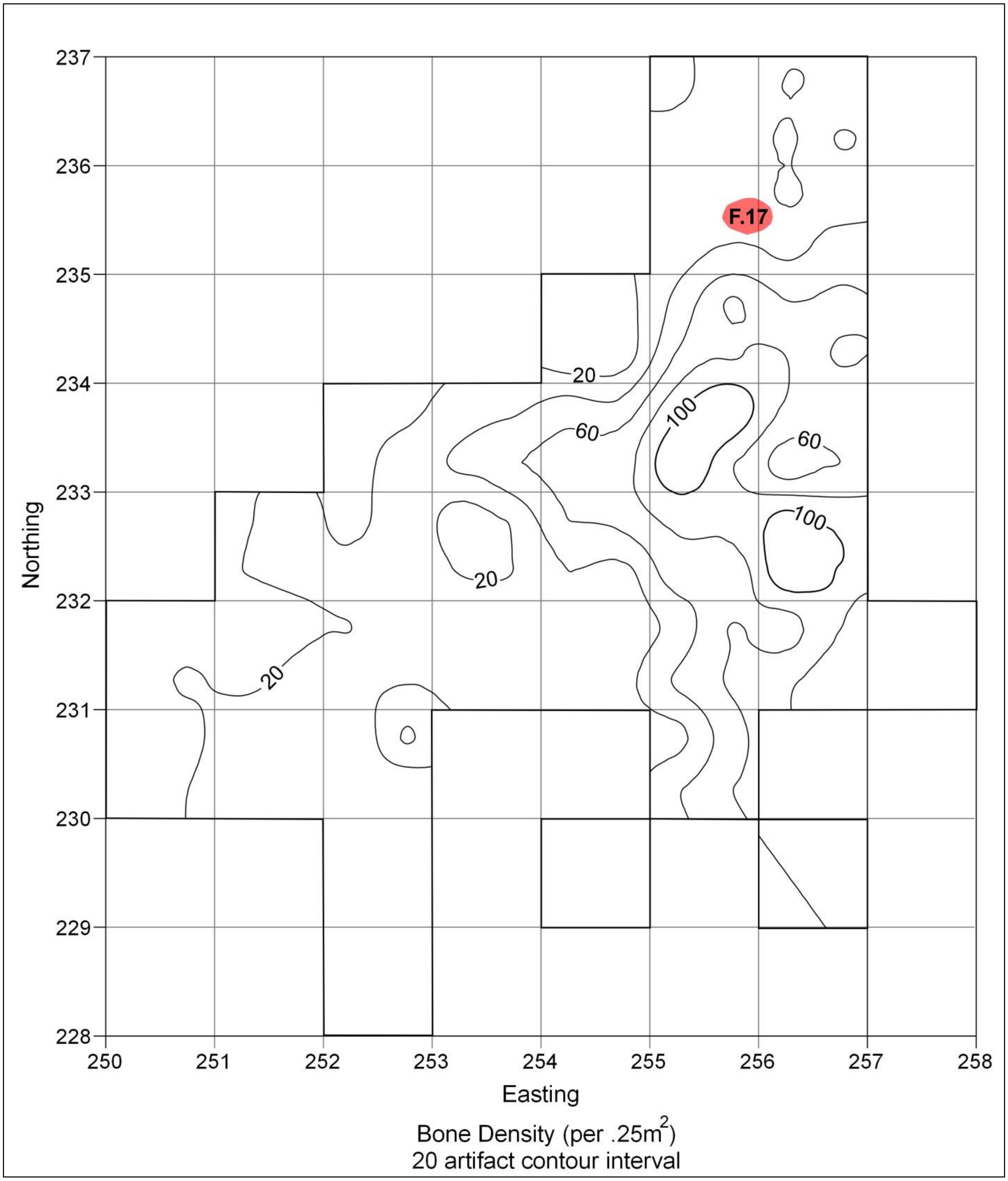


Figure 9-18 Map showing the interpolated bone artifact density from Block D Cultural Level 1.

but many were within a meter of the hearth. Therefore the bone clusters may represent refuse piles resulting from hearth maintenance. There are no patterns in the distribution of specific tool types that could be used to identify specific activity areas (Figure 9-16). Likewise, there are no spatial patterns in the distribution of the various lithic raw materials that could be used to distinguish the Paleoindian and Early Archaic occupations.

Cultural Level 4

Cultural Level 4 produced far fewer artifacts than Cultural Level 1. In all, 4,854 chipped stone artifacts, including 16 projectile points, 30 bifaces, six scrapers, a drill and 59 expedient flake tools, and 508 faunal specimens were recovered from Block D Cultural Level 4. Both Late Archaic and Late Prehistoric-aged projectile points were recovered from the level. The remains of a roasting pit, Feature 16, was also identified and dated to 920±70 BP (Beta-97537). Thus, it appears that Cultural Level 4 in Block D represents a mixed component that was deposited over a period perhaps as long as 2,000 years

Lithic Raw Material Utilization

Artifacts made from locally available Eocene-aged chert and silicified wood comprise the majority of the chipped stone assemblage from Cultural Level 4 (Table 9-7). Obsidian and non-local cherts from the Madison and Phosphoria formations are the most common non-local materials. Overall the proportion of material types closely resembles the underlying Cultural Level 1 assemblage in Block D. It is unlikely that these similarities are due to post-depositional mixing because the two levels are separated by 30-50 cm of deposit that contained relatively little cultural material. Since Cultural Level 4 is a palimpsest, it is highly improbable that the assemblage accurately reflects the raw material use of any of the individual components. Nevertheless, there is less obsidian in Block D Cultural Level 4 than in the Cultural Level 4 assemblages in Blocks C, E and F, indicating a pattern of increased obsidian use during the Late Archaic followed by a possible reduction in the Late Prehistoric.

Debitage

The composition of the debitage assemblage is very similar to all the other cultural levels at Goff Creek. Flake fragments (53.2%) are the most common type of debitage. That is followed in frequency by broken flakes (27%), complete flakes (12.1%) and debris (7.7%). Most (70.9%) of the debitage was less than ¼” in maximum diameter. As with the other cultural levels, it is clear that intensive procurement of tool stone and early reduction of cores and bifaces did not occur in Cultural Level 4, because such assemblages typically contain larger pieces of debitage and higher proportions of complete flakes (Sullivan and Rosen 1985). However, this level did produce the highest proportion of cortical debitage (17.9%) at Goff Creek. Moreover, four cores and four tested cobbles, all of locally available material were also found. Thus, although the debitage assemblage suggests that tool production and maintenance were the primary activities conducted on site, it is clear that some degree of raw material procurement and early stage reduction of cores and bifaces also took place.

Table 9-7 Block D Cultural Level 4 chipped stone artifacts by raw material type.

MATERIAL TYPE	**ARTIFACT TYPE**										
	Projectile Point	**Biface**	**Drill**	**Scraper**	**Retouched Flake**	**Utilized Flake**	**Tools Total**	**Core**	**Tested Cobble**	**Debitage**	**Material Total**
Local Chert	**7**	**23**	**1**	**3**	**17**	**15**	**66**	**2**		**2,493**	**2,561**
% of artifact	43.8	76.7	100	50.0	47.2	65.2	58.9	50.0		52.7	52.8
% of material	0.3	0.9	<0.1	0.1	0.7	0.6	2.6	0.1		97.3	100
Silicified Wood	**1**	**3**		**1**	**8**	**5**	**18**	**2**	**4**	**1,170**	**1,194**
% of artifact	6.3	10.0		16.7	22.2	21.7	16.1	50.0	100	24.7	24.6
% of material	0.1	0.3		0.1	0.7	0.4	1.5	0.2	0.3	98.0	100
Obsidian	**5**	**3**		**1**	**8**	**2**	**19**			**590**	**609**
% of artifact	31.3	10.0		16.7	22.2	8.7	17.0			12.5	12.5
% of material	0.8	0.5		0.2	1.3	0.3	3.1			96.9	100
Non-local Chert	**1**			**1**	**3**		**5**			**354**	**359**
% of artifact	6.3			16.7	8.3		4.5			7.5	7.4
% of material	0.3			0.3	0.8		1.4			98.6	100
Misc. QTZ	**1**	**1**					**2**			**69**	**71**
% of artifact	6.3	3.3					1.8			1.5	1.5
% of material	1.4	1.4					2.8			97.2	100
Morrison QTZ	**1**					**1**	**2**			**20**	**22**
% of artifact	6.3					4.3	1.8			0.4	0.5
% of material	4.5					4.5	9.1			90.9	100
C-grained QTZ										**21**	**21**
% of artifact										0.4	0.4
% of material										100	100
Basalt										**16**	**16**
% of artifact										0.3	0.3
% of material										100	100
UID chert										**1**	**1**
% of artifact										<0.1	<0.1
% of material										100	100
Artifact Total	**16**	**30**	**1**	**6**	**36**	**23**	**112**	**4**	**4**	**4,734**	**4,854**

Projectile Points

Cultural Level 4 in Block D produced a surprising number of projectile points given the overall size of the assemblage (Table 9-8, Figure 9-19). A total of 16 projectile points were recovered, all but four of which were identifiable to type. Most (n=10) of these are corner-notched darts including three complete or nearly complete points, three base and midsection fragments, three blade fragments and one base fragment. Each of these points closely resembles the Pelican Lake type. Generally speaking, there are several attributes of Late Archaic corner-notched darts that distinguish them from the Early Archaic varieties. These include lower proximal shoulder angles, wider and deeper notches, and the near absence of haft grinding. Late Archaic-aged points also tend to display more fine pressure flaking than Early Archaic-aged specimens.

Two Late prehistoric arrow points were also found and likely represent different Late Prehistoric components. Specimen #4,532 is the base of a corner-notched arrow point similar to the Rose Spring type believed to date from approximately 1500 BP to 650 BP (Justice 2002). The second specimen (#7,979) is a side and basally notched arrow point typical of the Desert Tri-notched variety that appeared at about 700 BP and continued to be made into the Historic period (Holmer 2009; Justice 2002).

Table 9-8 Attributes of projectile points recovered from Block D Cultural Level 4.

Cat#	Unit	Elevation	Material	Period	Portion	Haft Type	Prox. Shld. Angle	Length	Base Width	Base Length	Haft Width	Thickness	Notch Depth	Notch Width
1981	N231 E253	98.95-98.85	Eocene Chert	LA	BMS	C	135	18.5	17.7	5.9	13.7	5	4.5	2.5
2458	N231 E257	98.95-98.85	Morrison QTZ	LA	CO	C	124	27.2	12.6	6.8	10	4.4	3.3	4
2603	N231 E252	99.02-98.92	Obsidian	UN	ER	C	122	7.3				2.4		
4532	N229 E252	98.95-98.85	Obsidian	LPr	BA	C	126	6.3	10.3	6.3	7	2.9	1.5	
5378	N232 E256	98.92-98.62	Silic. Wood	UN	BA	C	118	9.8	13.4	9.8	10.3	4		
5379	N232 E256	98.92-98.62	Obsidian	UN	MS	UN		12.6				3.1		
5462	N231 E250	99.04-98.94	Eocene Chert	LA	CO	C	138	27.6	15.2	5	15.6	4.2	1.9	3.9
5555	N231 E251	99.04-98.94	Morrison Chert	LA	BL	C		26.3				4.6	3	
5638	N231 E255	98.87-98.77	Eocene Chert	LA	BA	C	132	6.7	23.1			3.5		
6252	N232 E253	99.07-98.90	Ten Sleep QTZ	LA	BMS	C	138	17.3	20.5	7.1	14.9	5.2	2.3	5
6906	N234 E255	98.90-98.80	Eocene Chert	LA	BMS	C	121	23.7	17.6	7.8	13.5	3.6	3.3	5.6
7363	N234 E254	98.97-98.87	Eocene Chert	LA	MS	C		25			9.3	3.9		
7366	N234 E254	98.97-98.87	Obsidian	UN	TP	UN		15.3				2.4		
7979	N229 E256	98.94-98.84	Obsidian	LPr	BA	SB	173	13.5	14.2	10.2	7.6	2.7	2.9	
7980	N229 E256	98.84-98.74	Eocene Chert	LA	NC	C	116	22.6	14	7.5	10	5.3	4.2	5.5
8095	N236 E256	99.08-98.77	Eocene Chert	LA	MS	C		18			9.7	4.3		

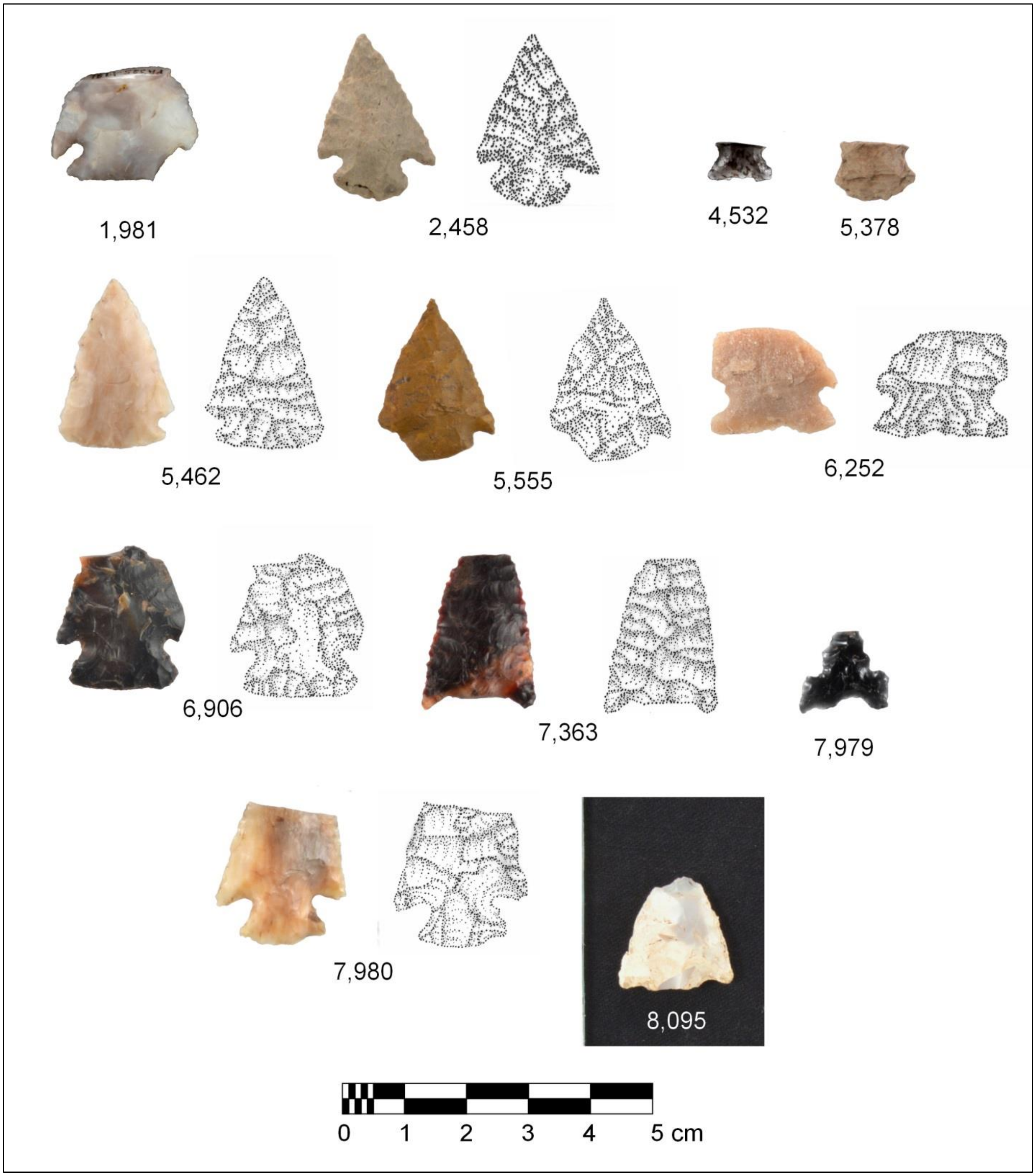


Figure 9-19 Photographs of projectile points recovered from Block D Cultural Level 4.

All of the identifiable projectile points were found between 99.08 m and 98.74 m, and there was no stratigraphic separation of the Late Archaic and Late Prehistoric-aged items. Both of the Late Prehistoric projectile points were recovered from the southern portion of the excavation block, but several

Table 9-9 Attributes of bifaces recovered from Block D Cultural Level 4.

Cat#	Unit	Elevation	Portion	Material	Stage	Length	Width	Thickness	Use 1	Material 1	Use 2	Material 2
2459	N231 E257	98.75-98.65	UN	Eocene Chert	II	29.8	23.9	10.5	SC	H		
2466	N231 E257	98.85-98.75	UN	Eocene Chert	IV	14.7	24.9	5.8				
2476	N231 E257	98.75-98.65	CO	Silic Wood	I	74.5	57.2	17	SC	H		
4127	N230 E251	99.04-98.94	UN	Eocene Chert	III	37.3	46.7	7.3				
4553	N229 E252	98.75-98.65	CO	Silic Wood	III	61.8	44.1	11.9				
4611	N228 E252	98.96-98.86	DS	Eocene Chert	IV	14.8	20.4	4.8				
4856	N231 E254	99.00-98.70	PR	Eocene Chert	III	33.3	31.9	7.4	C	S		
4994	N231 E256	98.84-98.74	PR	Silic Wood	III	28.3	20	5.6	C	S	C	S
5138	N230 E252	99.00-98.90	UN	Eocene Chert	IV	20.7	23	5.2				
5237	N230 E255	98.84-98.74	UN	Eocene Chert	II	24.4	36.2	8.9				
5239	N230 E255	98.84-98.74	LT	Obsidian	V	11.7	7.2	3.5				
5248	N230 E255	98.74-98.64	MD	Ten Sleep QTZ	III	30.3	58.3	10.2				
5374	N232 E256	98.92-98.62	LT	Eocene Chert	IV	17.5	8.3	3.6	C	S		
5375	N232 E256	98.92-98.62	UN	Eocene Chert	III	33	16.7	8.8				
5637	N231 E255	98.87-98.77	UN	Eocene Chert	IV	17.9	12.8	3.8				
5764	N232 E251	99.14-98.84	UN	Eocene Chert	IV	17.1	11.7	3.9				
5767	N232 E251	99.14-98.84	CO	Eocene Chert	II	47.1	34.3	10.5	SC	SH	S	SH
5923	N232 E254	99.00-98.70	MD	Obsidian	V	14.6	20.9	5.4				
6054	N232 E252	98.98-98.88	MD	Eocene Chert	IV	30.6	22	6.9	C	S		
6147	N232 E255	98.86-98.76	LT	Eocene Chert	IV	26.5	15	5.2				
6149	N232 E255	98.86-98.76	DS	Eocene Chert	V	12.7	10.4	2.9				
6337	N233 E254	99.08-98.78	UN	Obsidian	IV	14.6	6.8	3.5	C	S		
6456	N233 E252	99.10-99.00	CO	Eocene Chert	III	41.4	26.9	6.5	C	SH	C	SH
6491	N233 E252	98.90-98.80	LT	Eocene Chert	IV	21.1	10	4.8	C	SH		
6671	N233 E253	98.96-98.86	DS	Eocene Chert	IV	20	14.5	4.8	C	SH	C	SH
6677	N233 E253	98.96-98.86	DS	Eocene Chert	III	22.1	17	5.5	S/P	H	S	H
7235	N233 E255	98.80-98.70	DS	Eocene Chert	II	51.7	32.2	15.1				
7552	N235 E255	98.92-98.82	PR	Eocene Chert	IV	27	19.7	5	SC	S	S	S
7566	N235 E255	98.72-98.62	UN	Eocene Chert	V	16.3	21.2	3.4				
7755	N234 E256	99.00-98.54	DS	Eocene Chert	V	15	14.8	3.2	C	S		

Abbreviations; CO-complete, DS-distal, LT-lateral, MD-medial, PR-proximal, UN-unidentified, C-cut, SC-scrape, S/P-scrape/plane S-soft, SH-semi-hard

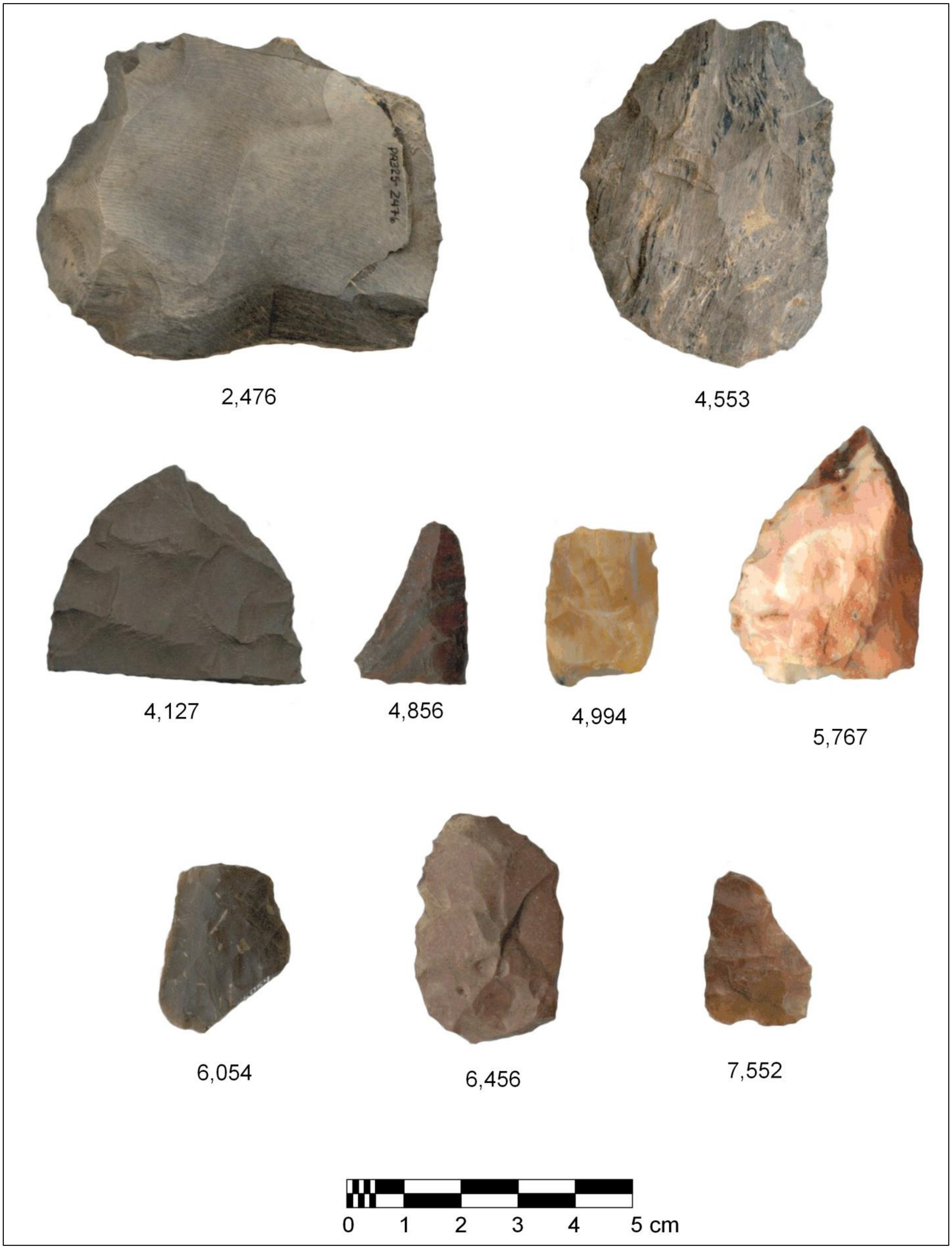


Figure 9-20 Photographs of bifaces recovered from Block D Cultural Level 4.

Late Archaic darts also originated from the area. Thus, the different aged components do not appear to be horizontally separated.

Bifaces

Thirty bifaces were recovered from Block D Cultural Level 4, of which four are complete and 26 are fragmentary (Table 9-9, Figure 9-20, Appendix B). Slightly more than half of the bifaces are in the later stages (IV or V) of reduction. Evidence of use was noted on 14 of the bifaces. Cutting of soft and semi-hard materials is the most common interpreted use. Scraping of soft and semi-hard materials was also observed on four bifaces. Six specimens show evidence of use wear on two edges. It would appear that the bifaces were used to process plant fiber or perhaps cut meat.

Drill

One drill (#6,475) was found in Cultural Level 4 (Appendix B, Figure 9-21). It is a tan Eocene chert complete, hafted and bifacially flaked drill. The item measures 23.1 mm long, 22.8 mm wide and 4.7 mm thick. The convex base is 14.7 mm wide. The haft width 11.1 mm, the notch width is 5.1 and 6.6 mm, and the notch depth and width are 3.8 mm and 5.0 mm, respectively. Use wear analysis reveals that the drill tip was used in a counter-clockwise direction and displays small step fractures. This indicates use on a semi-hard to hard material. The tool appears to have been made from a Late Archaic projectile point. The drill was located in unit N233 E252 in the central portion of the block.

Scrapers

Six tools classified as scrapers were recovered from Block D Cultural Level 4 (Table 9-10, Figure 9-21, Appendix B). Most of the items are hafted end scrapers, but one is a side scraper. Three scrapers are complete and do not appear to have been exhausted. The remaining end scrapers were exhausted or had broken near the proximal (haft) end. Use wear analysis reveals that two of the scrapers were used on fresh

Table 9-10 Attributes of scrapers recovered from Block D Cultural Level 4.

Cat#	**Unit**	**Elevation**	**Type**	**Portion**	**Material**	**Length**	**Width**	**Thickness**	**Bit Angle**	**Bit Width**	**Use Mat.**
2616	N231 E252	98.92-98.82	ES	CO	Eocene Chert	36.1	34.6	11.6	63	4	HD
4737	N229 E254	98.69-98.59	ES	CO	Non-local chert	36.9	19.6	4.3	65	4	HD
6259	N232 E253	98.90-98.80	SS	CO	Obsidian	91.5	45.6	16.1	59	2	SH
7555	N235 E255	98.92-98.82	ES	CO	Eocene Chert	58.6	39.1	15.1	73	3	H
7653	N235 E256	99.02-98.77	ES	DS	Silic. Wood	41.2	34.0	9.1	73	3	H
7655	N235 E256	99.02-98.77	ES	DS	Eocene Chert	21.4	12	5.6	59	3	H

Abbreviations; ES-end scraper, SS-side scraper, CO-complete, DS-distal, HD-hide, H-hard, SH-semi-hard

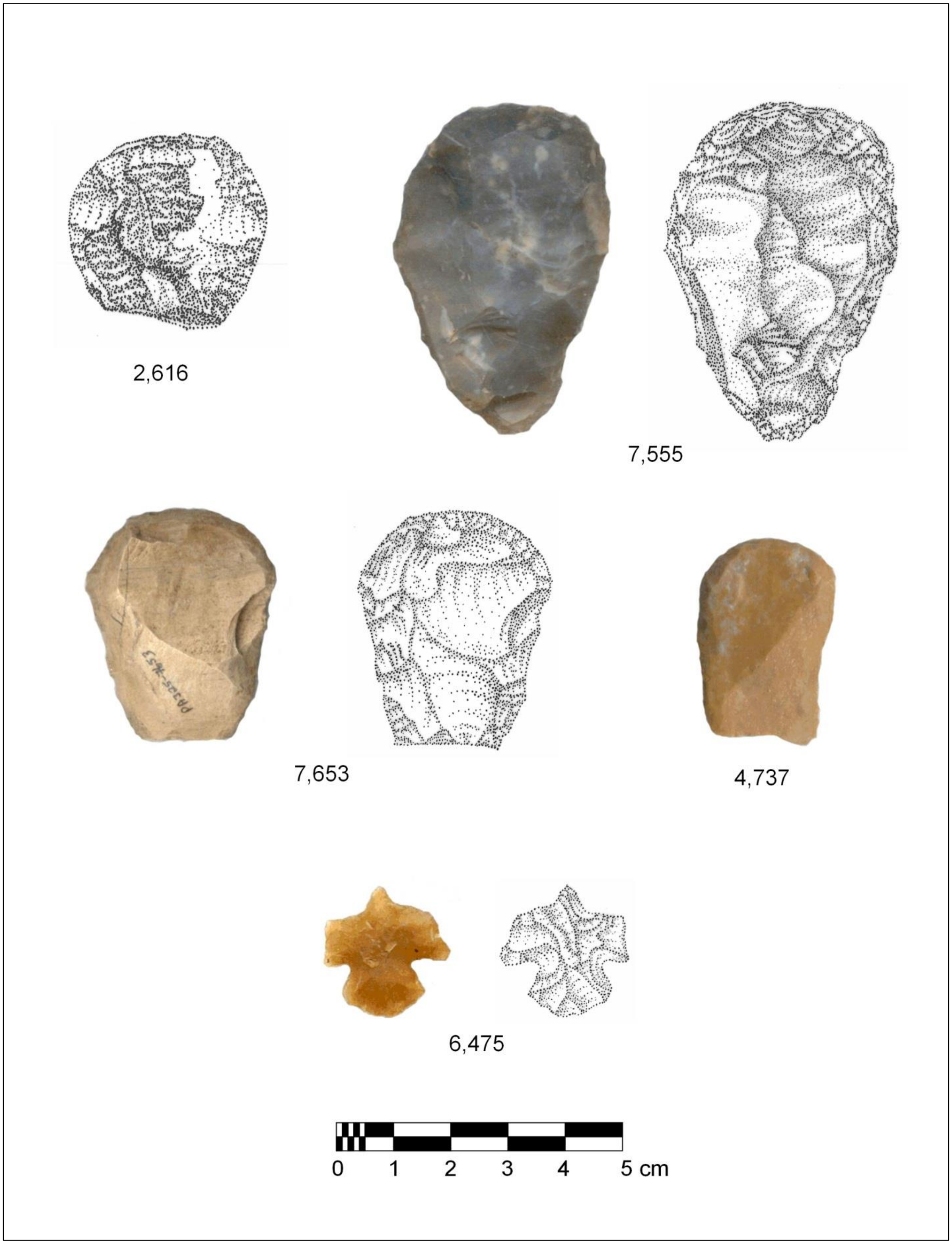


Figure 9-21 Photographs of scrapers and drill from Block D Cultural Level 4.

hide. The remainder evidence small scalar scars and step fractures on their working edges, indicative of use on hard or semi-hard materials.

Expedient Flake Tools

A large sample of expedient flake tools was recovered from Block D Cultural Level 4 (Table 9-7, Appendix B). Thirty-six of the flake tools are retouched flakes, 23 are utilized flakes and one is a utilized core. Use-wear analysis indicates that a majority of the retouched flakes were used to scrape (50%) hard (38.9%) and semi-hard (61.1%) materials. A significant number of the retouched flakes were used to cut (38.9%) soft (57.1%) and semi-hard (42.9%) materials. One retouched flake does not appear to have been utilized following retouch. Three retouched flakes were used to scrape/plane, plane and groove a semi-hard material. Use wear analysis of the utilized flakes indicates that cutting (39.1%) and scraping (43.5%) were the dominate use activities. Utilized flakes were used to cut both soft (66.7%) and semi-hard (33.3%) materials. Utilized flakes were used to scrape semi-hard (70%) and hard (30%) materials. In addition, four (17.4%) utilized flakes were used to scrape/plane a semi-hard material. One silicified wood polyhedral core (#2,478) has rounding, polish and several small micro-debitage scars, indicating that it was used to scrape a hide.

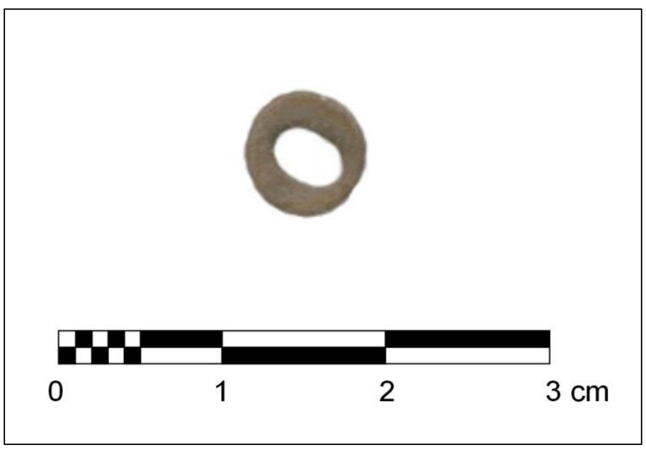


Figure 9-22 Photograph of steatite bead recovered from Block D Cultural Level 4.

Bead

A steatite bead (#5,246) was located between 20 and 30 cm BS in N230 E255 (Figure 9-22). It is a light brown, polished, round disk bead that is 7.7 mm in diameter, and 2.1 mm thick. The drilled hole is oblong at 4.5 mm wide and 3.3 mm tall.

Faunal Remains

A total of 380 pieces of bone and 128 pieces of tooth enamel were recovered from Block D Cultural Level 4 (Table 9-11). Of these, the majority (95.9%) is comprised of unidentifiable fragments. A

Table 9-11 Faunal specimens recovered from Block D Cultural Level 4.

Species	**Element**	**Portion**	**SIDE**	**NISP**
bighorn sheep	2nd phalange	distal end, <1/2 shaft	L	1
bighorn sheep	astragalus	distal end, >1/2 shaft	L	1
bighorn sheep	fused 2nd, 3rd tarsal	Complete	L	1
bighorn sheep	humerus	distal end, <1/2 shaft	R	1
m. artiodactyl	cervical vertebra	proximal epiphysis	axial	1
m. artiodactyl	femur	long bone shaft	R	1
m. artiodactyl	long bone	long bone shaft	NA	7
m. artiodactyl	metapodial	distal end	NA	1
m. artiodactyl	patella	Diaphysis	NA	1
m. artiodactyl	ulna	trochlear notch portion	R	1
beaver	mandible	dentary ramus	R	1
beaver	mandible	tooth row	R	1
beaver	mandibular molar	tooth row	R	1
unidentified	long bone	long bone shaft	NA	1
unidentified	bone frag.			359
unidentified	tooth frag.			127
intrusive rodent	undifferentiated			2
Total				508

Table 9-12 Presence and distribution of breakage morphology, cut/impact marks and burning on the Block D Cultural Level 4 faunal assemblage.

Species	**Break Pattern**	**Cut/Impact**	**Burned**	**NISP**
Beaver	green			1
Beaver				2
bighorn sheep	dry			2
bighorn sheep	green		X	1
bighorn sheep				1
m. artiodactyl	green	X	X	1
m. artiodactyl	dry		X	1
m. artiodactyl	dry			5
m. artiodactyl	dry			2
m. artiodactyl	green		X	1
m. artiodactyl	green			2
Unidentified			X	180
Unidentified				179
Unidentified	green			1
intrusive rodent	dry			1
intrusive rodent				1
Total				508

minimum of one bighorn sheep and one beaver are represented in the assemblage. Two fossorial rodent bones, interpreted as non-cultural and intrusive, were also found. Medium artiodactyl bones, probably from bighorn sheep, are also represented by 12 identifiable elements. Of the total sample, six specimens exhibit green bone fracture morphology, and one displays evidence of a cut mark (Table 9-12). Evidence of burning was noted on 184 specimens.

The faunal assemblage from this component is composed of highly fractured and burned bone suggestive of intensive processing. The high number of unidentified specimens might indicate that long bones were crushed in order to obtain additional nutrients through boiling. Subsistence appeared to have focused on medium sized animals such as deer and mountain sheep with just a couple of bones of the smaller pocket gopher.

Feature 16

Feature 16 was identified in unit N232 E255 at 98.82 m elevation (14 cmbs [Figure 9-23 through 9-25]). It was a roughly oval, measuring 60 cm north-south and 75 cm east-west with a maximum depth of 21 cm. The fill was dark brown in color with abundant charcoal and contained 63 pieces of fire-cracked rock weighing a total of 23.0 kilograms. The lower boundary of the feature was very distinct, with a light reddish-brown oxidation rind present. There were very few artifacts in or around the feature. The fill from Feature 16 was collected for flotation, which resulted in the recovery of 154 pieces of micro debitage (>2 mm), 19 unidentifiable bone fragments (>2 mm) and 77.4 grams of wood charcoal. A large sample of charcoal was removed from the feature fill prior to processing and submitted for standard radiometric dating, resulting in a date of 920±70BP (Beta-97537).

Feature 16 appears to have been deliberately excavated at least 21 cm deep and lined with stones, characteristics that correspond closely to roasting pits, or earthen ovens, that were used to roast roots and tubers. According to first-hand accounts (Wright 1984:11), roasting pits were constructed within a basin that was excavated to about 30 cm in depth and layered with stones. After the final use of the pit the fire-cracked rocks were often left in the bottom. Oxidation rinds of 1-3 cm often surround the features. Sediment within roasting pits typically contains large amounts of charcoal. Lastly, bone is often absent or poorly represented.

Spatial Analysis

Two chipped stone concentrations are apparent in the spatial analysis of Block D Cultural Level 4 (Figure 9-27). The largest and densest of these was located between N231-232 and E252-254. This cluster of artifacts also contained the only discernible concentration of bone (Figure 9-28). Four Late Archaic dart points were found within or immediately adjacent to this concentration, but neither of the Late Prehistoric diagnostics came from this area. Thus, the densest artifact concentration appears to be

Figure 9-23 Photograph of Feature 16, Block D, Cultural Level 4 at approximately 10 cmbs.

Figure 9-24 Photograph of Feature 6, Block D, Cultural Level 4, in profile (south half removed).

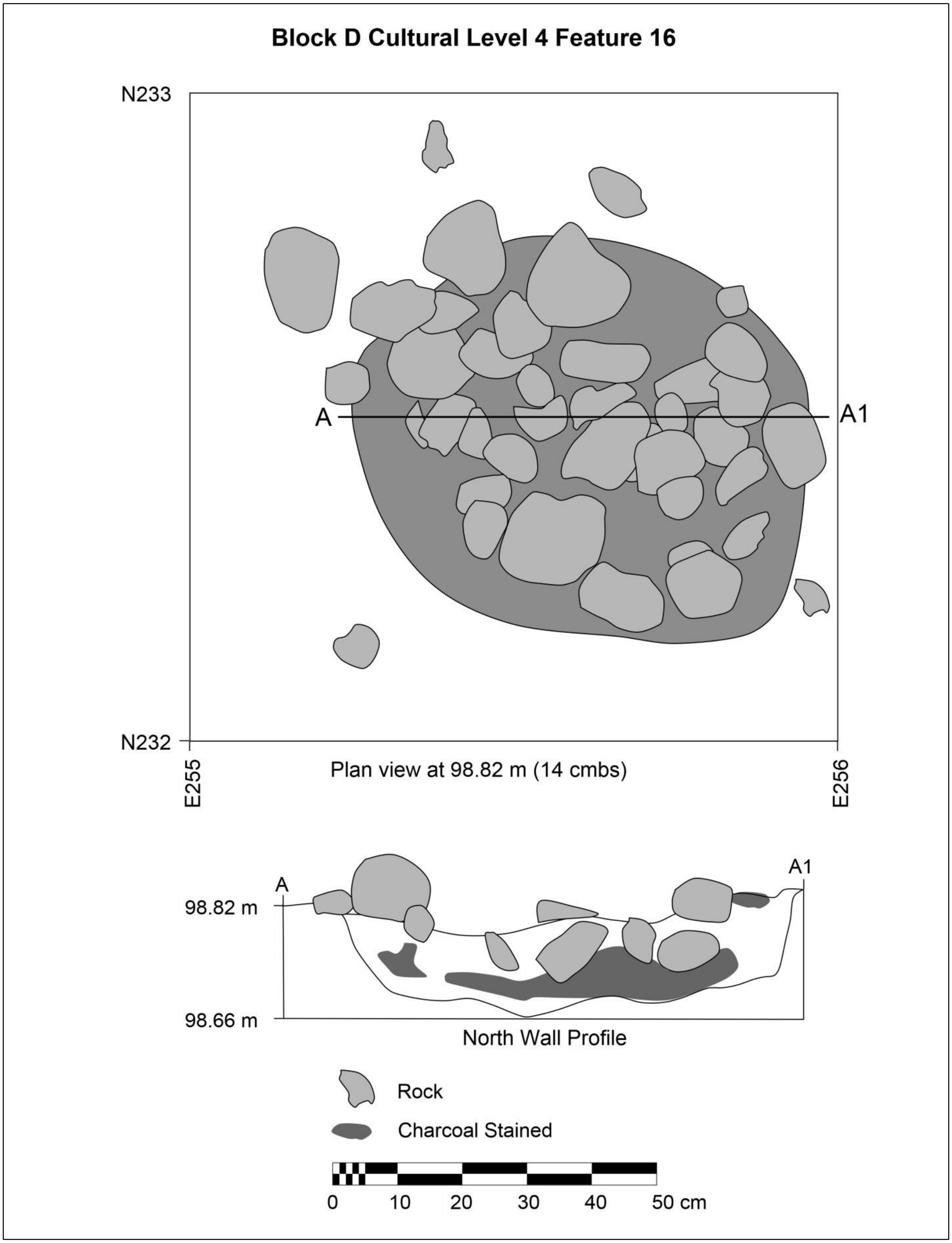


Figure 9-25 Illustration of Feature 16, Block D Cultural Level 4.

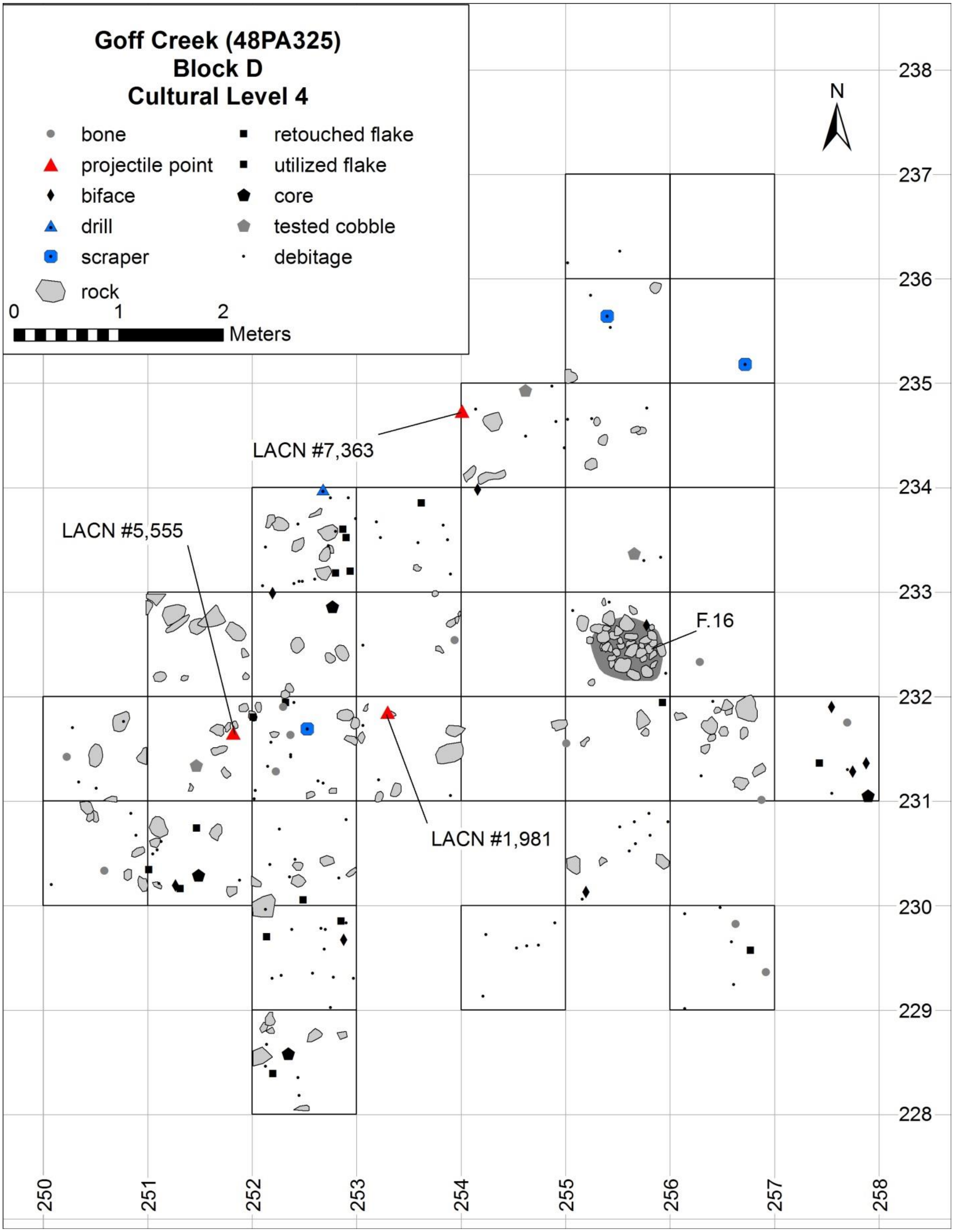


Figure 9-26 Plan view map of Block D Cultural Level 4.

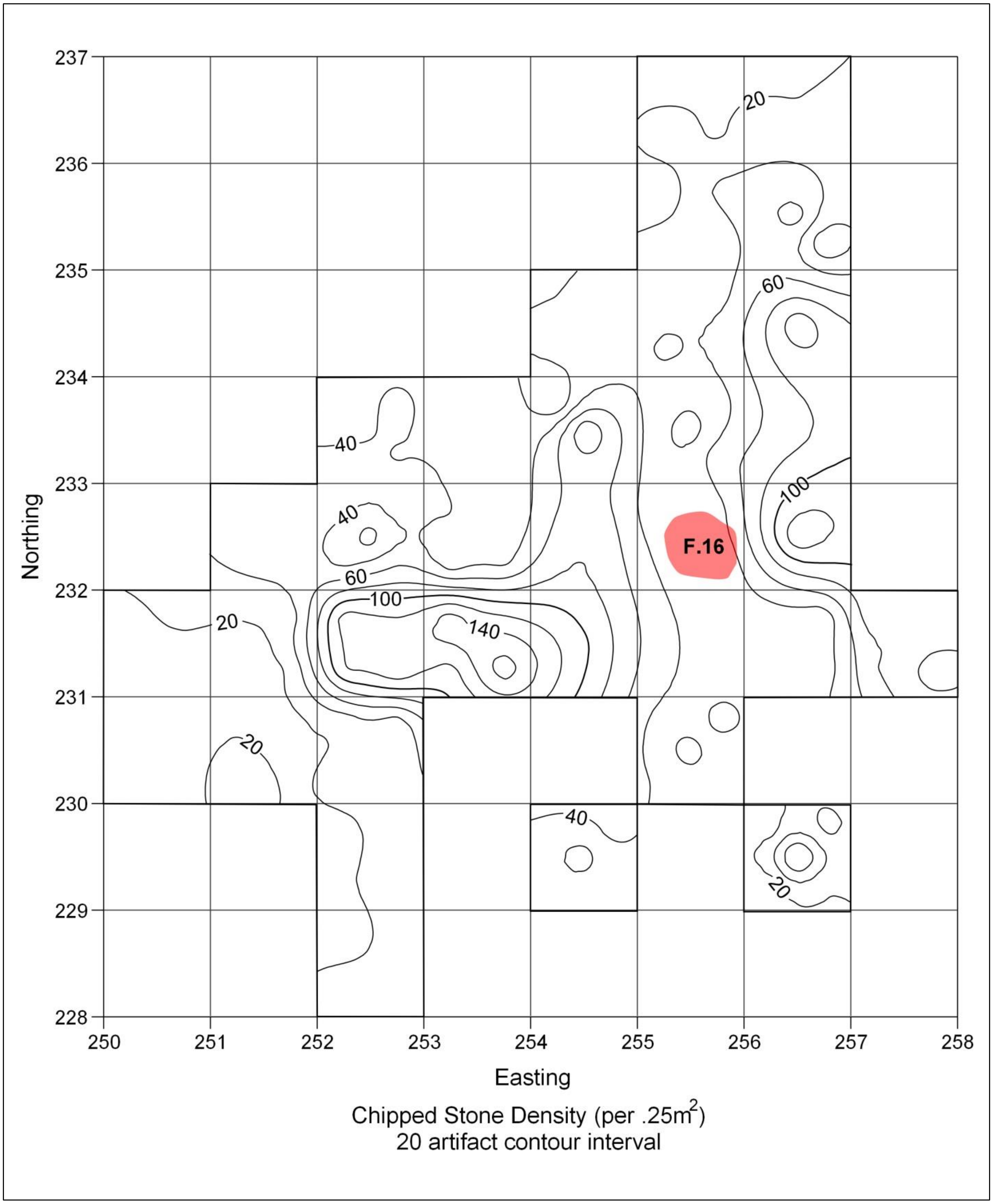


Figure 9-27 Map showing the interpolated chipped stone artifact density from Block D Cultural Level 4.

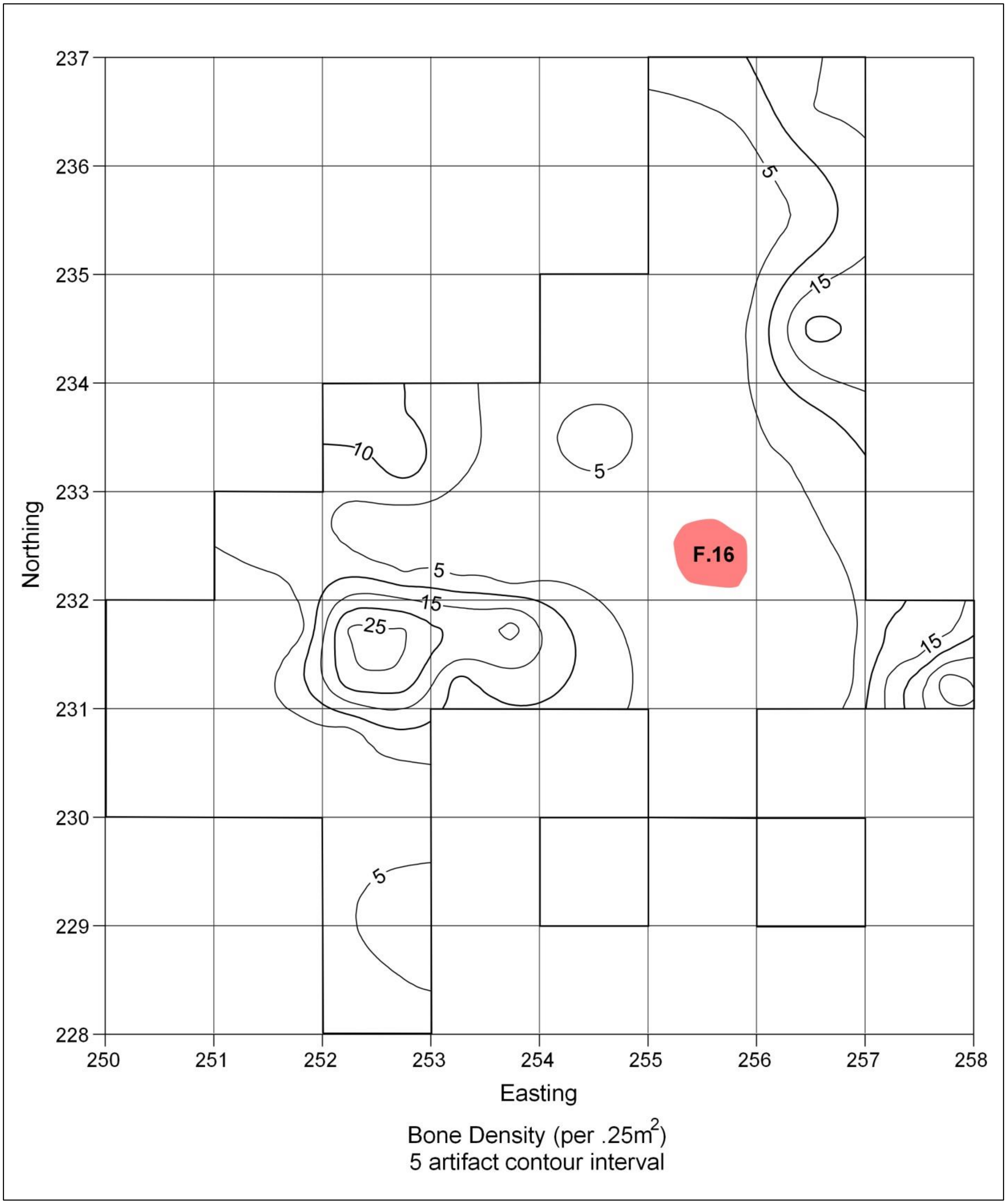


Figure 9-28 Map showing the interpolated bone artifact density from Block D Cultural Level 4.

associated with the Late Archaic component. A second, smaller concentration of chipped stone was found about one meter east of Feature 16, but no diagnostic artifacts were found within this concentration.

At many sites in the region relatively few artifacts are found in association with roasting pits (Francis 1995; Page 2015). This tendency for low artifact frequency and density around roasting pits probably indicates that there was little need to produce or maintain stone tools during root and tuber roasting. Moreover, when in use, the roasting pits would have created a lot of smoke and were probably placed downwind of activity areas. In short, roasting pits are special use features that appear to have been placed away from hearths or other activity areas. It is unclear whether the small cluster of chipped stone found one meter east of Feature 16 is related to the feature's use or is from an earlier or later occupation.

There are multiple occupations represented in Block D Cultural Level 4. Yet, apart from the possible Late Archaic association of the bone and dense debitage cluster noted above, there was no patterned distribution of tools or lithic raw material types that could be used to clarify the boundaries of activity areas from individual components. Given the circa 900 BP radiocarbon date, Feature 16 is probably associated with the earlier Late Prehistoric component that also produced a Rose Spring corner-notched arrow point.

Summary and Discussion

Two cultural levels, 1 and 4, were identified in Block D. Both of these levels appear to represent multiple mixed components. Given the limited chronometric data from the level it is difficult to assess the duration of occupation for either cultural level. As such, the data recovered from Block D are of somewhat limited value.

There are several reasons to questions the integrity of the deposits found within Cultural Level 1. The level is largely restricted to a paleosol within Stratum IIb, with some artifacts recovered from the overlying Stratum V that were displaced via faunalturbation and/or represent a diffuse scatter of artifacts from later occupations. It is possible that the occupations that produced Cultural Level 2 in Areas A and B comprises a part of Cultural Level 1 in Block D. In Blocks A and B, Cultural Level 2 was contained within Stratum III, which is absent from Block D. Thus, Stratum IIb (and Cultural Level 1) may have remained exposed on the surface in and around Area D for a much longer period of time than in Areas A and B. The Stratum IIb surface then appears to have experienced considerable post-depositional mixing given the relatively large number of intrusive fossorial rodent bones. Furthermore, artifacts diagnostic of the Late Paleoindian and Early Archaic periods were found, with the bulk attributed to the Early Archaic. Yet, there is more stylistic variation in the Early Archaic projectile point assemblage than was documented in any single cultural layer at Mummy Cave (Husted and Edgar 2002). A standard radiocarbon date from Feature 17 produced an age estimate of 5000±70 BP, the end of the Early Archaic period. It is therefore probable that multiple components spanning the Late Paleoindian and much, if not all, of the Early Archaic are present in a mixed palimpsest.

Evidence for subsistence in Block D Cultural Level 1 is limited to the faunal assemblage, as no groundstone or roasting features were found. The assemblage was fairly diverse and included bighorn sheep, mule deer, canid, porcupine, river otter and small mammal. Although most of the assemblage was highly fragmentary, the majority of the bone identifiable to body class size, as in all the other cultural levels at Goff Creek, was from medium artiodactyls. Since identifiable bighorn sheep specimens outnumber mule deer 26 to 1, the odds favor bighorn sheep as the target prey species.

Cultural Level 4 appears to contain at least three components. The earliest and most significant, judging from the frequency of diagnostic artifacts, dates to the Late Archaic period. One corner-notched Rose Spring arrow point was found that is probably associated with the Feature 16, a roasting pit that produced a standard radiocarbon date of 900±70 BP. The final occupation is represented by a single Desert tri-notched arrow point, a type that has been dated as early as 700 BP and continued to be made into historic times (Justice 2002).

Information on subsistence was mostly limited to the faunal assemblage, which was small and comprised predominantly of medium artiodactyl specimens. Feature 16 probably reflects a single event of roasting root or tubers.

CHAPTER 10RESULTS OF EXCAVATION: AREAS E AND F

Michael Page

Areas E and F were located at the eastern edge of excavations. These two areas are discussed together because they had similar stratigraphy and each contained what is believed to be the same two cultural levels. Area E consisted of a 4 m x 6 m rectangular excavation block and two isolated units, N236 E265 and N239 E265. Area F contained Block F, a 5 m x 3 m rectangular excavation block and three isolated units, N231 E271, N239 E283 and N244 E286. In all, 44 m^2 were excavated, but most of the units were only dug to a depth ranging from about 98.3 m to 98.2 m elevation (35-45 cmbs). These shallow units did not extend into the lower cultural deposits. Deeper excavations were carried out in 11 units, including three from Block E (~97.85 m), four from Block F (97.8 m – 97.6 m) and four isolated units in Area F (97.94 m – 97.64 m).

Stratigraphy

The vertical distribution of artifacts shows that there are two cultural levels present in Areas E and F (Figures 10-1 through 10-7). The upper cultural level was found in an approximately 25 cm thick zone within stratum VIa. This same cultural level was also identified in Blocks C and D and designated Cultural Level 4. A small number of artifacts were also recovered from the overlying stratum VII. This likely reflects a diffuse scatter of artifacts associated with a Late Prehistoric component. There appears to have been some mixing of the deposits because both Late Prehistoric and Late Archaic diagnostic artifacts were recovered from stratum VIa. Two radiocarbon dates were obtained from stratum VI. The fist was a standard radiometric date of a bulk organic sediment sample taken from Trench 1 that returned an age estimate of 2600±60 BP (Beta-87105). The second was an AMS date of charcoal recovered from Feature 21 in Block F that produced an age estimate of 130±30 BP (Beta-406661). This late date is almost certainly the result of contamination. Based upon the diagnostic items which have been dated in other contexts, the earlier 2600 BP date probably reflects the age of the Late Archaic Cultural Level 4 occupation.

The lower cultural level was present in a ~20 cm thick layer near the base of stratum Va. This cultural level likely corresponds to the Middle Archaic-aged Cultural Level 3, identified in the same stratigraphic position within Block C. Several projectile points diagnostic of the Middle

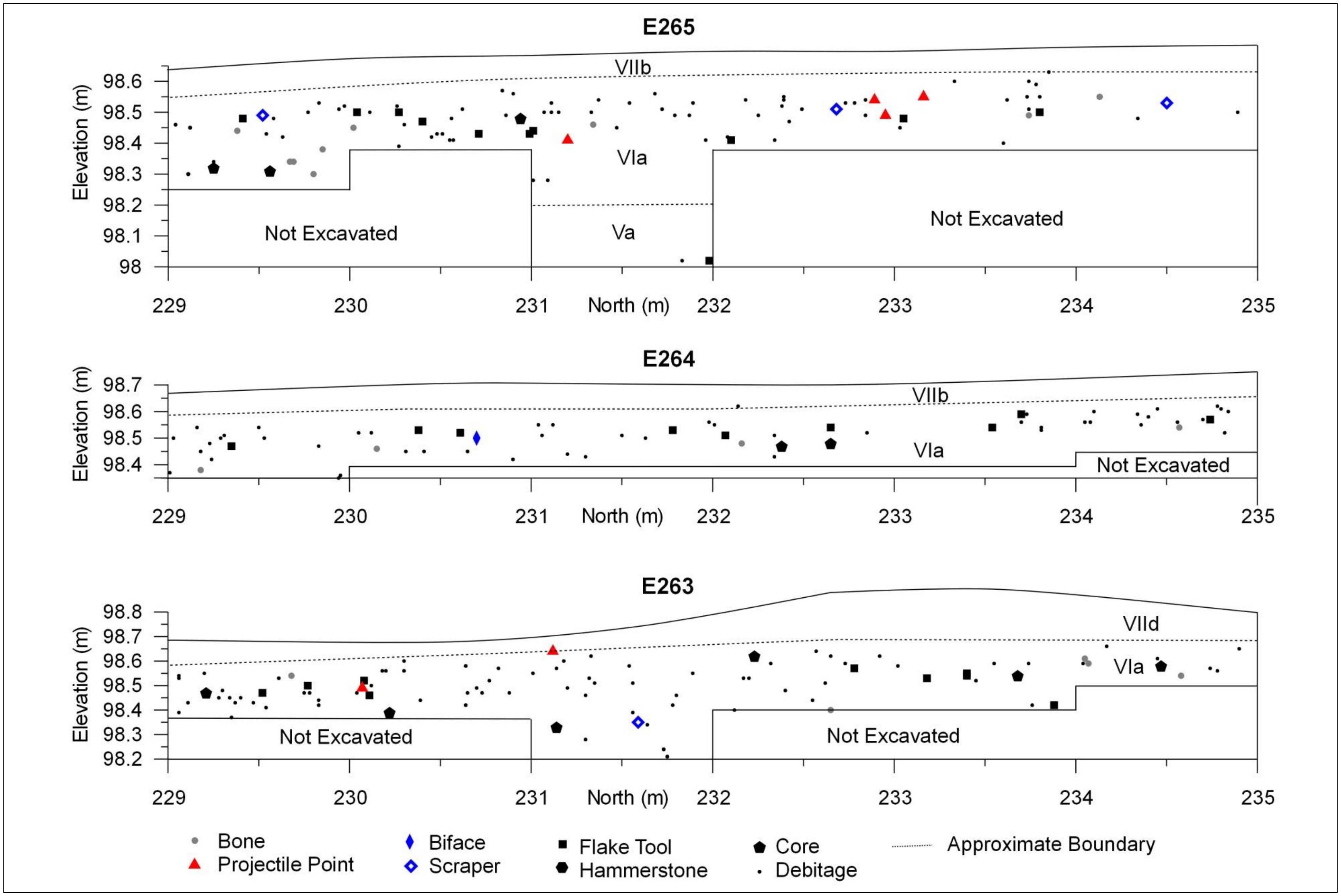


Figure 10-1 Backplots of point plotted artifacts from E263-E265 Block E.

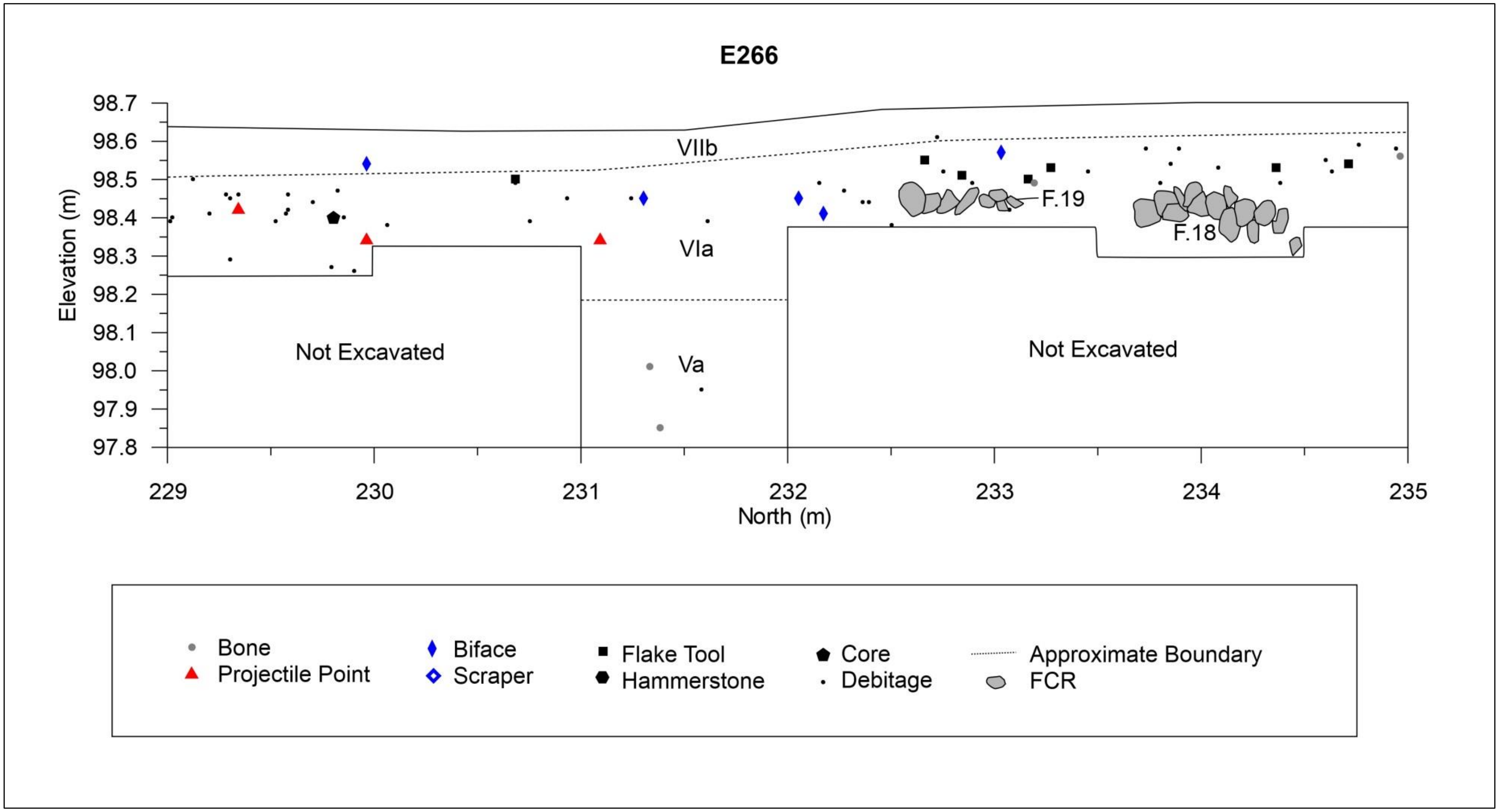


Figure 10-2 Backplots of point plotted artifacts from E266 in Block E.

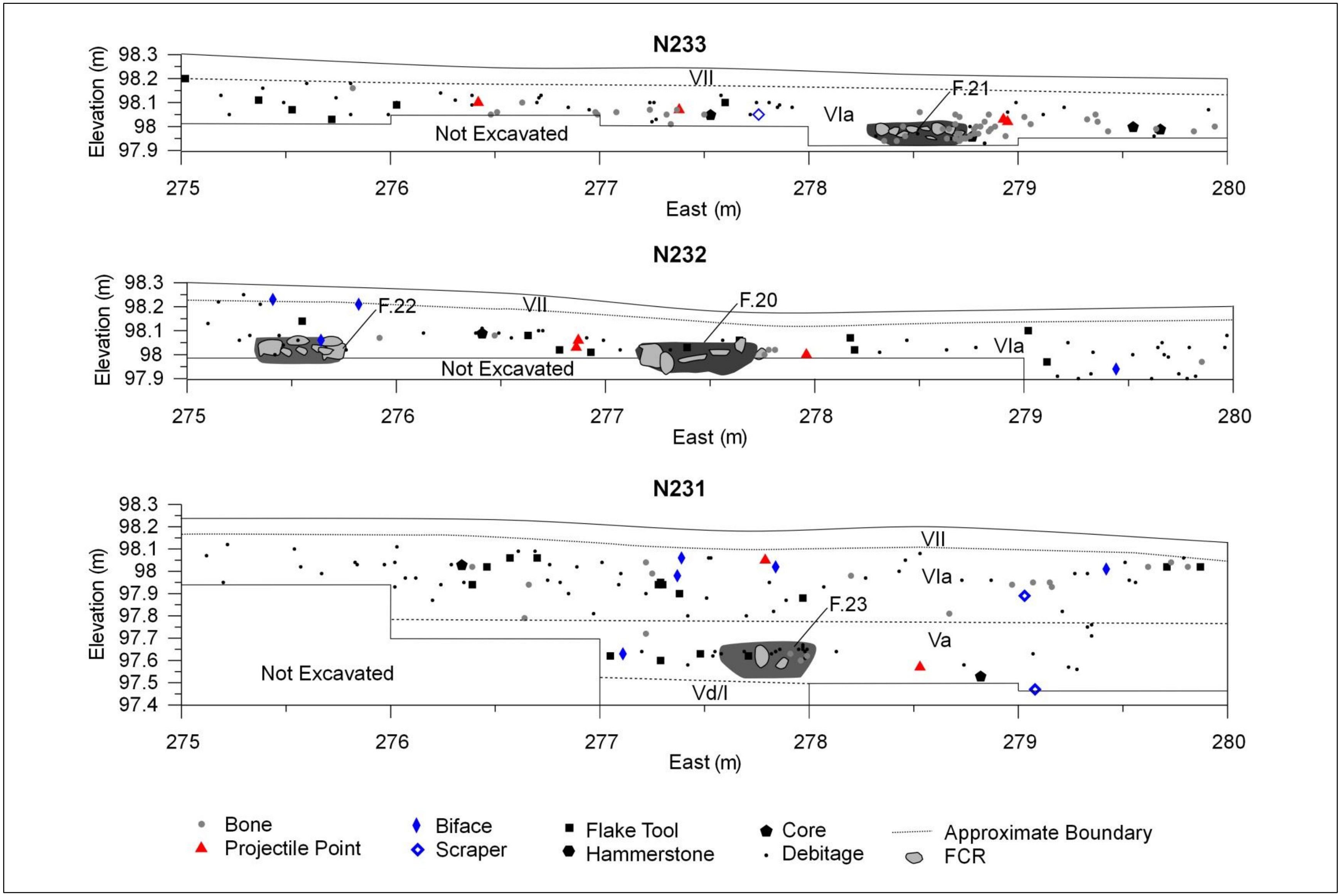


Figure 10-3 Backplots of point plotted artifacts from Block F.

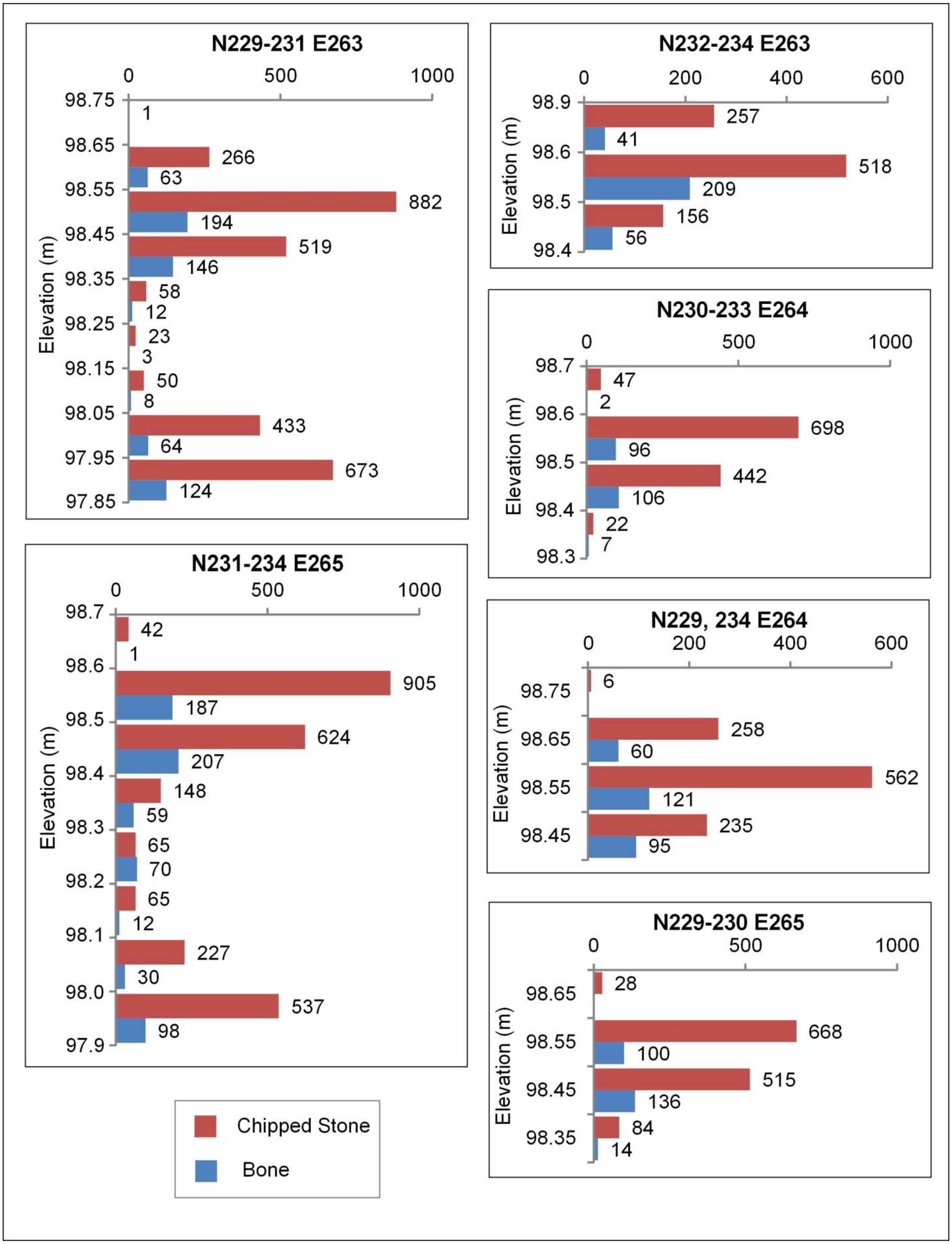


Figure 10-4 Graph showing the vertical distribution of chipped stone and bone artifacts from Block E.

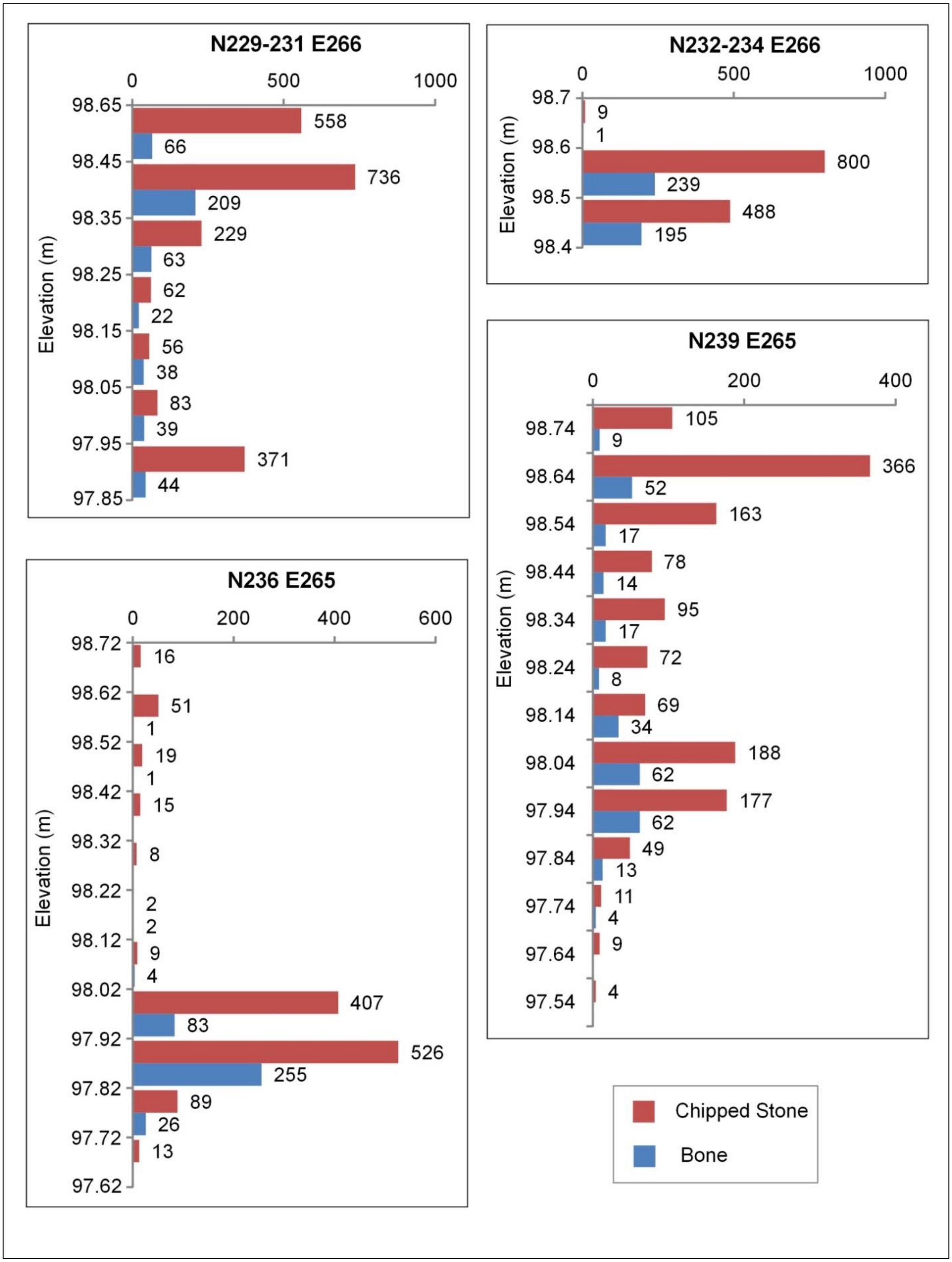


Figure 10-5 Graph showing the vertical distribution of chipped stone and bone artifacts from Area E.

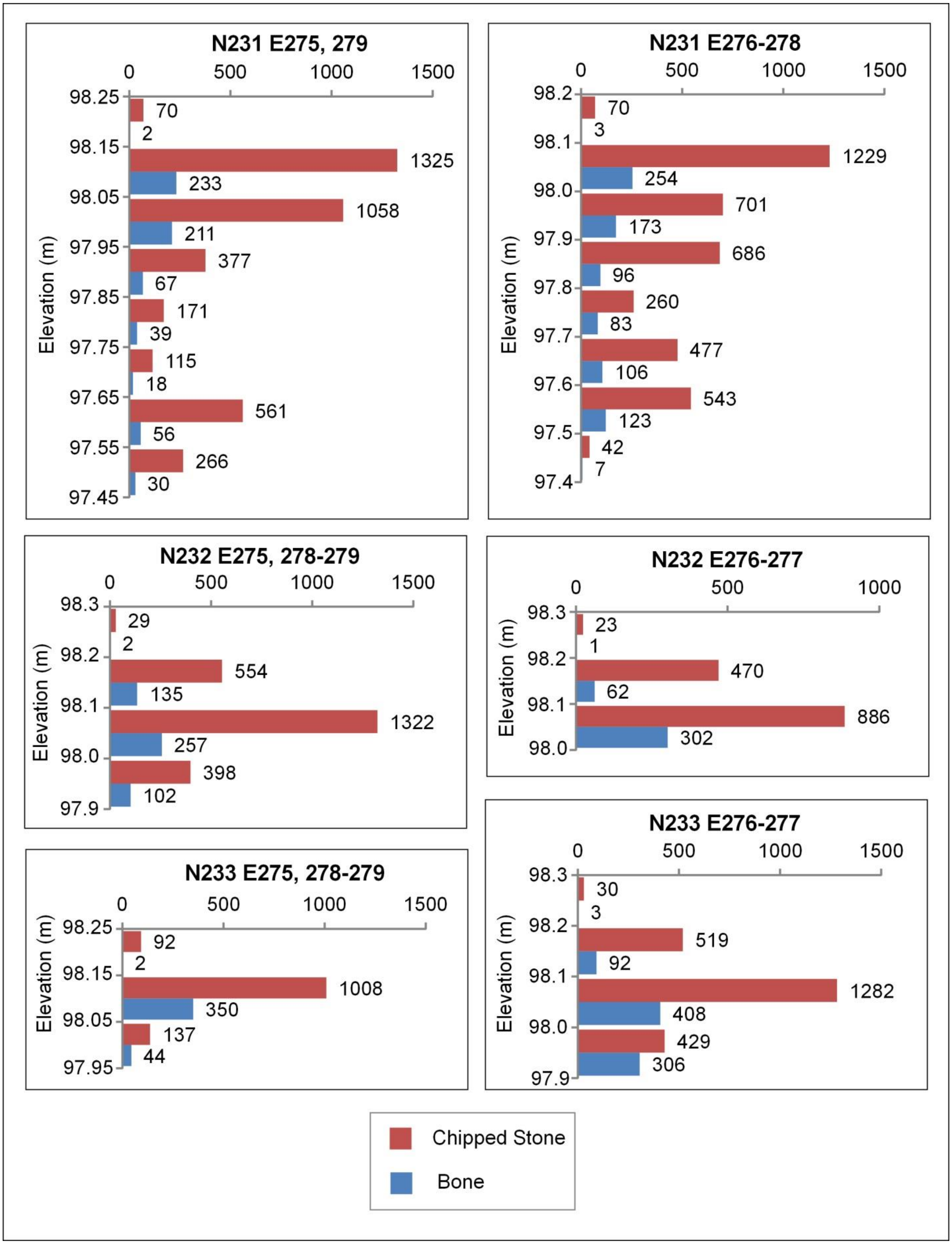


Figure 10-6 Graph showing the vertical distribution of chipped stone and bone artifacts from Block F.

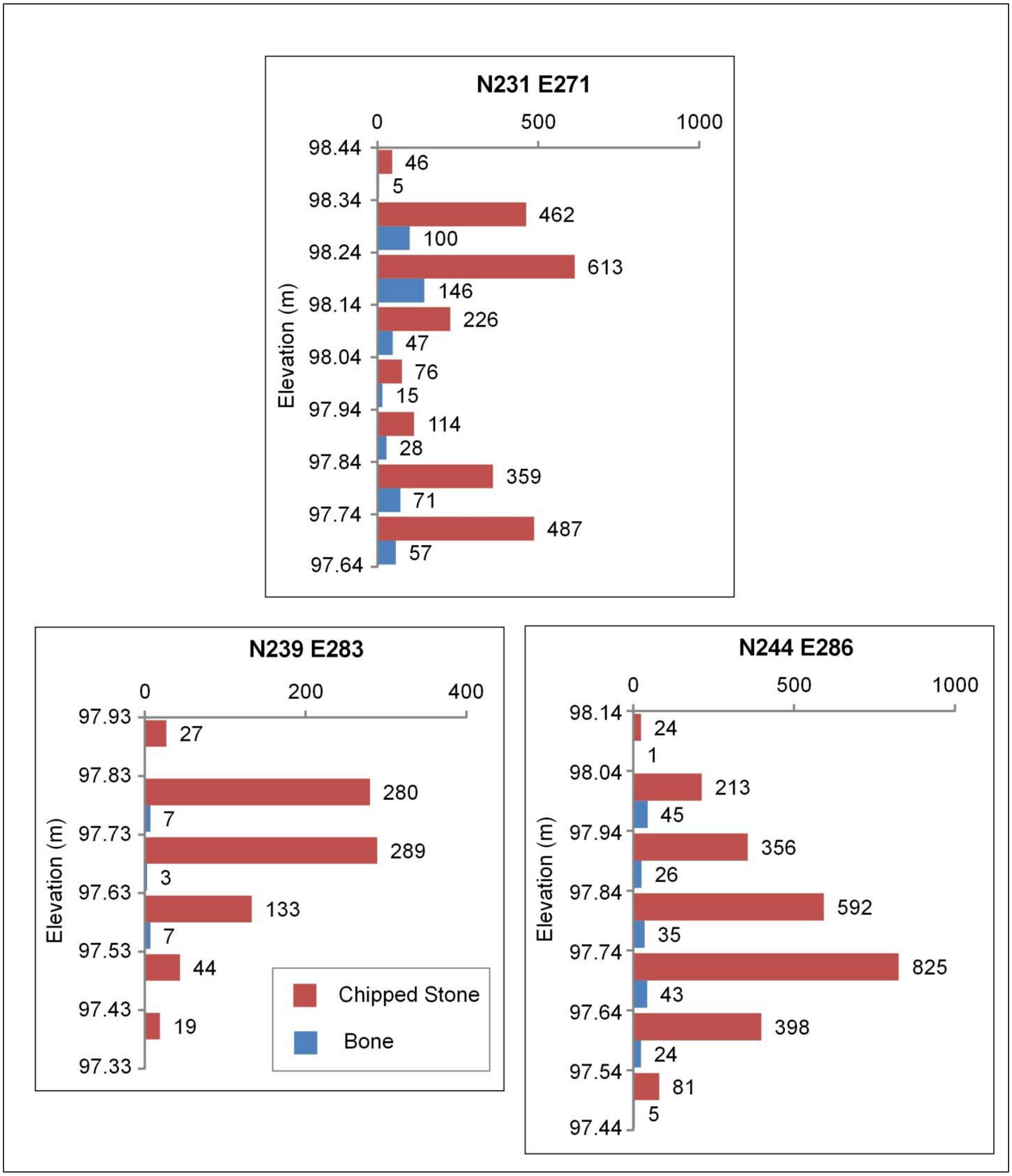


Figure 10-7 Graph showing the vertical distribution of chipped stone and bone artifacts from Area F.

Archaic period were recovered from this level, but so too was an Early Archaic point. An AMS radiocarbon date from charred material found in Feature 23 produced an age of 4310±30 BP (Beta-406662), which supports the interpretation of a Middle Archaic age for Cultural Level 3.

Cultural Level 3

Cultural Level 3 in Areas E and F produced 7,173 chipped stone artifacts, two groundstone artifacts and 1,531 faunal remains. Despite the relatively small size of the assemblage, there were 45 chipped stone tools, including four projectile points, one hafted knife, 10 bifaces, two scrapers and 28 expedient flake tools found in Cultural Level 3. One feature, Feature 23, was also identified in Block F.

Lithic Raw Material Utilization

Locally available Eocene chert and silicified wood were the most common raw materials comprising 77.6% of the chipped stone assemblage (Table 10-1). Obsidian and non-local chert were the most common non-local material types. A very similar pattern of stone use was observed in Block C Cultural Level 3 which contained similar percentages of obsidian (around 12%). This pattern differs significantly from the raw material utilization observed in both earlier and later assemblages. There are disproportionately more obsidian tools than debitage and conversely fewer tools than debitage made of local material types. This pattern probably reflects retooling, with broken or expended obsidian tools discarded at the site and replaced with locally manufactured items that, presumably, were transported offsite when the occupants left.

Debitage

Broken flakes (19.2%) and flake fragments (59%) are again the most common types of debitage in the assemblage. Complete flakes are fairly common (15%), most of which (90.2%) are tertiary. Early stage reduction of lithic raw materials was not apparently the focus of flint knapping activities given the low percentages of primary (1.1%) and secondary (8.7%) flakes within the complete flake category. This interpretation is generally supported by the small number of cores (n=3) and the low percentage of blocky debris (6.7%) recovered from Cultural Level 3. According to Sullivan and Rosen (1985), assemblages dominated by broken flakes and flake fragments with small amounts of cortical debitage are indicative of late stage tool production and maintenance activities.

Projectile Points and Hafted Knives

Four projectile points and one hafted knife (#3,855) were recovered from Cultural Level 3 in Areas E and F (Table 10-2, Figure 10-8). Only two of the projectile points are complete enough to allow identification of haft morphology. One nearly complete point (#3,778) that has been heavily resharpened has side notches and a shallow basal notch that is reminiscent of the Hanna point type - one of three

Table 10-1 Areas E and F Cultural Level 3 chipped stone artifacts by raw material type.

MATERIAL TYPE	**ARTIFACT TYPE**										
	Projectile Point	**Hafted Knife**	**Biface**	**Scraper**	**Retouched Flake**	**Utilized Flake**	**Tools Total**	**Core**	**Tested Cobble**	**Debitage**	**Material Total**
Local Chert	**2**	**1**	**4**	**1**	**2**	**10**	**20**			**3,629**	**3,649**
%artifact	50	100	40.0	50	18.2	62.5	44.4			50.9	50.9
% material	0.1	<0.1	0.1	<0.1	0.1	0.3	0.5			99.5	100
Silic. wood			**2**		**3**	**2**	**7**	**2**	**1**	**1,909**	**1,919**
%artifact			20.0		27.3	12.5	15.6	100	100	26.8	26.8
% material			0.1		0.2	0.1	0.4	0.1	0.1	99.5	100
Obsidian	**2**		**4**		**3**	**1**	**10**			**891**	**901**
%artifact	50		40.0		27.3	6.3	22.2			12.5	12.6
% material	0.2		0.4		0.3	0.1	1.1			98.9	100
Non-Local Chert				**1**	**3**	**2**	**6**			**373**	**379**
%artifact				50	27.3	12.5	13.3			5.2	5.3
% material				0.3	0.8	0.5	1.6			98.4	100
Misc. QTZ						**1**	**1**			**180**	**181**
%artifact						6.3	2.2			2.5	2.5
% material						0.6	0.6			99.4	100
Morrison QTZ										**69**	**69**
%artifact										1.0	1.0
% material										100	100
Porcellanite										**60**	**60**
%artifact										0.8	0.8
% material										100	100
Basalt						**1**	**1**			**12**	**13**
%artifact						6.3	2.2			0.2	0.2
% material						7.7	7.7			92.3	100
UID Chert										**2**	**2**
%artifact										<0.1	<0.1
% material										100	100
Artifact Total	**4**	**1**	**10**	**2**	**11**	**17**	**45**	**2**	**1**	**7,125**	**7,173**

named types diagnostic of the Middle Archaic aged McKean Complex. However, similar side and basal-notched points were recovered from the Layer 17 at Mummy Cave (Husted and Edgar 2002) and at Laddie Creek (Larson 1990), both of which date to the Early Archaic period. The second identifiable point (#2,534) is lateral base and midsection fragment that is side-notched with a pronounced concave base. This specimen most closely conforms to the Oxbow type that first appeared during Early Archaic

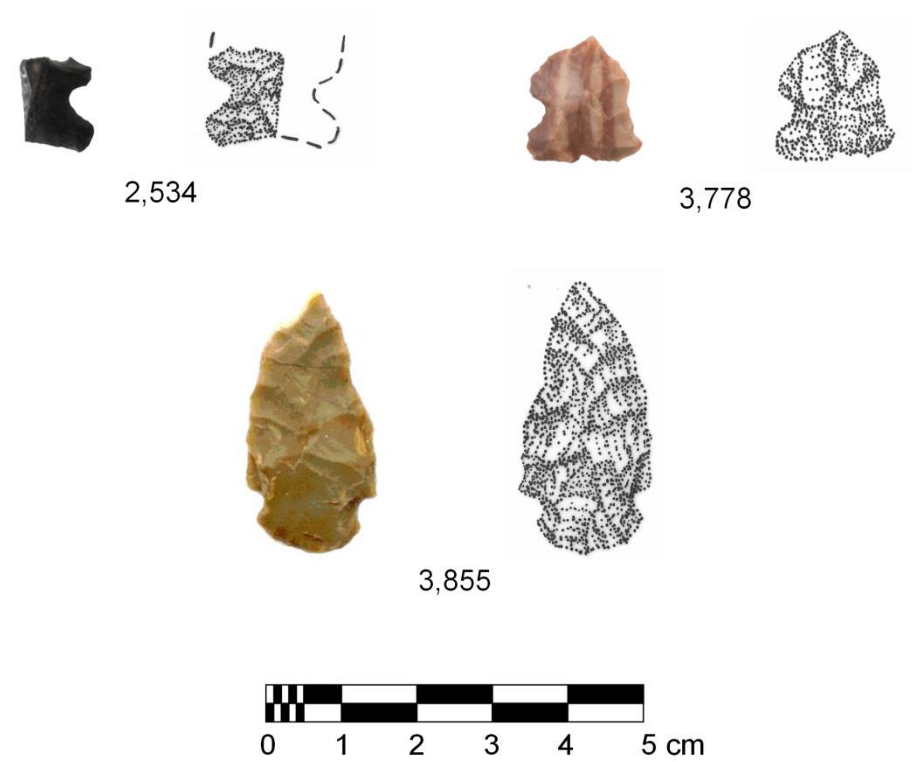


Figure 10-8 Photographs of projectile points and a hafted knife recovered from Cultural Level 3 of Areas E and F.

Table 10-2 Attributes of projectile points from Areas E and F Cultural Level 3.

Catalog#	Block	Unit	Elevation (m)	Material	Period	Portion	Haft Type	Prox Shld. Angle	Max. Length	Base Width	Base Length	Haft Width	Max. Thickness	Notch Depth	Notch Width
2534	E	N231 E263	97.95-97.85	Eocene Chert	?	BM	S	146	13.1		9.4		4.9	2.7	4.7
3485	E	N239 E265	97.94-97.84	Obsidian	?	ER			6.7				2		
3676	F	N231 E271	97.84-97.74	Obsidian	?	ER			6.4				3.7		
3778	F	N231 E277	97.60-97.50	Eocene Chert	MA	NC	S/B	144	16.8	15.6	8.1	11.7	4.7	2	5.2
3855	F	N231 E278	97.60-97.50	Eocene Chert	?	NC	C	116	35.4	13.7	6.5	12.2	5.8	1.7	4.5

Abbreviations; MA-Middle Archaic, BA-base, BM-base and midsection, ER-ear, S-side, S/B-side and base, C-corner times, but continued to be made well into the Middle Archaic period. Several Oxbow points were recovered from Layers 24 and 28 at Mummy Cave that were dated to the Middle Archaic period (Husted and Edgar 2002). The single hafted knife (#3,855) was rather crudely made with shallow corner notches and a convex base. Two similar specimens were found in Layer 28 at Mummy Cave (Husted and Edgar 2002).

Bifaces

A small assemblage of fragmentary bifaces was found in Cultural Level 3 (Table 10-3, Figure 10-9, Appendix B). Most of the specimens are small stage V fragments that were well on their way to becoming projectile points. The low frequency of stage II and III bifaces and complete absence of stage IV specimens further supports the interpretation that late stage tool production was one of the primary activities conducted during the Cultural Level 3 occupation. Many of the bifaces (40%) are made of obsidian that was brought to the site, most likely from the Yellowstone Plateau. A similar proportion of the bifaces from Block C Cultural Level 3 are also made of obsidian.

Table 10-3 Attributes of bifaces recovered from Cultural Level 3, Areas E and F.

Catalog#	Area	Unit	Elev. (m)	Portion	Material	Stage	Max Length	Max Width	Max Thickness	Use 1	Material 1	Use 2	Material 2	Use 3	Material 3
2531	E	N231 E263	98.05-97.95	DS	Obsidian	V	11.6	8.5	3.3						
3321	E	N236 E265	97.92-97.82	DS	Silic Wood	II	40.7	28.9	14						
3482	E	N239 E265	97.94-97.84	PR	Silic Wood	III	20.8	34.6	6.8						
3489	E	N239 E265	97.84-97.74	PR	Eocene	V	25.7	6.1	2.9	C	S				
3677	F	N231 E271	97.84-97.74	DS	Eocene	V	7.9	6.4	1.8	C	S	C	S		
3685	F	N231 E271	97.84-97.74	UN	Obsidian	V	4.7	8.9	3.4						
3690	F	N231 E271	97.84-97.74	UN	Obsidian	V	4	4.1	1.9						
3758	F	N231 E277	97.70-97.60	UN	Obsidian	III	18.5	28.4	5.5	S	SH	S	SH	S	SH
3857	F	N231 E278	97.60-97.50	LT	Eocene	V	9.5	1.4	1.8	C	SH				
4049	F	N231 E279	97.66-97.56	LT	Eocene	V	11.2	3.9	2.9						

Abbreviations; DS-distal, LT-lateral, PR-proximal, UN-unknown, C-cut, S-scrape, SH-semi-hard, S-soft

Figure 10-9 Photographs of chipped stone tools recovered from Cultural Level 3 in Areas E and F.

Scrapers

Two complete scrapers were found in Cultural Level 3, both of which came from Block F (Figure 10-9; Appendix B). One of these is an end scraper made of locally available Eocene chert. The specimen is 33.4 mm in maximum length and 25 mm wide at the distal end. This tool appears to have been sharpened prior to discard because no use wear was observed on its working edge. The second specimen is a side scraper made of Paleozoic-aged chert from the Phosphoria formation. The small tool is 22 mm in length and 19.4 mm in width. Given its small size, it had likely reached the end of it use life when it was discarded. Results of the use wear analysis show that it was last used to scrape a semi-hard material.

Expedient Flake Tools

In all, 28 expedient flake tools, including 11 retouched flakes and 17 utilized flakes. were recovered from Cultural Level 3 (Table 10-4, Appendix B). The results of use wear analysis show that most of the retouched flakes were used to scrape semi-hard and hard materials such as would be expected in the manufacture of wood or bone tools. The utilized flakes displayed more variability in use, with slightly more than half used to scrape and the remainder used to cut soft, hard and semi-hard materials. Only one expedient flake tool, a utilized flake, exhibits use wear on more than one edge. In short, a wide range of activities, from tool making, butchering and hide processing activities are reflected in the flake tool assemblage. A disproportionate number of retouched flakes are made of Phosphoria chert and obsidian, materials that occur east and west of Goff Creek, respectively.

Groundstone

Two metate fragments were recovered from Block F Cultural Level 3 (Figure 10-10). Specimen #3,694 is approximately 20 cm long and 15.5 cm wide and is made of vesicular basalt. The metate does not appear to have been intentionally shaped and may be complete. One side is slightly concave from use, but shows no polish. The second metate (#3,682) is a fragment made from coarse-grained sandstone. It is approximately 15 cm long and 12.8 cm wide. This specimen appears to have been trimmed to shape and has a slightly concave working surface. Although no pollen washes were taken from either metate, the specimens were intentionally left uncleaned to allow future analysis.

Faunal Remains

A relatively small faunal assemblage was recovered from Cultural Level 3 (Table 10-4). Bighorn sheep remains were again the most numerous, but specimens identified as beaver and river otter were also recovered. The presence of two distal right humeri fragments indicates that a minimum of two bighorn sheep are represented in the assemblage. A small number of fossorial rodent bones, believed to be intrusive and non-cultural were also found. The overwhelming majority of the faunal remains consist of unidentifiable fragments, about half of which are burned (Table 10-5). Green bone fracture patterns were observed on four of the bighorn sheep/medium artiodactyl bones (Table 10-5). The fragmentary state of the bone and large number of burned specimens is indicative of intensive bone grease production.

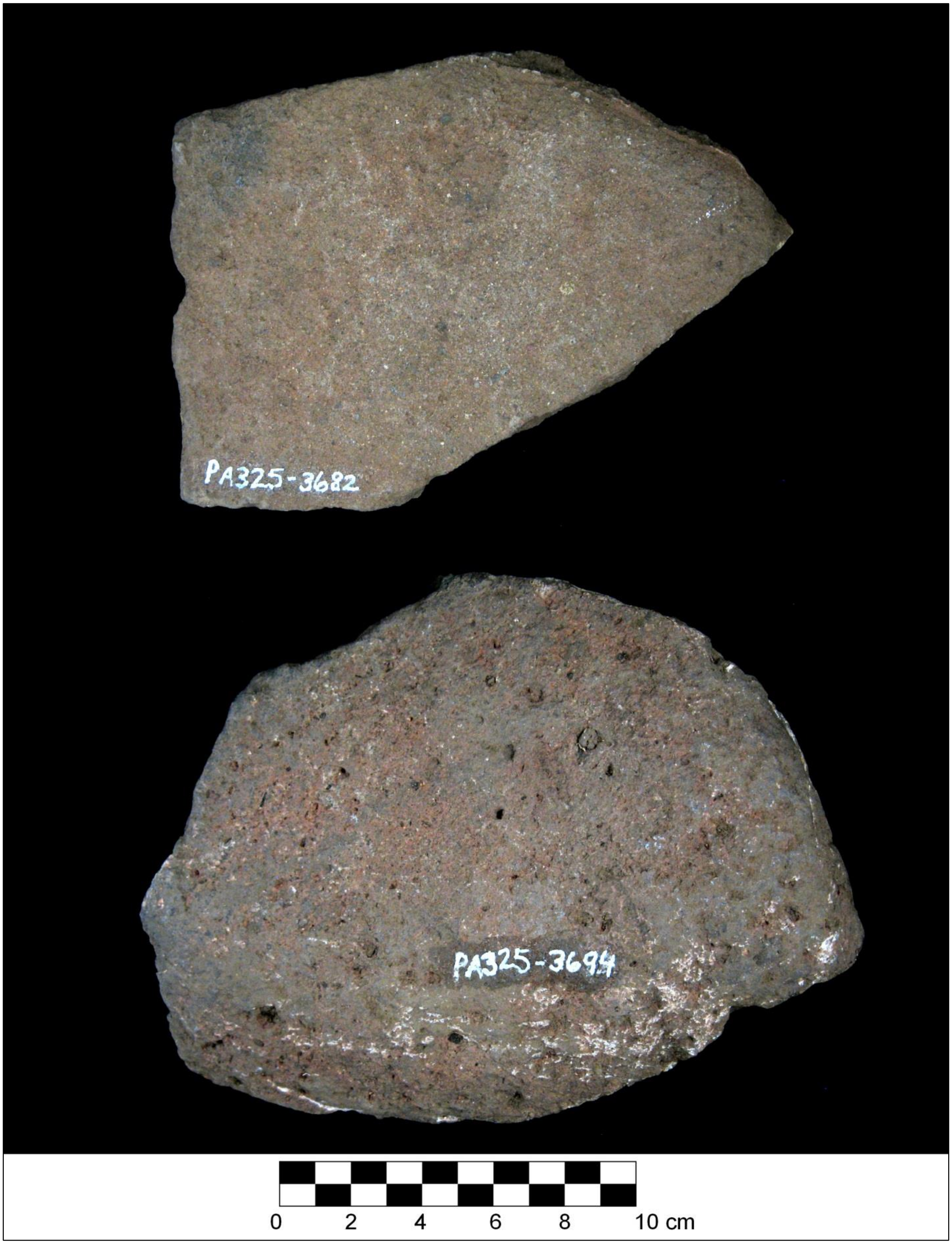


Figure 10-10 Photographs of metates recovered from Block F Cultural Level 3.

Table 10-4 Faunal remains recovered from Cultural Level 3 Areas E and F.

Species	Element	Portion	Side	NISP
Bighorn Sheep	humerus	distal end, <1/2 shaft	left	1
Bighorn Sheep	humerus	distal end, <1/2 shaft	right	2
Bighorn Sheep	innominate	acetabulum, ischium	right	1
Bighorn Sheep	mandible	tooth row	left	1
Bighorn Sheep	radius	proximal end, <1/2 shaft	left	1
M. Artiodactyl	femur	long bone shaft	right	1
M. Artiodactyl	long bone	long bone shaft	not sided	1
M. Artiodactyl	scapula	glenoid portion	left	1
Beaver	unidentified molar	Complete	not sided	1
River Otter	long bone	long bone shaft	not sided	1
Intrusive Rodent	undifferentiated			4
Unidentified	cranium	Petrous	not sided	1
Unidentified	flat bone	unidentified bone portion	not sided	3
Unidentified	long bone	long bone shaft	not sided	5
Unidentified	unidentified bone	Fragments		1,086
Unidentified	unidentified tooth	Fragments		421
Total				1,531

Table 10-5 Breakage, cut marks and burning from the Cultural Level 3 Faunal Assemblage from Areas E and F.

Species	Break	Cut/Impact	Burned	NISP
Bighorn Sheep	dry			4
Bighorn Sheep	green	X		1
Bighorn Sheep	green			1
M. Artiodactyl	dry			1
M. Artiodactyl	green			2
Beaver				1
River Otter	dry			1
Unidentified Bone	dry			9
Unidentified Bone	NA		X	530
Unidentified Bone	NA			556
Unidentified Tooth	NA		X	37
Unidentified Tooth	NA			384

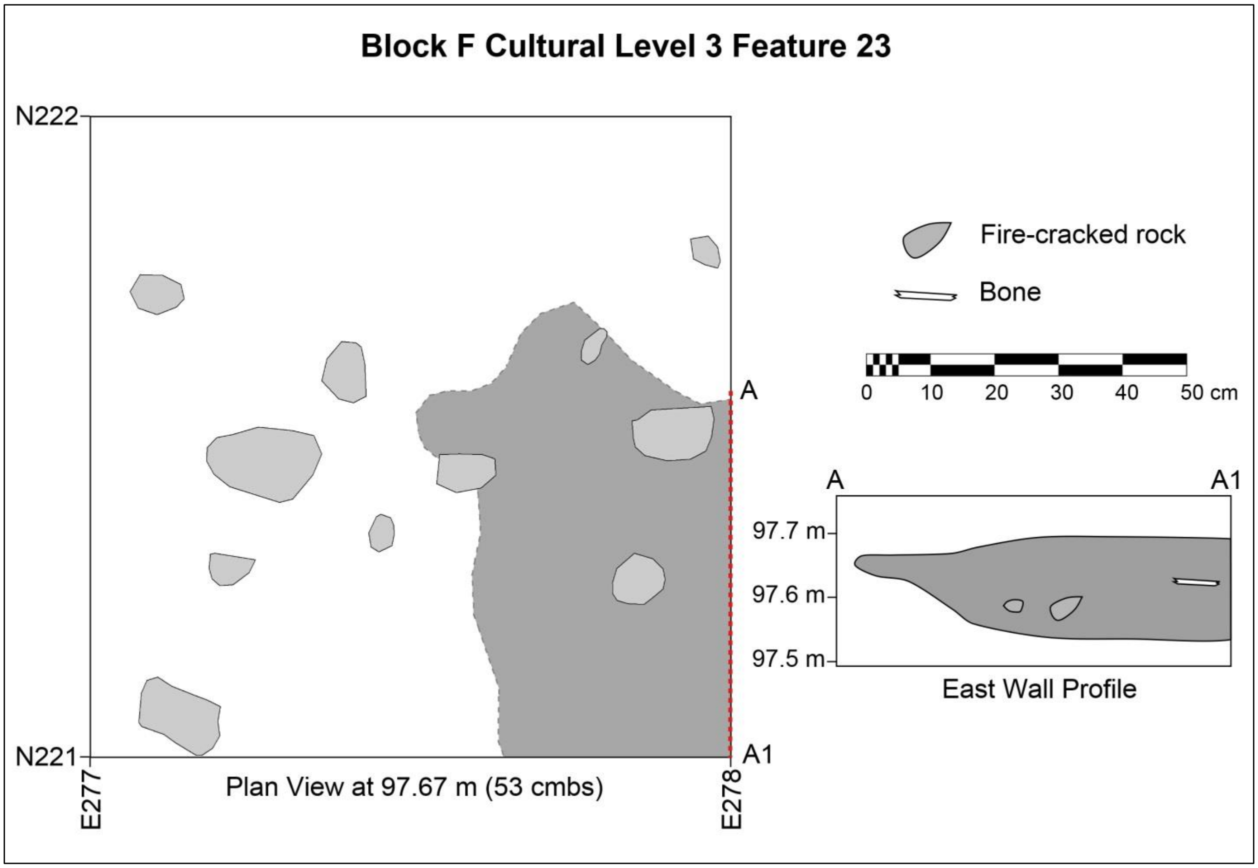


Figure 10-11 Illustration of Feature 23, Block F Cultural Level 3.

Feature 23

Feature 23 was located in Block F unit N231 E278 at approximately 97.67 m elevation (Figure 10-11). It is described as a shallow, basin-shaped hearth with an amorphous form that appeared to extend into the units to the south and east. The unit to the south was not excavated. The unit to the east was excavated, but the portion of the feature presumably in that unit was apparently not mapped or described. The portion of the feature in unit N231E278 measured 71 cm north-south and 49 cm east-west. A profile drawn along the east line of the unit indicates a thickness of approximately 20 cm. The sediment in the level surrounding the feature was light yellowish-brown gravelly mud that was hard and fairly difficult to dig. The feature fill was described as being mottled gray and light yellowish brown gravelly clayey silt and was difficult to differentiate from the surrounding level fill. Some charcoal flecks and occasionally very small flecks of red ochre were present. Bone and lithics were present in the feature fill. Some rocks were mapped and pulled before the feature was noted, but none of the rocks appear to have been thermally altered. One charcoal chunk was mapped in place and collected, and the entire feature fill was collected for flotation. Macrobotanical analysis of the light fraction from Feature 23 resulted in the identification of 76 mg of Douglas fir charcoal and three carbonized fragments of an unidentified tuber species (Appendix C). One piece of charcoal recovered from the light fraction was submitted for AMS radiocarbon dating and returned an age estimate of 4310±30BP (Beta-406662).

Cultural Level 4

Cultural Level 4 from Blocks E and F produced sizeable chipped stone and faunal assemblages. The chipped stone assemblage is particularly impressive with 29,544 specimens recovered, including 35 projectile points, one hafted knife, 72 bifaces, three drills, 10 scrapers and 143 expedient flake tools. The faunal assemblage contains 6,627 specimens and three bone tools. One large metate was also found. There were also a surprising number of features identified, two of which were in Block E (Features 18 and 19) and three in Block F (Features 20-22).

Lithic Raw Material Utilization

The majority of the chipped stone was made of locally available Eocene cherts and silicified wood (Table 10-6). However, as in Block C, the Cultural Level 4 assemblage from Areas E and F contained relatively large percentages of obsidian (16.5%) and non-local chert (6.1%). Obsidian made up a higher proportion of the tools than debitage, which indicates that expended or broken obsidian tools were discarded at the site and replaced with locally made tools.

Debitage

Flake fragments (55.1%) and broken flakes (24.4%) were again the most common types of debitage in the Cultural Level 4 assemblage. Of the complete flakes, which combined constitute 10.5 percent of the assemblage, 1.3 percent are primary flakes, 8.4 percent are secondary and 90.3 percent are tertiary. The overwhelming majority (96.5%) of the debitage is less than ½” in maximum width. The high proportion of flake fragments, broken flakes and tertiary flakes, combined with the small size of debitage and the low incidence of cortical debitage, indicates that late stage tool production and maintenance were the primary activities reflected in the debitage assemblage (Sullivan and Rosen 1985). However, a large assemblage of cores (n=21) and tested cobbles (n=7) was also recovered from Cultural Level 4. This shows that early stage lithic reduction for either the production of useable flakes or bifaces also occurred at a higher frequency than in earlier or later cultural levels.

Projectile Points and Hafted Knives

A large assemblage of projectile points and/or hafted knives was found in Cultural Level 4 (Table 10-7, Figures 10-12 and 10-13). Of the 36 specimens recovered, 27 are complete enough to allow identification of haft morphology; the remaining points consist of small unidentifiable fragments. Most (n=22) of the identifiable points are corner-notched dart points similar to the Pelican Lake type diagnostic of the Late Archaic period. Yet, there is considerable variation in proximal shoulder angle, notch depth

Table 10-6 Areas E and F Cultural Level 4 chipped stone artifacts by raw material type.

MATERIAL TYPE	ARTIFACT TYPE											
	Projectile Point	**Hafted Knife**	**Biface**	**Drill**	**Scraper**	**Retouched Flake**	**Utilized Flake**	**Tools Total**	**Core**	**Tested Cobble**	**Debitage**	**Material Total**
Local Chert	**15**	**1**	**40**		**7**	**56**	**36**	**155**	**5**	**3**	**18,049**	**18,212**
%artifact	42.9	100	55.6		70.0	67.5	60.0	58.7	23.8	42.9	61.7	61.6
%material	0.1	<0.1	0.2		<0.1	0.3	0.2	0.9	<0.1	0.0	99.1	
Obsidian	**12**		**19**	**3**		**12**	**5**	**51**			**4,813**	**4,864**
%artifact	34.3		26.4	100		14.5	8.3	19.3			16.5	16.5
%material	0.2		0.4	0.1		0.2	0.1	1.0			99.0	
Silic. Wood	**3**		**7**		**2**	**7**	**10**	**29**	**16**	**3**	**3,286**	**3,334**
%artifact	8.6		9.7		20.0	8.4	16.7	11.0	76.2	42.9	11.2	11.3
%material	0.1		0.2		0.1	0.2	0.3	0.9	0.5	0.1	98.6	
Non-Local Chert	**3**		**3**		**1**	**5**	**4**	**16**			**1,783**	**1,799**
%artifact	8.6		4.2		10.0	6.0	6.7	6.1			6.1	6.1
%material	0.2		0.2		0.1	0.3	0.2	0.9			99.1	
Misc. QTZ.	**1**					**1**	**2**	**4**			**833**	**837**
%artifact	2.9					1.2	3.3	1.5			2.8	2.8
%material	0.1					0.1	0.2	0.5			99.5	
Morrison QTZ.			**1**			**1**		**2**			**301**	**303**
%artifact			1.4			1.2		0.8			1.0	1.0
%material			0.3			0.3		0.7			99.3	
Basalt			**1**			**1**	**3**	**5**		**1**	**59**	**65**
%artifact			1.4			1.2	5.0	1.9		14.3	0.2	0.2
%material			1.5			1.5	4.6	7.7		1.5	90.8	
C-grained QTZ											**73**	**73**
%artifact											0.2	0.2
%material											100	
UID Chert	**1**		**1**					**2**			**39**	**41**
%artifact	2.9		1.4					0.8			0.1	0.1
%material	2.4		2.4					4.9			95.1	
Porcellanite											**16**	**16**
%artifact											0.1	0.1
%material											100	
Artifact Total	**35**	**1**	**72**	**3**	**10**	**83**	**60**	**264**	**21**	**7**	**29,252**	**29,544**

Table 10-7 Attributes of projectile points/hafted knives recovered from Cultural Level 4 Areas E and F.

Catalog#	BLOCK	Unit	Elevation	Material	Portion	Period	Haft Type	Prox. Shld. Angle	Max. Length	Base Width	Base Length	Haft Width	Max. Thickness	Notch Depth	Notch Width
1915	E	N229 E264	98.56-98.46	Paleozoic Chert	TP	?			15.4				3.7		
1954	E	N229 E266	98.44-98.34	Silic. Wood	BMS	LA	CN	117	27.6	14.6	8.7	12.7	4.4	2.2	5.1
1960	E	N229 E260	98.44-98.34	Eocene Chert	CO	LA	CN	113	44.8	16	8.1	13.7	5.6	3.7	5.8
2143	E	N230 E265	98.57-98.47	UID Chert	MS	LA			18.7			14.8	4.8		
2270	E	N229 E263	98.57-98.47	Obsidian	BA	?			4			7.8	1.9		
2374	E	N230 E263	98.57-98.47	Obsidian	BA	LA	CN	115	12.2	16.1	9.1	11.9	3.6		
2427	E	N230 E264	98.50-98.40	Obsidian	BA	LA	CN	123	6				3.7		
2600	E	N233 E265	98.60-98.50	Obsidian	BA	LA	CN	114	12.2	18.4	12.3	14.4	5.9		
2741	E	N231 E265	98.48-98.38	Eocene Chert	BA	LA	CN	105	9.3				3.2		
2945	E	N231 E266	98.44-98.34	Obsidian	CO	LA	CN	127	33.3	16.9	9.6	12.8	4.1	2.9	5.9
2973	E	N231 E263	98.65-98.55	Obsidian	BA	LPR	SN	158	6.1	12.9		6.6	1.9		
3029	E	N232 E265	98.60-98.50	Morrison Chert	CO	LA	CN	129	24.9	13.2	6.8	10	5.3	3	5.6
3059	E	N232 E265	98.50-98.40	Eocene Chert	BA	LA	CN	115	10.1	16.6		12.8	5.4		
3114	E	N233 E266	98.60-98.50	Eocene Chert	BA	?	SN	148	7.1				4		
3542	F	N231 E276	98.24-98.14	Ten Sleep QTZ	BMS	MA	CN	115	21.2	16.9	10.3	13.7	5.5		
3612	F	N231 E271	98.34-98.24	Eocene Chert	BMS	LA	CN	114	23.6	14.2	4.4	12.4	4.7	3.1	3.5
3701	F	N231 E277	98.19-98.09	Obsidian	BA	LA	CN	122	15.2	17	17	14.4	5.8		
3713	F	N231 E277	98.09-97.99	Eocene Chert	MS	LA			26.8		6.9	14.8	4.4		
3839	F	N231 E278	97.93-97.80	Eocene Chert	NC	MA	CN	138	35.2	15.8	7.9	13.4	5.5	2.1	4.5
3840	F	N231 E278	97.93-97.80	Eocene Chert	BMS	LA	CN	113	17	12.4	6.9	10.7	5.6	2.9	5.9
3889	F	N232 E276	98.15-98.05	Eocene Chert	BA	LA	CN	128	7.9	16.7	7.9	12.4	4.6		
3890	F	N232 E276	98.05-98.00	Morrison Chert	BMS	LA	CN	114	26.2	17.4	6.4	15.2	4.2	3.6	4.1
3964	F	N233 E275	98.21-98.11	Paleozoic Chert	BA	?	CN	108	7.4				3.3		
4006	F	N231 E279	98.06-97.96	Eocene Chert	BMS	?			15.8		6.9	11.8	3.5	3.2	3.2
4022	F	N231 E279	98.06-97.96	Silic. Wood	BMS	LA	CN	135	17.9	11.6	7.2		2.8	2	2.7
4257	F	N232 E277	98.07-97.97	Obsidian	BMS	LA	CN	119	20.6	15.3	7.7	12.8	5.4	3.8	5.7
4288	F	N233 E276	98.25-98.15	Eocene Chert	BMS	LA	CN	111	17	15.7	8.3	13	4		
4294	F	N233 E276	98.15-98.05	Eocene Chert	NC	LPR	CN	116	19	7.9	5.4	6.2	2.6	2.7	3.2
4344	F	N233 E279	98.10-98.00	Eocene Chert	ER	?	CN	136	8				3.4		
4377	F	N244 E286	98.04-97.94	Obsidian	MS	?			13.1				4.3		
4392	F	N244 E286	97.94-97.84	Eocene Chert	CO	LA	CN	109	24.4	12.8	8	11	4.7	1.3	6.7
4416	F	N233 E278	98.11-98.01	Obsidian	MS	?			17.6				3.3		
4420	F	N233 E278	98.11-98.01	Eocene Chert	NC	LPR	CN	110	22.2	8.3	5.8	6.7	2.6	3.3	4.7
4463	F	N233 E278	98.01-97.91	Eocene Chert	ER	?			7.5		7		3.5		
4834	F	N244 E286	97.74-97.64	Obsidian	BA	LA	CN	123	9.5	18.8		13.4	4.1		
6132	F	N233 E277	98.15-98.05	Obsidian	BA	LA	CN	132	18.1	15.9	6.4	13.6	5.9	3.6	5.3

Abbreviations; LA-Late Archaic, LPR-Late Prehistoric, MA-Middle Archaic, BA-base, BM-base and midsection, CO-complete, ER-ear, LT-lateral, MS-midsection, NC-nearly complete, TP-distal tip

Figure 10-12 Photographs of projectile points/hafted knives recovered from Cultural Level 4 Area E.

and width. Husted and Edgar (2002) report similar variability in the corner-notched darts found in Layers 32 and 34 at Mummy Cave. Two projectile points (#'s 3,542 and 3,839) have broad corner notches and concave bases that conform closely to the Hanna point type, one of three styles diagnostic of the Middle Archaic period. The Hanna point type was the most common style of projectile point recovered from Layers 24, 28 and 30 at Mummy Cave (Husted and Edgar 2002). Two nearly complete Rose Spring corner-notched arrow points (4,294 and 4,420) were also found in Cultural Level 4. At Mummy Cave, Rose Spring points were the most common type present in Cultural Layer 36. One Desert side-notched

Figure 10-13 photographs of projectile points/hafted knives recovered from Cultural Level 4 Area F.

arrow point base (2,973) was recovered from Block E. The Desert side-notched and tri-notched point types first appeared approximately 700 years ago (Holmer 2009) and continued to be produced by Numic-speaking peoples well into the Historic period (Justice 2002). Desert side- and tri-notched points were the most common point type found in Cultural Layer 38 at Mummy Cave (Husted and Edgar 2002).

The presence of Middle Archaic, Late Archaic and Late Prehistoric projectile points within Cultural Level 4 provides clear evidence of post-depositional mixing of the deposit. There may be some stratification in Area E where the only Late Prehistoric diagnostic was found 11 cm below the surface, at least 5 cm above any of the Late Archaic points. In Area F, however, there was no correlation between depth and inferred age of points. One of the Hanna points was found in the upper 10 cm of deposit and another in at about 30 cm below surface. Both Late Prehistoric points were 20-30 cm below the surface and Late Archaic corner-notched darts were recovered throughout the cultural level. Despite the mixing, most (81.5%) of the diagnostic projectile points are Late Archaic-aged Pelican Lake corner-notched darts.

Bifaces

The biface assemblage from Cultural Level 4 was also substantial with 73 specimens recovered (Table 10-8, Appendix B, Figures 10-14 and 10-15). Of these only six are complete. The remaining specimens include 10 distal fragments, eight proximal fragments, 15 lateral fragments and 33 small fragments that could not be oriented. A slight majority (58.9%) of the bifaces were broken or discarded during the later stages of reduction. A disproportionate number (41.9%) of the stage IV and V bifaces are made of obsidian. Conversely, the majority (82.8%) of the stage II and III bifaces are made of locally available materials. Use wear analysis resulted in the identification of 25 utilized bifaces. Of these 19 were used to cut soft (n=9), semi-hard (n=9) and hard (n=1) materials. Another six specimens appear to have been used to scrape soft (n=3) or semi-hard (n=3) materials. Only one edge was utilized on most (68%) of the bifaces that displayed wear, but six specimens had use wear on two edges.

Drills

Three small obsidian drill fragments were found in Cultural Level 4 (Appendix B). Specimens 2,946 and 3,654 are bit midsection fragments that are ovate in cross-section and measure 7.5 mm and 16.4 mm in length, respectively. The third drill (#3,546) is a small 8.8 mm long tip fragment that is also ovate in cross-section. Two of the drills (#'s 3,654 and 3,546) fragments appear to have been used to perforate a soft material such as green hide or finished buckskin and the third (#2,946) drill fragment was used to work a semi-hard material. Obsidian is particularly brittle and poorly suited to reaming or drilling of semi-hard or hard material. On the other hand, obsidian produces an exceptionally sharp edge and is therefore useful in working soft leather.

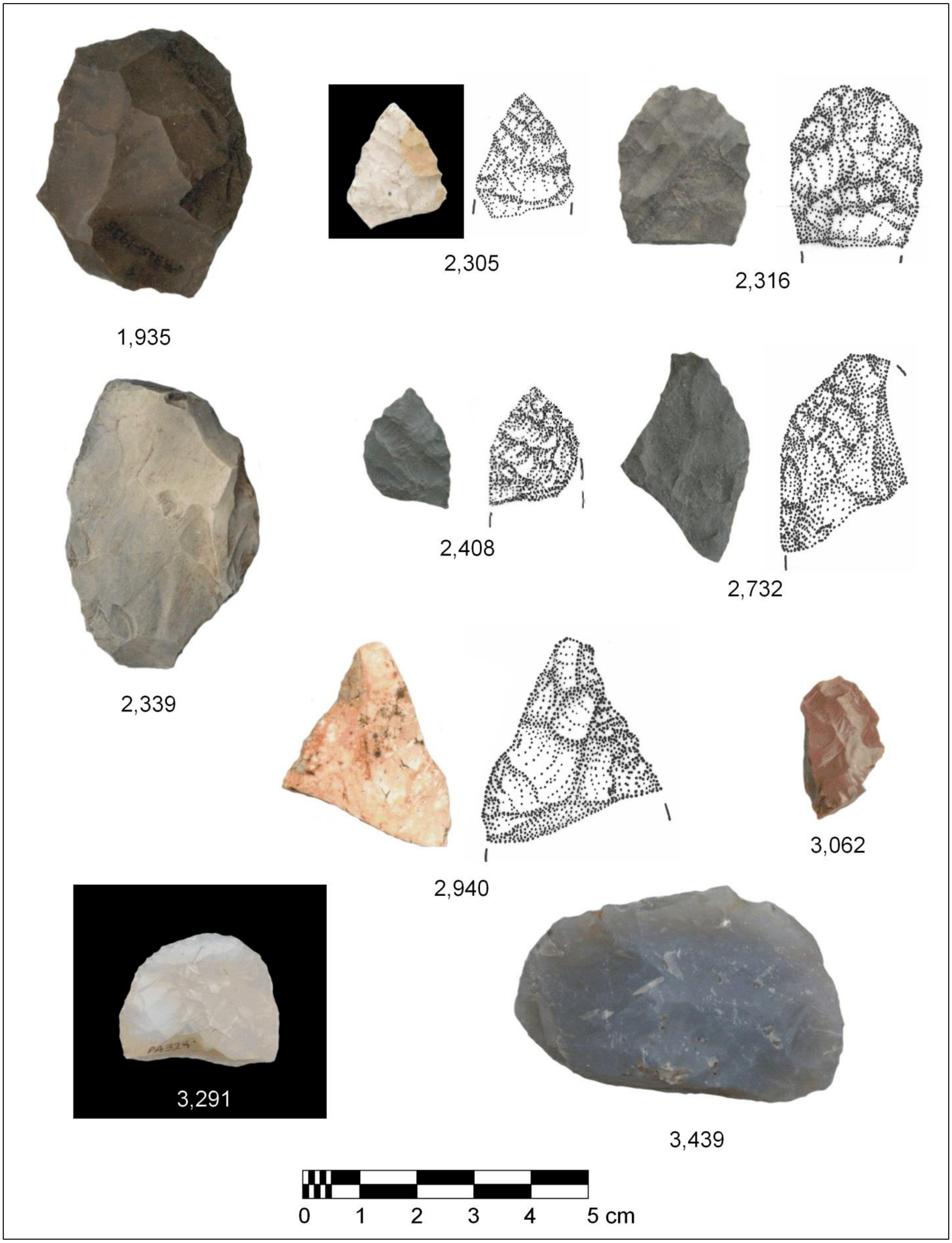


Figure 10-14 Photograph of bifaces recovered from Cultural Level 4, Area E.

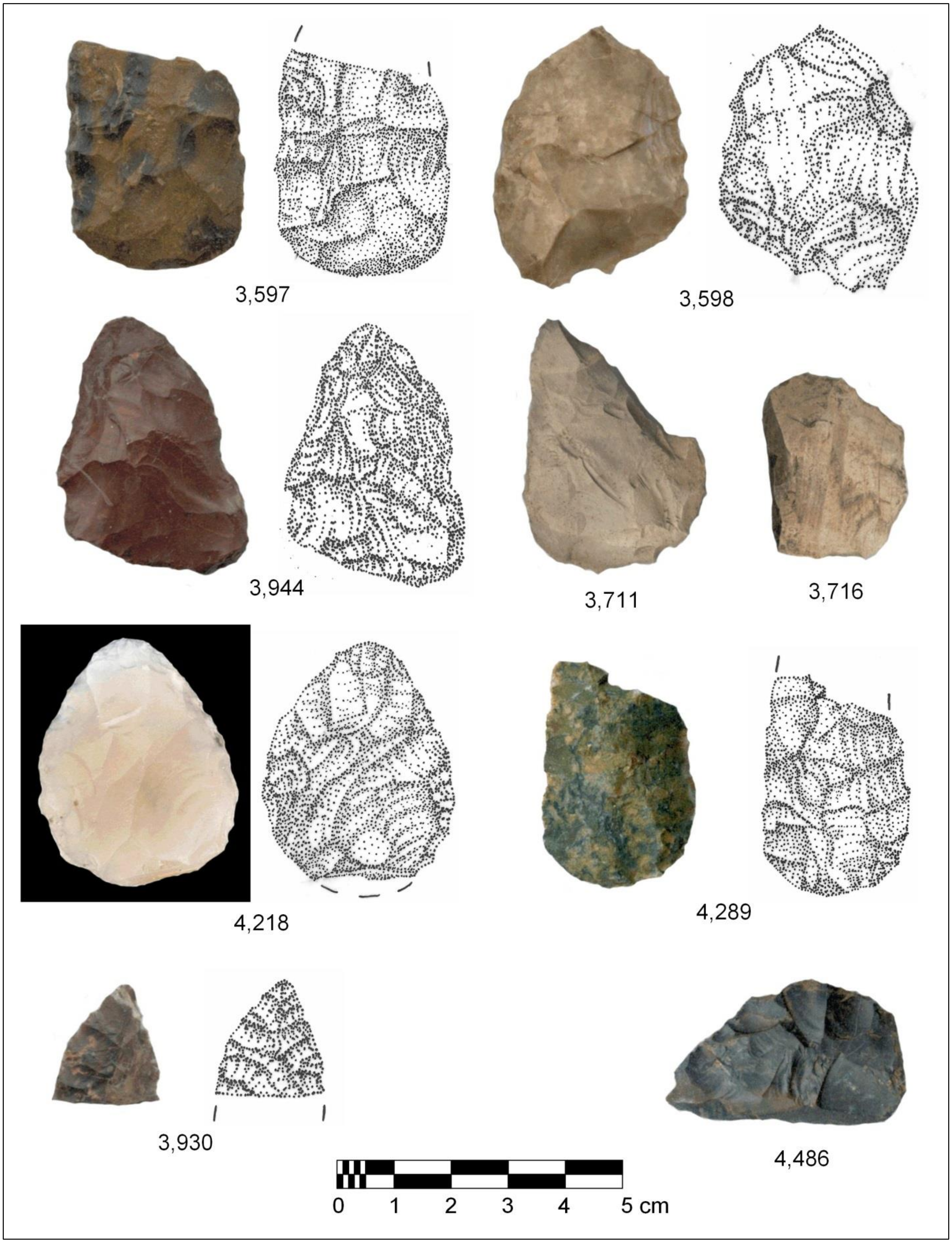


Figure 10-15 Photograph of bifaces recovered from Cultural Level 4, Area F.

Table 10-8 Attributes of bifaces recovered from Cultural Level 4 in Areas E and F.

Catalog #	Area	Unit	Elevation (m)	Portion	Material	Stage	Max Length	Max. Width	Max. Thick.	Use 1	Material 1	Use 2	Material 2
1935	E	N229 E266	98.64-98.44	CO	Paleozoic Chert	II	49.4	37.2	18.9				
1961	E	N229 E266	98.44-98.34	DS	Eocene Chert	V	7	6.5	2.1				
2305	E	N229 E265	98.64-98.54	DS	Eocene Chert	V	20	17.1	4.1				
2310	E	N229 E265	98.54-98.44	LT	Obsidian	V	13.8	6	3.4				
2316	E	N229 E265	98.54-98.44	UN	Silic Wood	III	27.7	23.2	3.9				
2339	E	N229 E265	98.44-98.34	CO	Silic Wood	II	50.9	34	13.3				
2408	E	N230 E264	98.60-98.50	DS	Eocene Chert	V	20.9	16.3	4.3				
2451	E	N230 E266	98.43-98.33	UN	Paleozoic Chert	II	34.5	14.8	8.9				
2732	E	N231 E265	98.48-98.38	LT	Basalt	III	37.9	23.1	6.9	c	S		
2739	E	N231 E265	98.48-98.38	PR	Eocene Chert	III	17.8	30.6	7.8				
2940	E	N231 E266	98.54-98.44	DS	Eocene Chert	IV	34.3	30.9	7.3	c	SH	C	SH
3047	E	N232 E265	98.50-98.40	UN	Eocene Chert	V	5.9	4.6	2.5				
3062	E	N232 E266	98.68-98.58	UN	Paleozoic Chert	III	25.1	15	5.2	S	SH		
3092	E	N232 E266	98.48-98.38	CO	Silic Wood	II	60.7	32.6	16.8				
3095	E	N232 E266	98.48-98.38	LT	Silic Wood	II	41.1	11.3	11.3				
3109	E	N233 E266	98.60-98.50	UN	Eocene Chert	V	8	5.7	3.7				
3111	E	N233 E266	98.60-98.50	UN	Morrison Qtz	V	20.9	16.4	4.3				
3126	E	N233 E266	98.50-98.40	DS	Obsidian	V	9.3	10.9	2.5				
3262	E	N234 E265	98.52-98.42	UN	Obsidian	V	12.9	11.2	4.3				
3291	E	N236 E265	98.42-98.32	PR	Eocene Chert	III	21.9	27.9	6.7				
3379	F	N233 E277	98.15-98.05	UN	Obsidian	V	4.7	2.1	1.3				
3405	E	N239 E265	98.64-98.54	LT	Obsidian	IV	17.7	23.2	6.5	c	S		
3410	E	N239 E265	98.64-98.54	LT	Obsidian	V	20.3	9.8	4.2				
3415	E	N239 E265	98.64-98.54	UN	Obsidian	V	11.3	5.4	3.2				
3421	E	N239 E265	98.54-98.44	LT	Eocene Chert	IV	12.4	24.9	5.9				
3422	E	N239 E265	98.54-98.44	PR	Obsidian	IV	10.1	6.4	3.7				
3433	E	N239 E265	98.44-98.34	LT	Eocene Chert	IV	16.2	12.6	5.2				
3439	E	N239 E265	98.34-98.24	CO	Eocene Chert	III	60.2	38.5	13.7	c	S		
3515	F	N231 E275	98.14-98.04	UN	Obsidian	V	6.5	5.5	2.7				
3597	F	N232 E275	98.30-98.20	PR	Eocene Chert	III	42.1	32	9.6	c	SH	C	SH
3598	F	N232 E275	98.30-98.20	UN	Eocene Chert	III	47.3	34.9	8.7	S	H		
3603	F	N231 E271	98.44-98.34	DS	Eocene Chert	V	13.5	12.1	4.5				
3643	F	N231 E271	98.24-98.14	UN	Eocene Chert	IV	63.6	22.7	8.3	c	H		
3700	F	N231 E277	98.19-98.09	UN	Eocene Chert	III	30.8	21.2	14.2				
3705	F	N231 E277	98.09-97.99	UN	Eocene Chert	II	30.3	44.8	27.3				
3711	F	N231 E277	98.09-97.99	UN	Silic Wood	IV	45.7	32.5	8.3	c	S		
3716	F	N231 E277	98.09-97.99	UN	Silic Wood	III	24.5	31.9	13.5				
3796	F	N231 E279	98.16-98.06	DS	Eocene Chert	IV	29	16.5	5.4	c	S		
3800	F	N231 E279	98.06-97.96	UN	Eocene Chert	III	20.5	16.7	6.3	S	H		
3802	F	N231 E278	98.20-98.10	UN	Eocene Chert	IV	15	38.8	6.9	S	SH		
3810	F	N231 E278	98.10-98.00	UN	Obsidian	V	5.2	4.9	2.7				
3837	F	N231 E278	97.93-97.80	UN	Eocene Chert	III	14.2	16.2	7.2	c	SH		
3882	F	N232 E276	98.15-98.05	LT	Eocene Chert	V	12.9	6.5	3.5	c	S		
3900	F	N232 E276	98.05-98.00	UN	Eocene Chert	III	25.8	12.4	8.3				
3913	F	N232 E279	98.10-98.00	LT	Obsidian	V	13.2	5.6	4				
3917	F	N232 E279	98.10-98.00	UN	Eocene Chert	V	6.3	7.2	2.8				
3930	F	N232 E279	98.10-98.00	DS	Eocene Chert	V	20.1	19.2	3.8	c	S	C	S
3939	F	N232 E279	98.00-97.90	LT	Obsidian	V	13.6	7.5	3.5	c	SH		
3944	F	N232 E279	98.00-97.90	UN	Eocene Chert	III	46.8	32.9	9.3	c	SH	C	SH
3974	F	N233 E275	98.21-98.11	PR	Obsidian	V	9.1	7.1	4				

Table 10-8 Attributes of bifaces recovered from Cultural Level 4 in Areas E and F.

Catalog #	Area	Unit	Elevation (m)	Portion	Material	Stage	Max Length	Max. Width	Max. Thick.	Use 1	Material 1	Use 2	Material 2
3981	F	N233 E275	98.11-98.01	DS	Eocene Chert	IV	16.6	7.1	3.1				
3987	F	N233 E275	98.11-98.01	UN	Obsidian	V	10.7	4.4	2.9				
4000	F	N233 E277	98.25-98.15	UN	Obsidian	III	15.2	23.5	5.7	c	SH	C	SH
4212	F	N232 E275	98.20-98.10	PR	Eocene Chert	V	10.9	8.9	4				
4216	F	N232 E275	98.10-98.00	UN	Silic Wood	V	7.8	4	2.6				
4218	F	N232 E275	98.10-98.00	CO	Eocene Chert	III	42.4	34.5	8.9	c	SH	C	S
4225	F	N232 E275	98.10-98.00	UN	Obsidian	IV	9.5	6.6	3.6				
4253	F	N232 E277	98.07-97.97	UN	Eocene Chert	II	24.9	21	9.3				
4285	F	N232 E278	98.08-97.98	UN	Eocene Chert	III	20.2	15.7	4.7				
4289	F	N233 E276	98.25-98.15	PR	Eocene Chert	III	41.2	27.7	7.9	c	SH	C	SH
4310	F	N233 E276	98.15-98.05	LT	Obsidian	IV	18.8	11	5.2	c	SH		
4315	F	N233 E276	98.15-98.05	UN	Eocene Chert	V	5.6	3.9	1.6				
4331	F	N233 E279	98.10-98.00	UN	Obsidian	V	7.2	4.9	1.8				
4343	F	N233 E279	98.10-98.00	LT	Eocene Chert	IV	19.8	10.2	2.9	c	S		
4354	F	N233 E279	98.00-97.95	DS	Eocene Chert	V	8.8	12.7	2.8	c	S	C	S
4384	F	N244 E286	97.94-97.84	UN	Eocene Chert	V	7	8.4	3.4				
4390	F	N244 E286	97.94-97.84	LT	Eocene Chert	V	12.4	4.8	3.2				
4396	F	N244 E286	97.84-97.74	PR	Eocene Chert	III	47.9	27.1	7.9				
4467	F	N239 E283	97.93-97.83	LT	Eocene Chert	III	17	11.6	6.5				
4486	F	N239 E283	97.83-97.73	CO	Eocene Chert	II	42.3	26.1	9.9	S	H		
4497	F	N239 E283	97.73-97.63	UN	Obsidian	V	6.4	6.7	2.2				
4839	F	N244 E286	97.64-97.54	LT	UID Chert	III	27.8	27.5	10	S	SH		

Scrapers

A total of 10 end scrapers were recovered from Cultural Level 4 in Areas E and F (Table 10-9, Figure10-16). Most of the end scrapers (n=7) are complete, and all but one (# 2,357) appear to have been expended. Locally available chert and silicified wood were used to make all but one of the scrapers. Only four of the scrapers showed any evidence of use wear. The standard functional interpretation is that end scrapers were used to remove flesh, fat and or hair from hide that was either green or dry. Yet, the use wear analysis indicates that at least three of the scrapers were used on a hard material, such as hard wood or bone and one was used on a semi-hard material like soft wood. None of the scrapers showed typical hide working use wear patterns. The absence of identifiable use wear on six of the scrapers is puzzling. Perhaps the "unused" scrapers had been resharpened and lightly used prior to discard.

Expedient Flake Tools

Cultural Level 4 produced a large and varied assemblage of flake tools, including 83 retouched flakes and 60 utilized flakes (Appendix B). A disproportionate percentage of the flake tools are made from locally available stone (79%), significantly higher than both the combined stone tool (71.6%) and debitage assemblage (73.4%) (Table 10-6). The high frequency of flake tools made from local material is

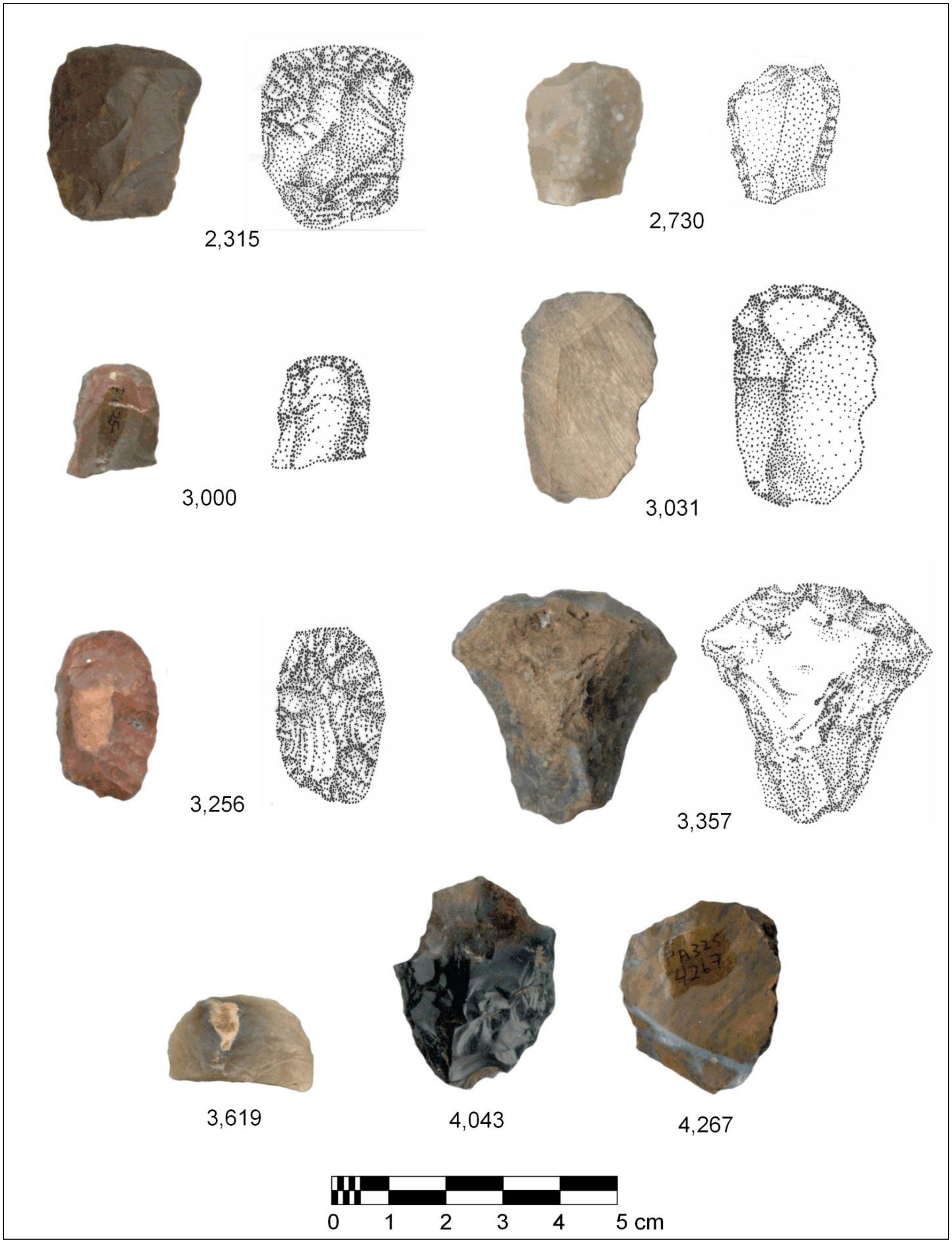


Figure 10-16 Photograph of scrapers found in Cultural Level 4 Areas E and F.

Table 10-9 Attributes of end scrapers recovered from Cultural Level 4 Areas E and F.

Catalog #	Area	Unit	Elevation (m)	Portion	Material	Max Length	Max Width	Max Thick.	Material Worked
2315	E	N229 E265	98.54-98.44	CO	Eocene Chert	31.7	26.0	6.4	H
2730	E	N231 E265	98.48-98.38	MD	Eocene Chert	26.2	21.0	7.3	
3000	E	N231 E263	98.45-98.35	DS	Paleozoic Chert	21.0	15.8	4.6	
3031	E	N232 E265	98.60-98.50	CO	Silic. Wood	38.2	25.5	7.1	
3256	E	N234 E265	98.62-98.52	CO	Eocene Chert	31.0	20.3	8.7	SH
3357	E	N230 E264	98.60-98.50	CO	Eocene Chert	41.9	40.1	15.1	H
3370	F	N233 E277	98.15-98.05	CO	Eocene Chert	45.5	31.0	15.8	
3619	F	N231 E271	98.34-98.24	LT	Eocene Chert	18.8	30.7	7.0	
4043	F	N231 E279	97.96-97.86	CO	Eocene Chert	37.8	29.7	13.6	
4267	F	N232 E278	98.18-98.08	CO	Silic. Wood	32.7	28.4	22.1	H

Abbreviations; CO-complete, DS-distal, LT-lateral, MD-medial, H-hard, SH-semi-hard, S-soft

not unexpected given the relatively large core assemblage. Use wear analysis reveals that both retouched and unmodified utilized flakes were used in roughly the same manner and proportion to scrape (62.1%) and cut (34.3%) a variety of materials. Flake tools were used most frequently to scrape semi-hard material (40%), cut soft material (22%) and scrape hard material (20%). Utilized flakes (25%) were more frequently used for cutting soft material than retouched flakes (16%), but otherwise the two tool types appear to have been used for the same purposes. These data clearly show that production of useful flakes for expedient use was a dominant technological strategy that stands in sharp contrast to the specialized and curated lithic technologies of other cultural periods.

Groundstone

One groundstone tool (# 3,649), a complete metate formed from a fortuitously shaped basalt boulder, was found in Area F, unit N231E271 (Figure 10-17). The metate is approximately 38 cm long, 35 cm wide and 17 cm thick and weighs about 25 kg. The small boulder appears to have been only slightly modified by pecking of the grinding surface. One end of the boulder is broken off, but it is unclear if this was intentional because the entire grinding surface is present.

Bone Tools/Ornaments

Three pieces of culturally modified bone were found in Area E, Cultural Level 4 (Figure 10-18). Specimen 1,929 is a burned midsection fragment of a bone awl, recovered from unit N229 E264, which is 17.8 mm in length and 5 mm in maximum width. Specimen 1,972 appears to be a lateral fragment of a bone bead found in unit N229 E266. The cylindrical bead is approximately 7 mm in length with a

Figure 10-17 Photograph of metate recovered from Area F Cultural Level 4.

Figure 10-18 Photograph of bone tools and bead recovered from Areas E and F Cultural Level 4.

diameter of 4 mm. The exterior surface and the edges of the central cavity are polished perhaps from use on a necklace. The final modified bone artifact consists of an unidentifiable bone fragment, possibly from a medium to large mammal cranium. It has five notches cut into one margin to create a serrated tool edge. The specimen is 19.5 mm x 19 mm in maximum length and width and approximately 3.5 mm thick and shows some use wear on the serrated edge. The function of this item is unknown.

Faunal Assemblage

The faunal assemblage from Cultural Level 4, though large, is comprised mostly of unidentifiable fragments (98.1%). Bone from medium artiodactyls (NISP=75 [Table 10-10]) were the most numerous. Of these bighorn sheep (NISP=18) remains outnumbered mule deer (n=4). At least two individual bighorn sheep are represented in the assemblage given the presence of two left metacarpals. A minimum of one mule deer is present. The remains of at least one elk are represented by 10 identifiable specimens. One or two identifiable beaver, carnivore porcupine and river otter elements were also identified and represent a minimum of one individual each. Non-cultural, intrusive, fossorial rodent bones comprise 8% of the identifiable assemblage.

Table 10-10 Number of identifiable specimens from Cultural Level 4, Areas E and F.

Species	**Element**	**Portion**	**Side**	**NISP**
elk	4th carpal	Complete	left	3
elk	fused 2nd, 3rd carpal	Complete	left	1
elk	long bone	medial shaft	not sided	1
elk	Metacarpal	distal, <1/2 shaft	left	1
elk	proximal sesamoid	Complete	left	1
elk	radial carpal	Complete	left	1
elk	ulnar carpal	Complete	left	1
elk	unidentified molar	Complete	not sided	1
bighorn sheep	1st phalange	Complete	not sided	1
bighorn sheep	1st phalange	proximal, >1/2 shaft	right	1
bighorn sheep	Astragalus	Complete	right	1
bighorn sheep	Astragalus	proximal , >1/2 shaft	left	1
bighorn sheep	Calcaneus	Complete	right	1
bighorn sheep	distal sesamoid	Complete	not sided	1
bighorn sheep	fused 2nd, 3rd carpal	Complete	left	1
bighorn sheep	fused central, 4th tarsal	Complete	right	1
bighorn sheep	Innominate	Acetabulum	left	1
bighorn sheep	intermediate carpal	Complete	left	1
bighorn sheep	Metacarpal	proximal, <1/2 shaft	left	2
bighorn sheep	Metatarsal	proximal , <1/2 shaft	left	1
bighorn sheep	radial carpal	Complete	left	1
bighorn sheep	Tibia	distal, <1/2 shaft	left	1
bighorn sheep	Tibia	distal, <1/2 shaft	right	1

Table 10-10 Number of identifiable specimens from Cultural Level 4, Areas E and F.

Species	Element	Portion	Side	NISP
bighorn sheep	Tibia	proximal, <1/2 shaft	right	1
bighorn sheep	unidentified molar	Complete	left	1
mule deer	mandibular premolar	Complete	left	1
mule deer	Radius	proximal, <1/2 shaft	left	1
mule deer	Radius	proximal, <1/2 shaft	right	1
mule deer	Ulna	olecranonal portion	right	1
m. artiodactyl	1st phalange	distal, <1/2 shaft	not sided	1
m. artiodactyl	2nd phalange	Proximal	left	1
m. artiodactyl	Calcaneus	Diaphysis	right	1
m. artiodactyl	cervical vertebra	centrum, neural arch	axial	1
m. artiodactyl	Cranium	Petrous	axial	1
m. artiodactyl	Femur	medial shaft	not sided	2
m. artiodactyl	flat bone	Ilium	not sided	1
m. artiodactyl	flat bone	medial shaft	not sided	1
m. artiodactyl	fused 2nd, 3rd carpal	Proximal	right	1
m. artiodactyl	Humerus	long bone shaft	left	1
m. artiodactyl	Innominate	Ischium	right	1
m. artiodactyl	long bone	medial shaft	not sided	29
m. artiodactyl	Mandible	ascending ramus	left	1
m. artiodactyl	Metacarpal	distal, <1/2 shaft	left	1
m. artiodactyl	Metacarpal	proximal, >1/2 shaft	right	1
m. artiodactyl	radius-ulna	proximal, <1/2 shaft	right	1
m. artiodactyl	Rib	Blade	left	2
m. artiodactyl	Rib	Blade	not sided	1
m. artiodactyl	Rib	proximal end	not sided	1
m. artiodactyl	Tibia	long bone shaft	not sided	1
m. artiodactyl	tooth fragment	unidentified	not sided	1
m. artiodactyl	unidentified molar	unidentified	left	1
m. artiodactyl	unidentified phalange	distal, <1/2 shaft	not sided	1
carnivore	tooth fragment	Distal	not sided	2
beaver	unidentified molar	Complete	not sided	2
porcupine	Cranium	Maxilla	right	1
river otter	long bone	Shaft	not sided	1
intrusive rodent	Undifferentiated			8
unidentified	Cranium	Maxilla	not sided	1
unidentified	Femur	medial shaft	right	1
unidentified	flat bone	Blade	not sided	1
unidentified	flat bone	unidentified	not sided	1
unidentified	long bone	medial shaft	not sided	24
unidentified	Rib	Proximal	not sided	1
unidentified	unidentified bone	unidentified		4,246
unidentified	tooth enamel	unidentified		2,253
Total				6,627

Table 10-11 Break pattern, cut/impact marks and presence of burning in the Cultural Level 4 faunal assemblage

Species	Break Patter	Cut/Impact Marks	Burned	NISP
Elk	dry			2
Elk	green			1
Elk				7
bighorn sheep	dry			4
bighorn sheep	green			5
bighorn sheep				9
mule deer	dry			1
mule deer	green	X		1
mule deer	green			1
mule deer				1
m. artiodactyl	dry	X		1
m. artiodactyl	dry		X	4
m. artiodactyl	dry			19
m. artiodactyl	green	X	X	1
m. artiodactyl	green	X		2
m. artiodactyl	green		X	4
m. artiodactyl	green			22
carnivore tooth	dry			2
Beaver				2
Porcupine	dry			1
river otter	dry		X	1
intrusive rodent				8
unidentified bone			X	2,236
unidentified bone				2,011
unidentified bone	dry			13
unidentified bone	green	X		1
unidentified bone	green		X	1
unidentified bone	green			14
unidentified tooth			X	253
unidentified tooth				2,000

Many of the bones showed evidence for intensive processing (Table 10-11). Green bone fracture patterns were noted on 53 specimens, six of which also exhibit impact fractures or cut marks. A significant number of bones (37.7%), particularly small unidentifiable fragments, are charred or calcined.

Feature 18

Feature 18 is a concentration of FCR and unburned rock located in the northwestern four units of Block E at approximately 98.5 m elevation (20 cmbs [Figures 10-19 and 10-20]). The densest cluster of rock measured 130 cm north-south and 145 cm east-west. It was roughly oval in shape, with the long axis trending northwest-southeast and measuring about 175 cm. Fire-cracked rock was stacked within the

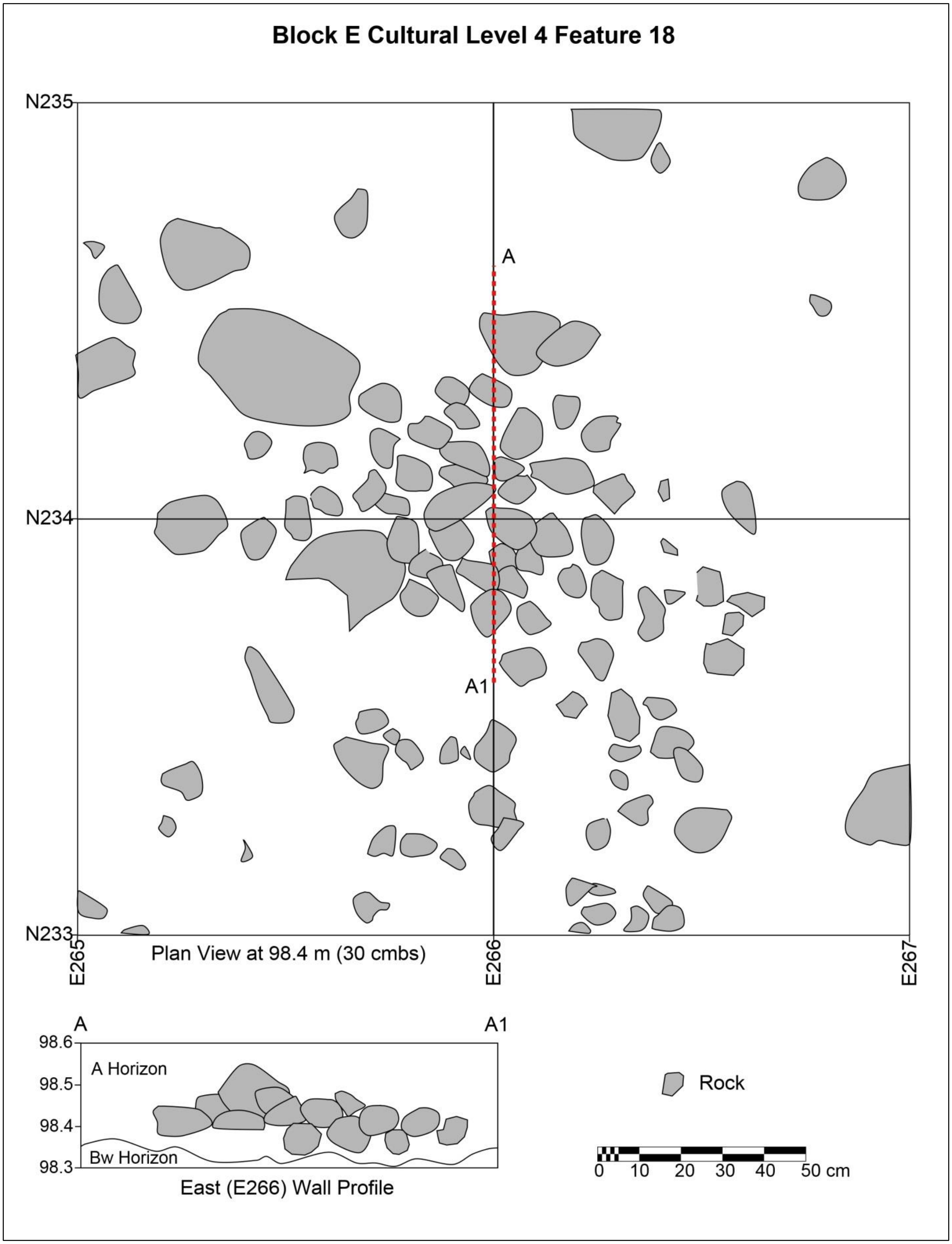


Figure 10-19 Illustrations of Feature 18, Block E, Cultural Level 4.

Figure 10-20 Photograph of Feature 18, Block E, Cultural Level 4.

concentration and scattered out to about a meter around the center of the concentration. There were 78 individual rocks with an estimated weight of 55 kg found in and around Feature 18. No organic staining was observed, but charcoal flecking and chunks up to 1 cm in size were observed throughout the feature and surrounding sediments. Samples of charcoal or feature were not collected due to an oversite by field technicians. Given the dispersed nature of the rock and FCR, lack of staining and absence of a clearly defined pit, it would appear that Feature 18 represents a refuse pile of rocks that may have either been used in a roasting or boiling pit.

Feature 19

The second feature in Block E was located between 98.48 m and 98.38 m in units N232 E266 and N233 E266 (Figure10-21). It consisted of another concentration of river cobbles, some of which were cracked. The rocks were clustered within area measuring 60 cm north-south and 36 cm east-west, with a depth of 10 cm. A total of 34 rocks were contained in the feature, weighing 9.75 kg. Rocks in the feature were up to just over 25 cm in diameter. Most were intact, but at least two were cracked in place. The soil composition was a dark brown silty loam with some gravel. A soil sample of the feature fill was collected, as well as five pieces of charcoal collected *in situ* from within the feature. The fill was floated for recovery of macrobotanicals and

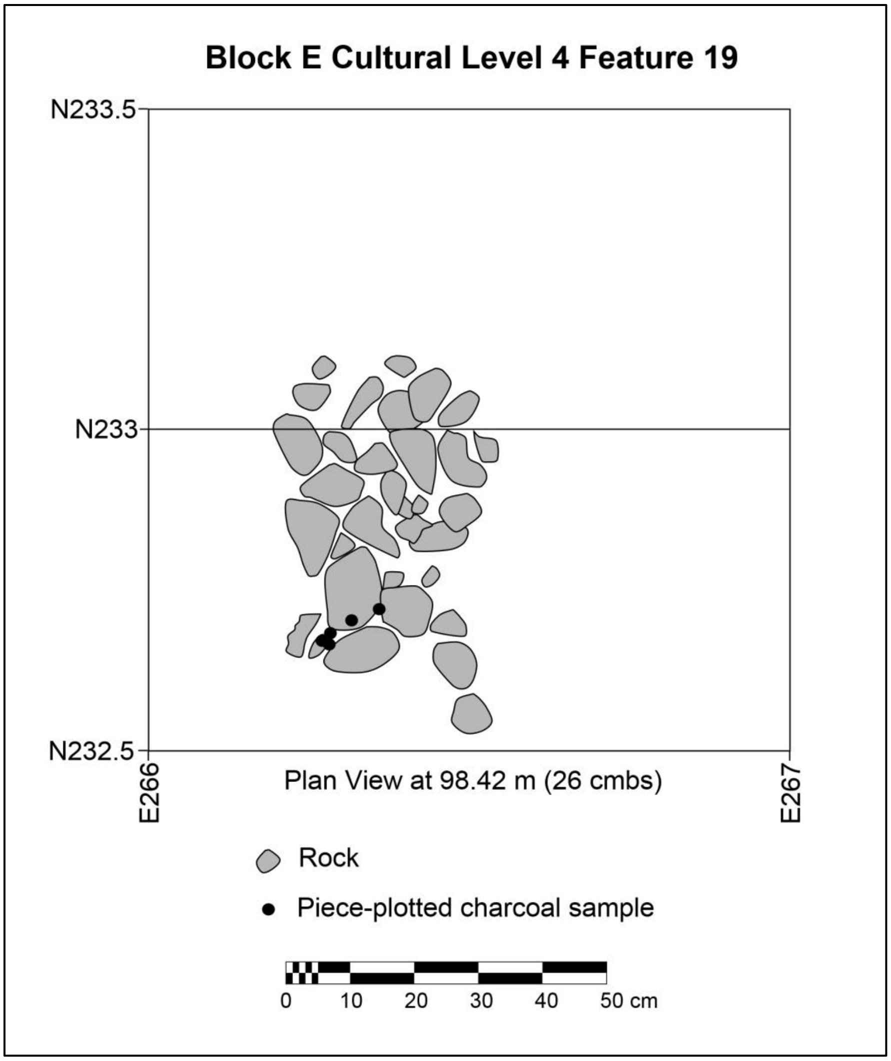


Figure 10-21 Illustration of Feature 19, Block E, Cultural Level 4.

produced 305 mg of charcoal identified as aspen/cottonwood/willow (Appendix C), 10 pieces of micro-debitage (>2 mm), and two unidentifiable pieces of bone.

Feature 20

Feature 20, was located between about 15 cm below the surface between 98.01 m and 97.91 m in Block F within parts of units N231 E277 and N232 E277. The feature consisted of a shallow, basin-shaped, rock-filled pit that measured 65 cm north-south and 75 cm east-west, with a depth of approximately 15 cm (Figures 10-22 through 10-24). It consisted of a rock ring filled with large rocks. Most of the rocks were not heavily cracked. A separate cluster of six rocks was located immediately north of the feature. The soil surrounding the feature consisted of a gray

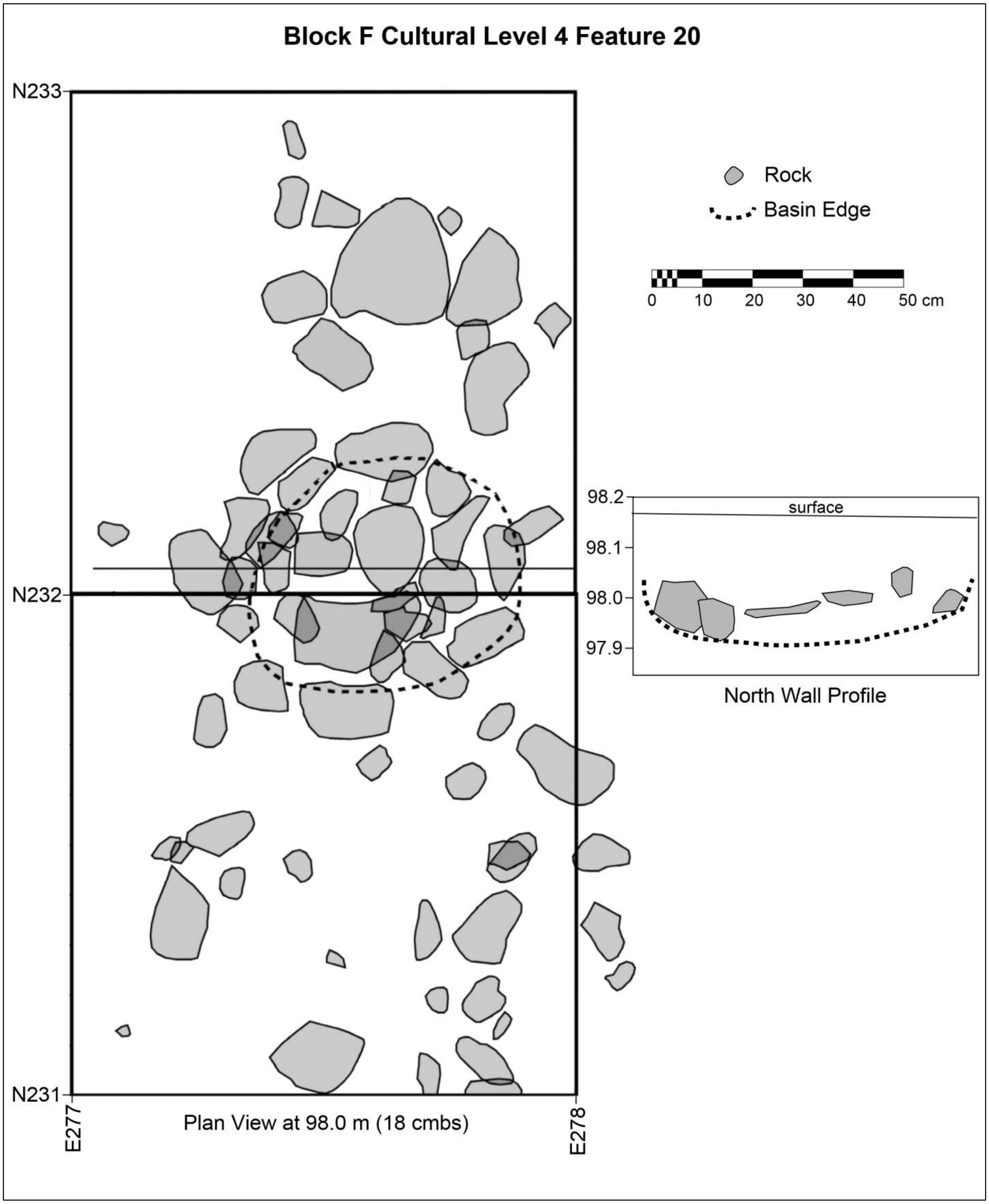


Figure 10-22 Illustrations of Feature 20, Block F, Cultural Level 4.

Figure 10-23 Photograph of Feature 20 exposed in plan view at about 98.0 m (18 cmbs).

Figure 10-24 Photograph of Feature 20 after removal of interior stones.

loam with gravels. The feature fill was slightly darker than the surrounding matrix, but contained only a few small flecks of charcoal. Approximately 32 rocks, 17 of which were fire-cracked, weighing a total of 30.75 kg were recovered from within the feature. An additional concentration of six rocks weighing 17 kg was found less than a meter north of the feature and is presumed to be a clean-out of Feature 20. No bones were observed in the fill, however, flakes were present as well as an obsidian scraper. One small fleck of charcoal was collected *in situ* from the feature, as well as flotation and pollen samples. The feature fill contained nine pieces of debitage, nine pieces of bone, two carbonized pieces of an unidentified tuber species and 276 mg of charcoal identified as Douglas fir (Appendix C). The lack of oxidized sediments and abundance of complete rock that has not been thermally fractured indicates that Feature 20 was probably not a roasting pit. A more likely interpretation, especially given the amount of heavily processed bone in Cultural Level 4, is that Feature 20 was a pit used to heat stones to be used in stone boiling.

Feature 21

Feature 21 was a rock-filled basin located approximately 2 m northeast of Feature 20 in unit N233 E278 (Figure 10-25). Like Feature 20, this feature was identified at approximately 15 cm below the surface at 98.01 m. The feature consisted of a roughly oval concentration of fire-cracked rock, charcoal, bones, and lithics. It measured about 50 cm north-south, 40 cm east-west, and 9 cm deep. The sediment in the level surrounding the feature was a dark gray silty loam, with the feature fill being softer and finer in texture, slightly darker in color, and containing some charcoal. The feature was described as being very amorphous, with the boundaries being difficult to differentiate as the feature fill extended beyond the boundaries of the fire-cracked rock. Some differentiation of materials within the feature was noted, with bone concentrated in the north half of the feature. A total of 57 fire-cracked rocks were present in the feature, weighing 19.5 kg. The fill from the feature was collected for flotation, which resulted in the recovery of 1.88 g of charcoal identified as Douglas fir (Appendix C). The heavy fraction of the floated feature fill contained 23 pieces of debitage and 102 unidentifiable pieces of bone. A piece of this charcoal was submitted for AMS radiocarbon dating and produced an age estimate of 130±30 BP (Beta-406661). This date is almost certainly in error given the multiple Late Archaic diagnostic artifacts found in close association with Feature 21. Feature 21, is very similar to Feature 20 in size and content. Therefore, Feature 21 was likely used to heat stones that were then placed in hide-lined, water-filled pits, to render grease out of pulverized sheep bone.

Feature 22

Feature 22 is another rock-filled basin believed to be associated with bone grease processing (Figure 10-26). The feature was first identified about 10 cm below surface at an

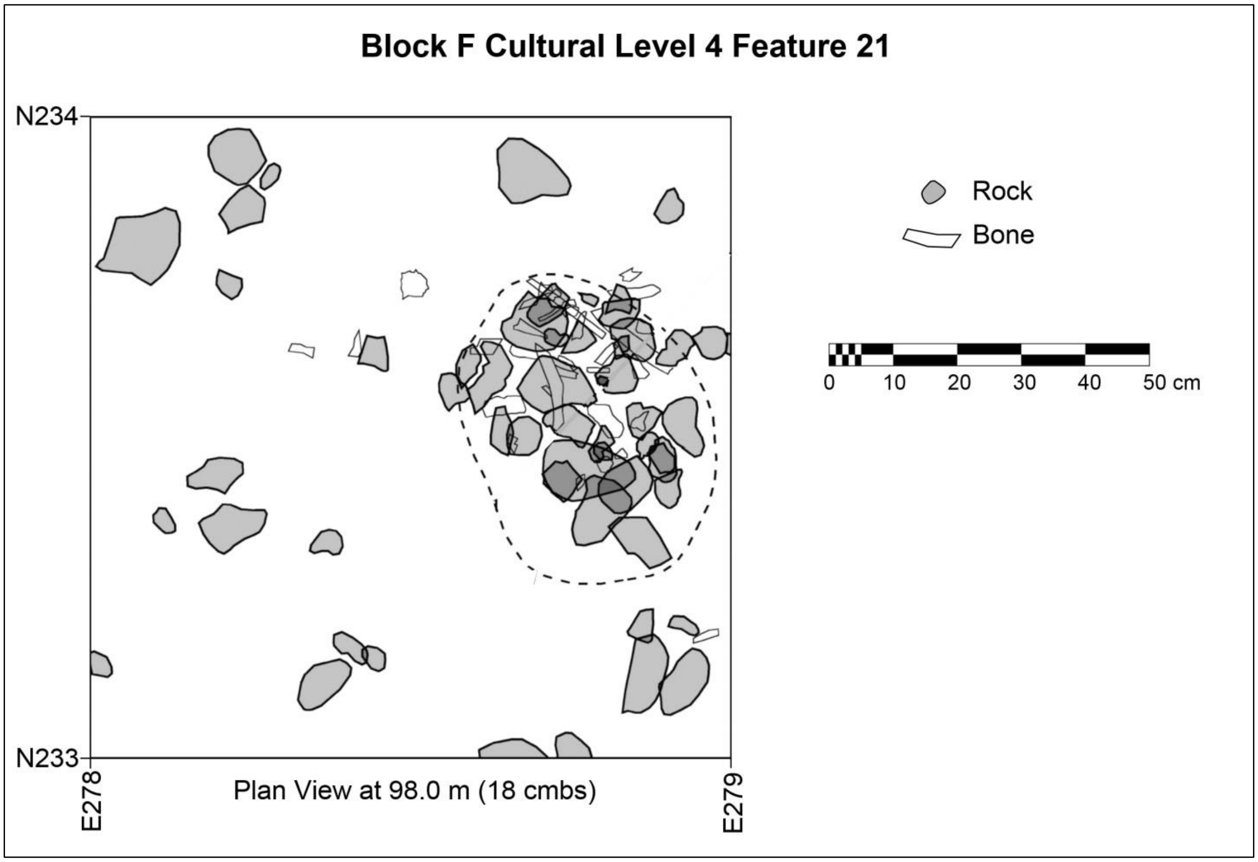


Figure 10-25 Illustration of Feature 21, Block F, Cultural Level 4.

elevation of 98.07 m, slightly higher than Features 20 and 21, in units N231 E275 and N232 E275. It was roughly circular in shape and relatively small in size, measuring 53 cm north-south and 45 cm east-west. Depth was recorded as about 10 cm. The fill in the level surrounding the feature consisted of a gray silty loam. The feature fill was noted to be slightly finer in texture and darker in color, with a couple of small flecks of charcoal. Flakes were noted in the fill of the feature, but no bone was observed. A total of 25 rocks, mostly river cobbles, were present in the feature, weighing 5.75 kg. The fill was collected for advanced recovery of macrobotanical remains. The feature fill yielded only 289 mg of unidentifiable (Appendix A), 12 pieces of debitage and four pieces of unidentifiable bone.

Spatial Analysis

The spatial analysis of Block E reveals one concentration of chipped stone and bone approximately 1.2 m south-southwest of Feature 18 in unit N231 E265 (Figures 10-27 and 10-28). Much of the bone in this concentration was burned suggesting that the concentration may represent a refuse pile

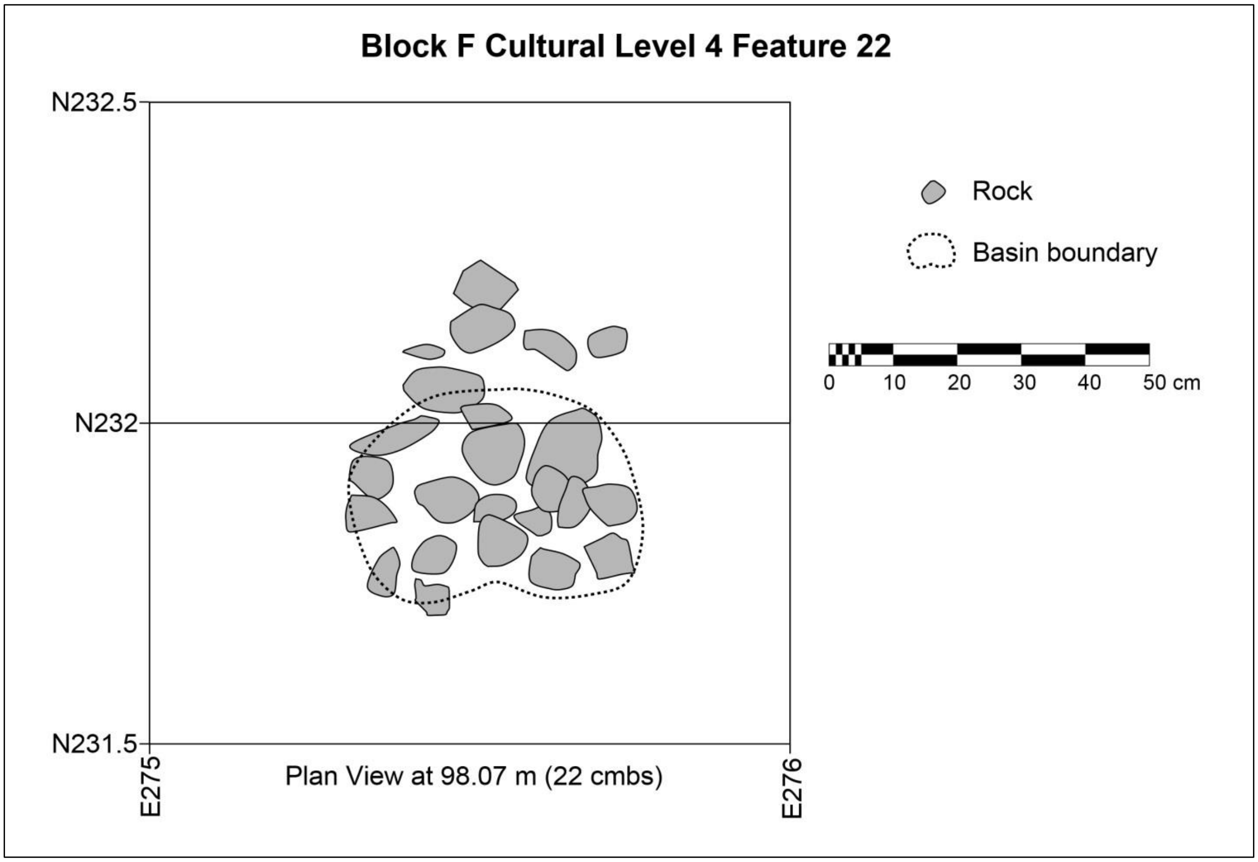


Figure 10-26 Illustrations of Feature 22, Block F, Cultural Level 4.

from the cleaning of a hearth. The greatest concentration of chipped stone was encountered in the southern 1 m of the excavation block in association with several cores. There does not appear to be any clustering of artifacts directly associated with Features 18 and 19. Stone tool production and maintenance as well as hide processing, butchering and bone grease production also occurred in Bock E, but no clear discrete activity areas are discernible. It is possible, perhaps even likely, that multiple occupations over a prolonged period have blurred the boundaries of activity areas.

The results of the spatial analysis of Block F are quite similar to Block E. Chipped stone artifacts are concentrated in the southern 1 m of the block with no clear clustering of artifacts that could be interpreted as discrete hearth-centered activities (Figures 29 and 30). There was one cluster of bone found within and around Feature 21 that probably represents intensive bone grease processing. It would appear that the Block F features constitute a special use activity area where intensive bone grease processing was conducted. Typical domestic activities such as stone tool production and maintenance also occurred within Block F judging by the large tool and debitage assemblages, but none of these appear to be clustered around the features in a manner indicative of hearth-centered use of space.

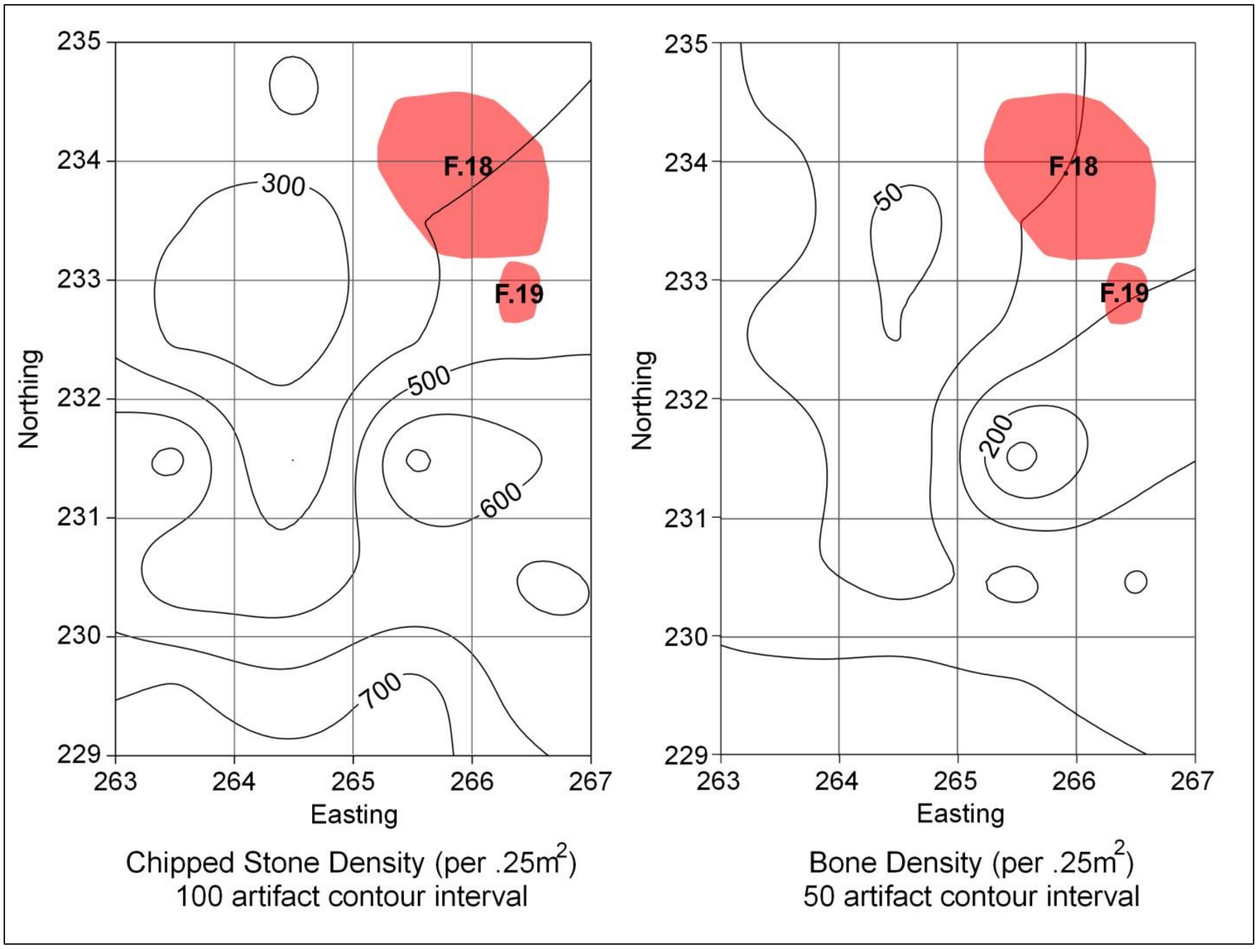


Figure 10-27 Map showing the interpolated artifact densities from Block E Cultural Level 4.

Summary and Discussion

Areas E and F contained at least two identifiable cultural levels. However, it is highly improbable that either of the levels represent single components. Cultural Level 3 was found in the lower half of stratum Va and is likely associated with Block C Cultural Level 3. Cultural Level 4 produced a large assemblage of chipped stone and bone artifacts within a ~30 cm thick zone of stratum VIa. The two cultural levels were separated by approximately 20 cm of deposit that contained low artifact frequencies. Stratum VIa was overlain by stratum VII, which is only about 10 cm thick and contained at least one Late Prehistoric diagnostic artifact. Faunalturbation, which was evidenced by the presence of intrusive fossorial rodent bones recovered from both cultural levels, combined with occupational trampling and cultural disturbances, such as the excavation of features, has caused some degree of post-depositional mixing. Consequently, Cultural Level 4 contained a mixture of artifacts diagnostic of the Middle Archaic, Late Archaic and Late Prehistoric periods, with most of the diagnostics identified as Late Archaic.

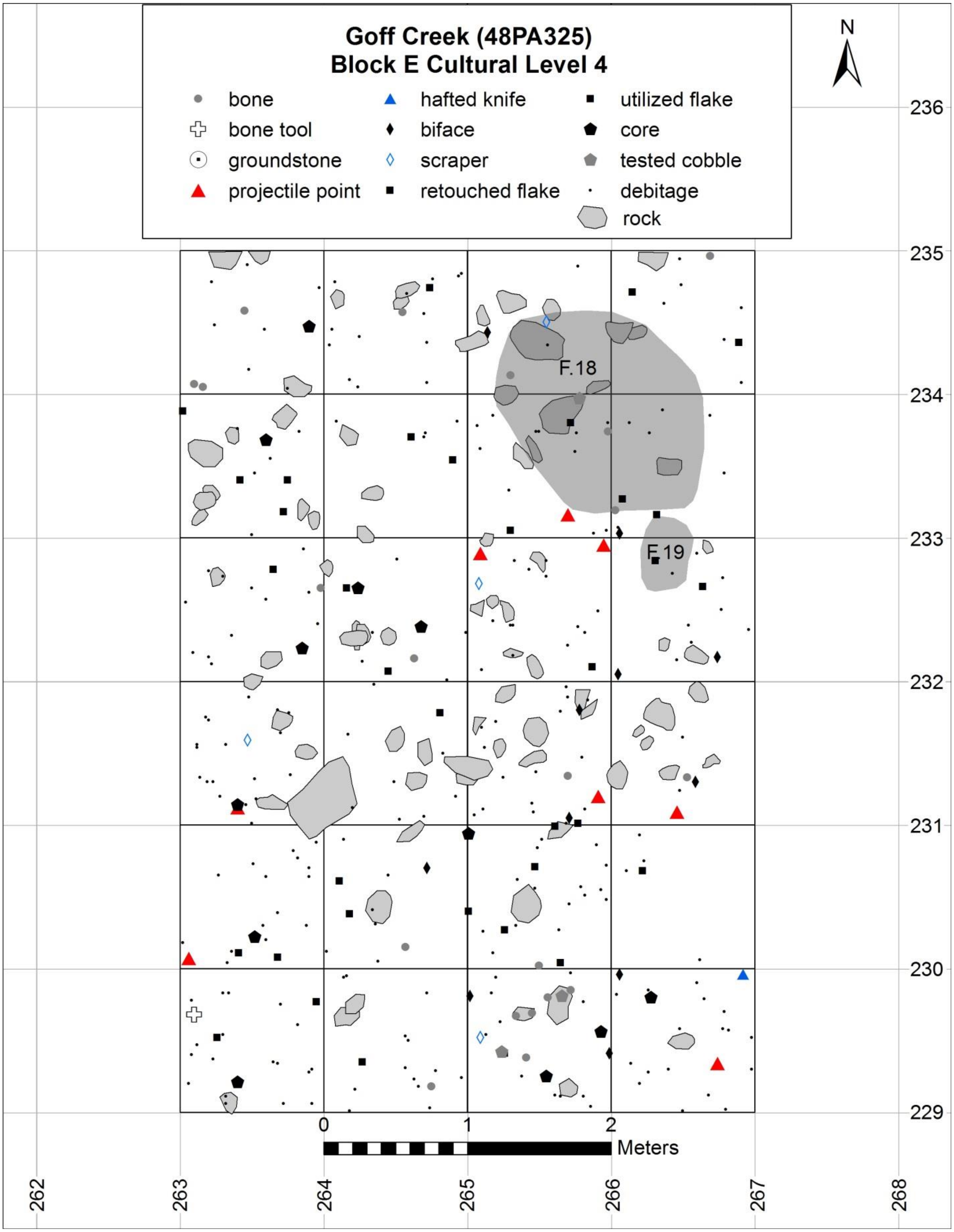


Figure 10-28 Plan view map of Block E Cultural Level 4.

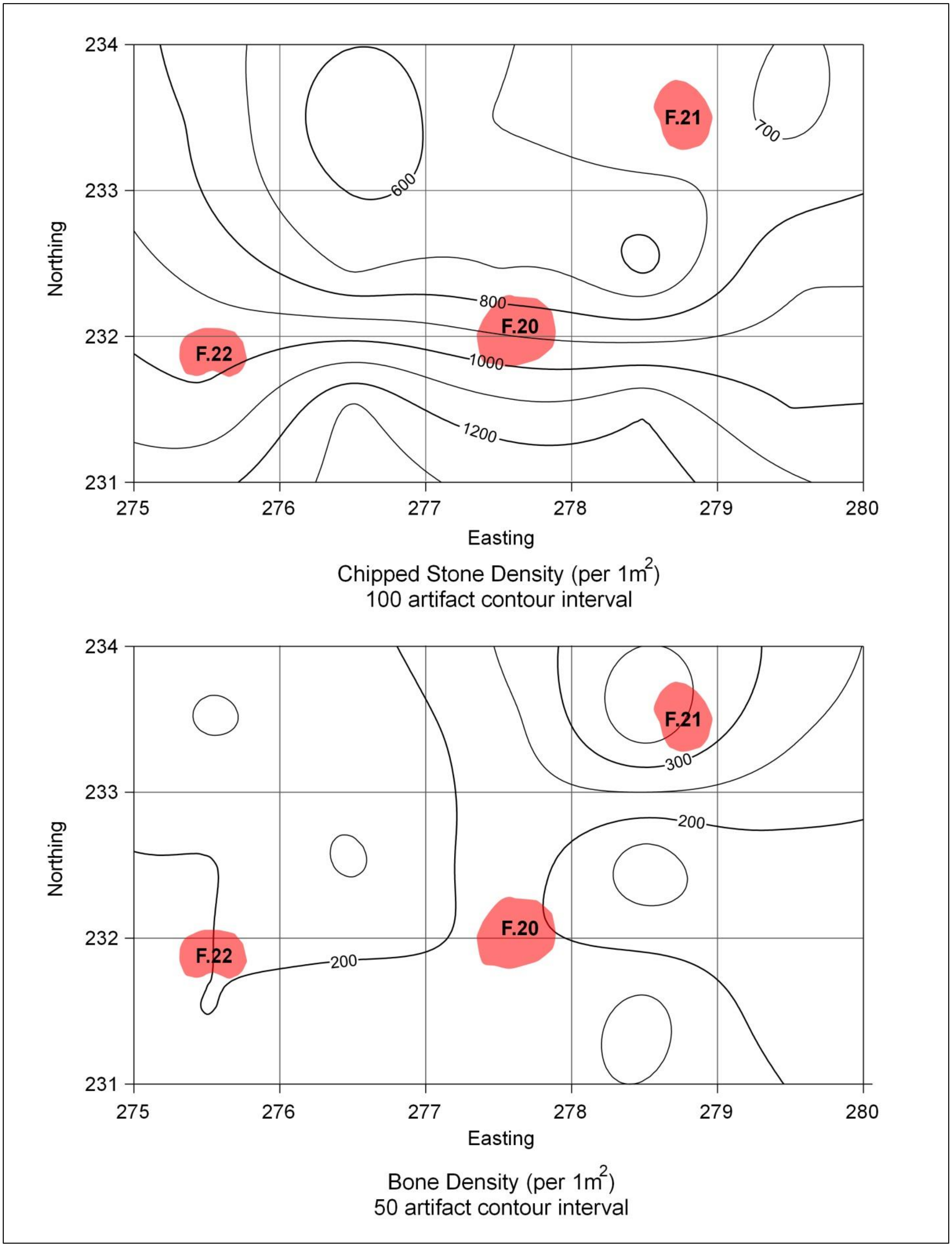


Figure 10-29 Map showing the interpolated artifact densities from Block F Cultural Level 4.

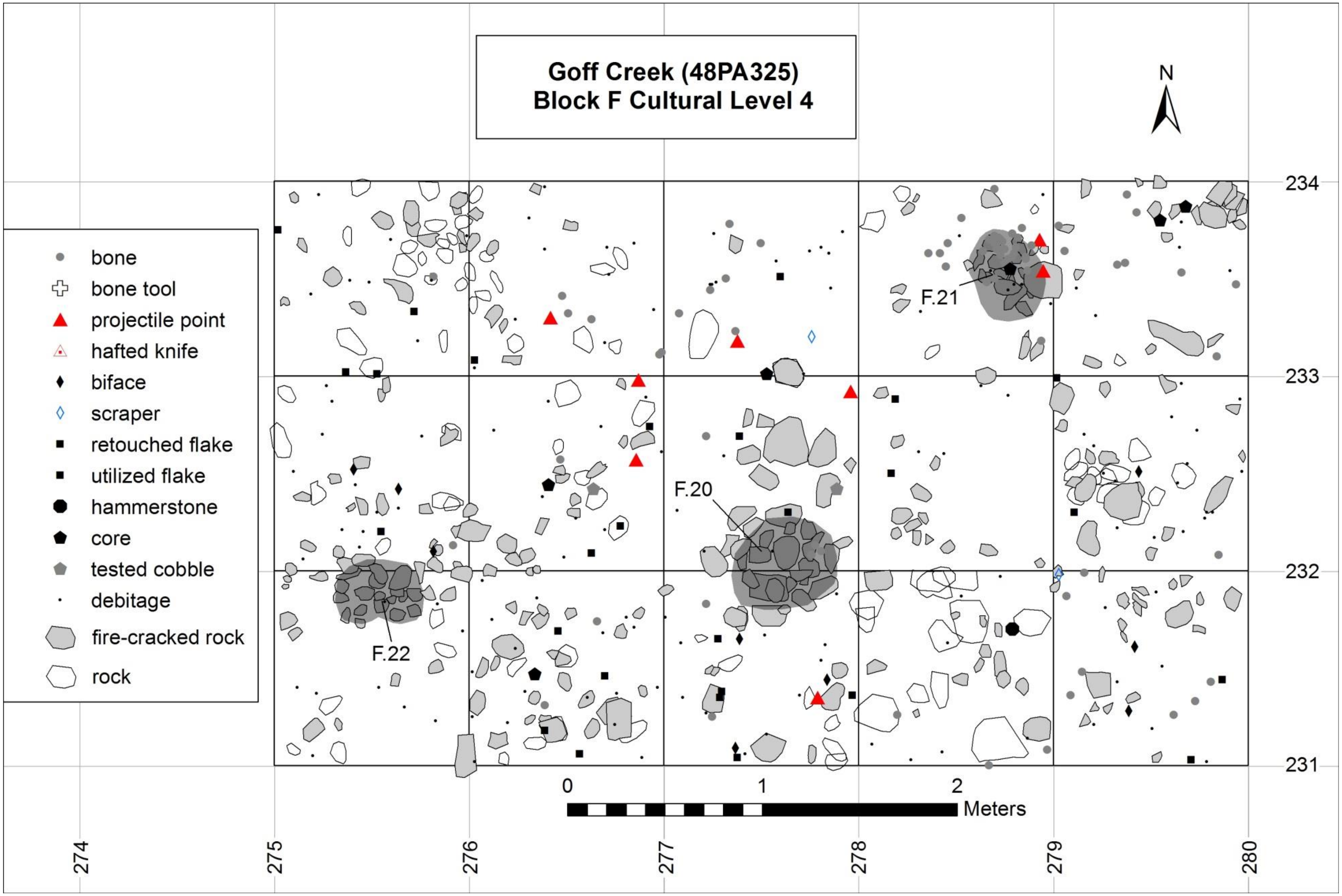


Figure 10-30 Plan view map of Block F Cultural Level 4.

Cultural Level 3 contained a relatively small assemblage of chipped stone, groundstone and bone as well as one hearth, Feature 23. There was marked increase in the use of obsidian and non-local cherts in this level, much like the Block C Cultural Level 3 chipped stone assemblage. The diagnostic artifacts found in this level were similar to many specimens recovered from Middle Archaic contexts at Mummy Cave (Husted and Edgar 2002). Furthermore, an AMS date of charcoal collected from Feature 23 produced an age estimate of 4310±30 BP (Beta-406662), which also indicates a Middle Archaic age of the occupation(s).

Unfortunately, only a small sample of Cultural Level 3 was excavated precluding detailed spatial analysis. Nevertheless, a wide variety of tools, including projectile points, bifaces, scrapers and expedient flake tools were found that provide evidence of a many domestic activities. The identifiable faunal assemblage was dominated by medium artiodactyl bone, with six specimens positively identified as bighorn sheep. Most of the bone had been heavily processed for marrow and bone grease extraction. The pronounced increase in groundstone documented in Block C Cultural Level 3, can also be seen in Areas E and F. Half of all the groundstone artifacts recovered from Goff Creek were found in Cultural Level 3, yet this level overall contained the smallest chipped stone and bone assemblages of any of the cultural levels identified. Husted and Edgar (2002) report a similar increase in groundstone during the Middle Archaic occupations at Mummy Cave. The manos and metates found in Cultural Level 3 may have been used to process small seeds, such as Indian ricegrass, roasted roots and tubers, such as tobaccoroot, sago lily or balsamroot or a combination of each. The identification of several carbonized tuber fragments recovered from Feature 23 indicates that collection and processing of high-value roots and tubers was conducted during the Middle Archaic occupation(s).

Cultural Level 4 in Areas E and F yielded a very large chipped stone and bone assemblage. One of the notable and defining characteristics of Cultural Level 4 is the high percentage of obsidian, especially in the chipped stone tool assemblage. A similar increase in the use of obsidian during the Late Archaic is documented at other sites in the area. At Mummy Cave 18% of the chipped stone tools in Layer 32, dated to 2820±135 BP, were obsidian, nearly twice as much as any other layer at the site (Husted and Edgar 2002). Similarly, the upper cultural level of Block E at Moss Creek (PA919), thought to include a Late Archaic component, contained 13.4% obsidian, again nearly twice as high as any other cultural level at the site (Eakin 2012). These data, though limited, suggest a pattern of stone tool use with fairly clear temporal parameters. The reason behind the increased use of obsidian during the Late Archaic period may be tied to an increase in human populations in the Central Rocky Mountains and Bighorn/Wind River Basins that is inferred from frequency distributions of radiocarbon dates in the region (Kelly et al. 2013; Page 2016). Other portions of western Wyoming, as well as much of North America, witnessed steady population declines during this same period of time (Kelly et al. 2013;

Williams 2012). The cause or causes of the widespread population decline is unknown (Williams 2012), but they do not seem to have affected populations in the Central Rockies.

Most of the temporally diagnostic artifacts from Cultural Level 4 were corner-notched darts, quite similar to the specimens recovered from Layers 32 and 34 at Mummy Cave. The Hanna, Rose Spring and Desert side-notched points appear mostly to have been out of context. The 130±30 BP radiocarbon date from Cultural Level 4 is markedly discordant with the remainder of the evidence and therefore does not appear to accurately date the use of Feature 21. However, a bulk soil sample collected from stratum VIa returned a standard radiocarbon date 2600±60 BP. This date corresponds rather well with the dates from Layers 32 (2820±135 BP) and 34 (2050±150 BP) at Mummy Cave (Husted and Edgar 2002).

The faunal assemblage is again dominated by medium artiodactyl remains, most of which are probably from bighorn sheep. The appearance of elk is unusual for a region where elk bone is conspicuously rare (Frison 1991). These data suggest that the target prey species was bighorn sheep, but plant resources, small seeds, were also processed on site given the presence of a large metate.

CHAPTER 11RESULTS OF EXCAVATION: AREA G

Michael K. Page

Area G consists of 11 noncontiguous excavation units located east of Area B. Three of the units were placed north of Trench 6, and eight were excavated south of Trench 6. These units were placed around 1988 test units in order to further assess the cultural deposits in the area. The eight units in the southern portion of Area G were excavated to depths ranging from 99.47 to 99.62 m, or about 80-110 cm below surface. One of the northern units, N231 E203 was excavated to a depth of 99.13 m (150 cmbs). Twelve 10-cm thick levels were excavated from unit N231 E199, which encountered stratum I cobbles at 99.52 m. Only 30 cm of deposit was removed from the remaining northern unit due to the scarcity of cultural material recovered from the lower strata in other two units.

Stratigraphy

The stratigraphy and cultural deposits differed significantly between the northern and southern units. Almost all of the artifacts recovered from the northern portion of Area G were found in the upper 30-40 cm of deposit within Stratum VII (Figure 11-1 and 11-2). Although no diagnostic artifacts were recovered, the stratigraphy and lithic raw material composition indicates that this component is likely part of the mixed Late Archaic/Late Prehistoric-aged Cultural Level 4. There are no radiocarbon dates available for Stratum VII in Area G, but Feature 16 identified in Stratum VII in Block D produced a standard radiocarbon date of 920±70 BP (Beta 97537).

The vertical distribution of artifacts in the southern portion of Area G indicates at least two cultural levels (Figures 11-3 through 11-5). The upper level is likely the same as Cultural Level 4 identified in Areas C, D, E and F. The level was within strata VI and VII in the upper 30 cm of deposit. The stratigraphic boundary between Strata VI and VII was difficult to discern. Stratum VII may in fact have been absent from several of the units. Given the stratigraphic position, the upper cultural component likely represents a mixture of Late Archaic and Late Prehistoric-aged material. The only diagnostic artifacts recovered consist of two Late Prehistoric side-notched arrow points. No features and no radiocarbon dates were found in Area G Cultural Level 4.

The lower component was approximately 25 cm thick and located predominantly in stratum III. In unit N212 E191, however, the lower cultural component was found within Stratum II, and therefore may be part of Cultural Level 1, which was also identified in stratum II in Area B. Given its stratigraphic position and the recovery of one Early Archaic projectile point, the lower cultural component is probably part of Cultural Level 2 identified in Areas A and B. No features were found and no radiocarbon dates were obtained from Area G Cultural Level 2.

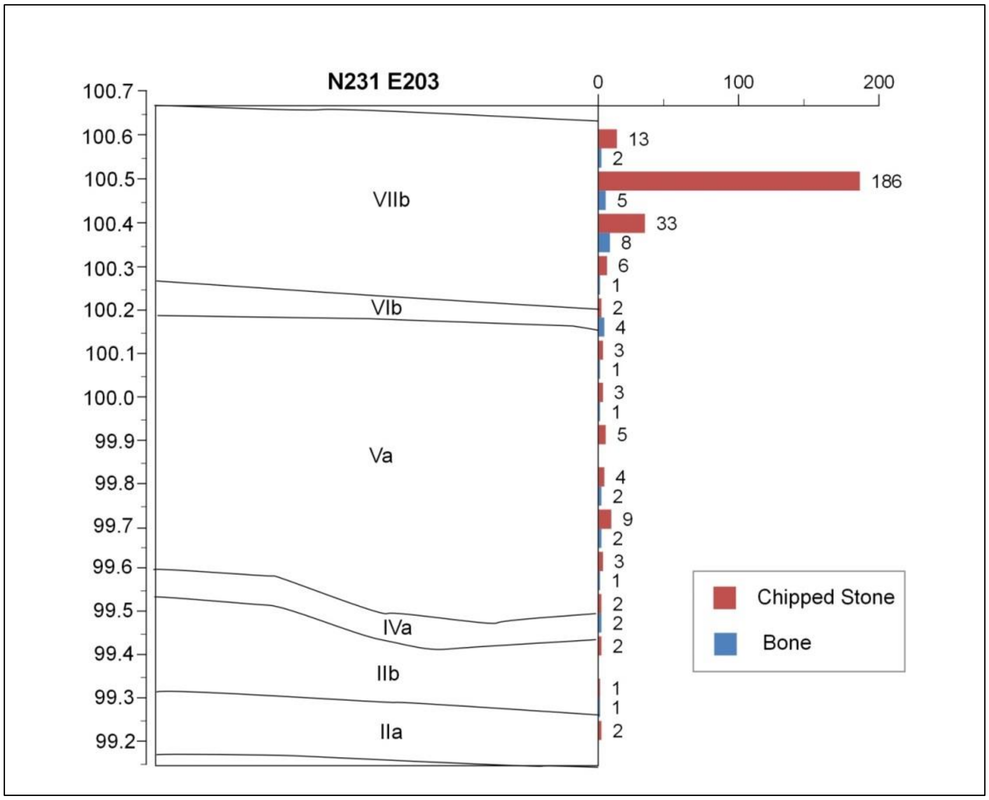


Figure 11-1 Illustrated profile and artifact frequency graph for north Area G.

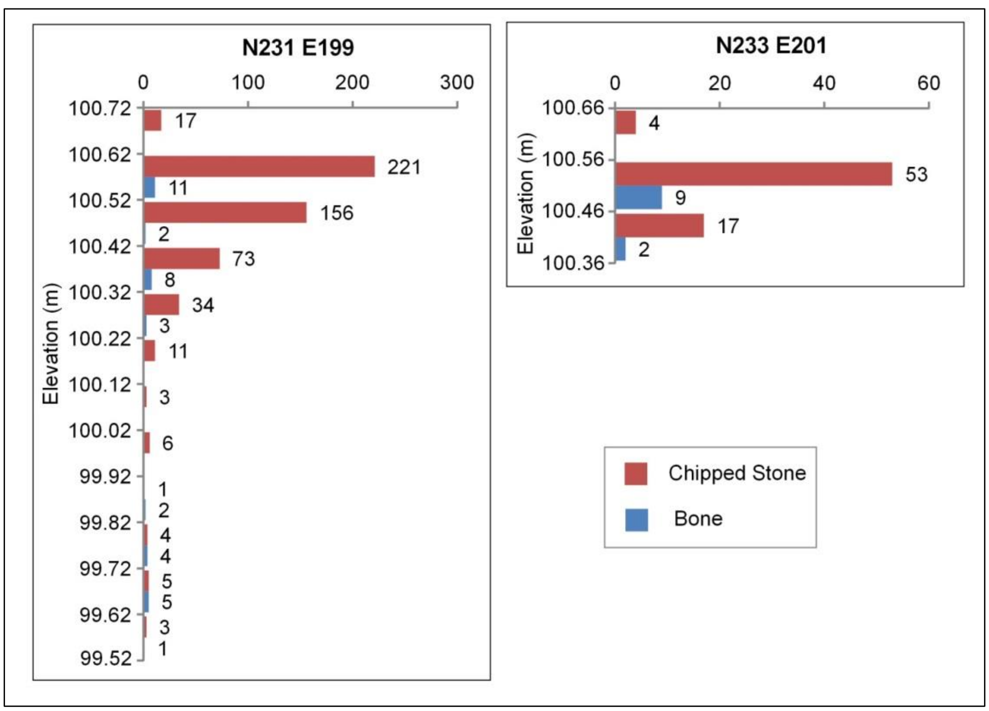


Figure 11-2 Illustrated profile and artifact frequency graph for north Area G.

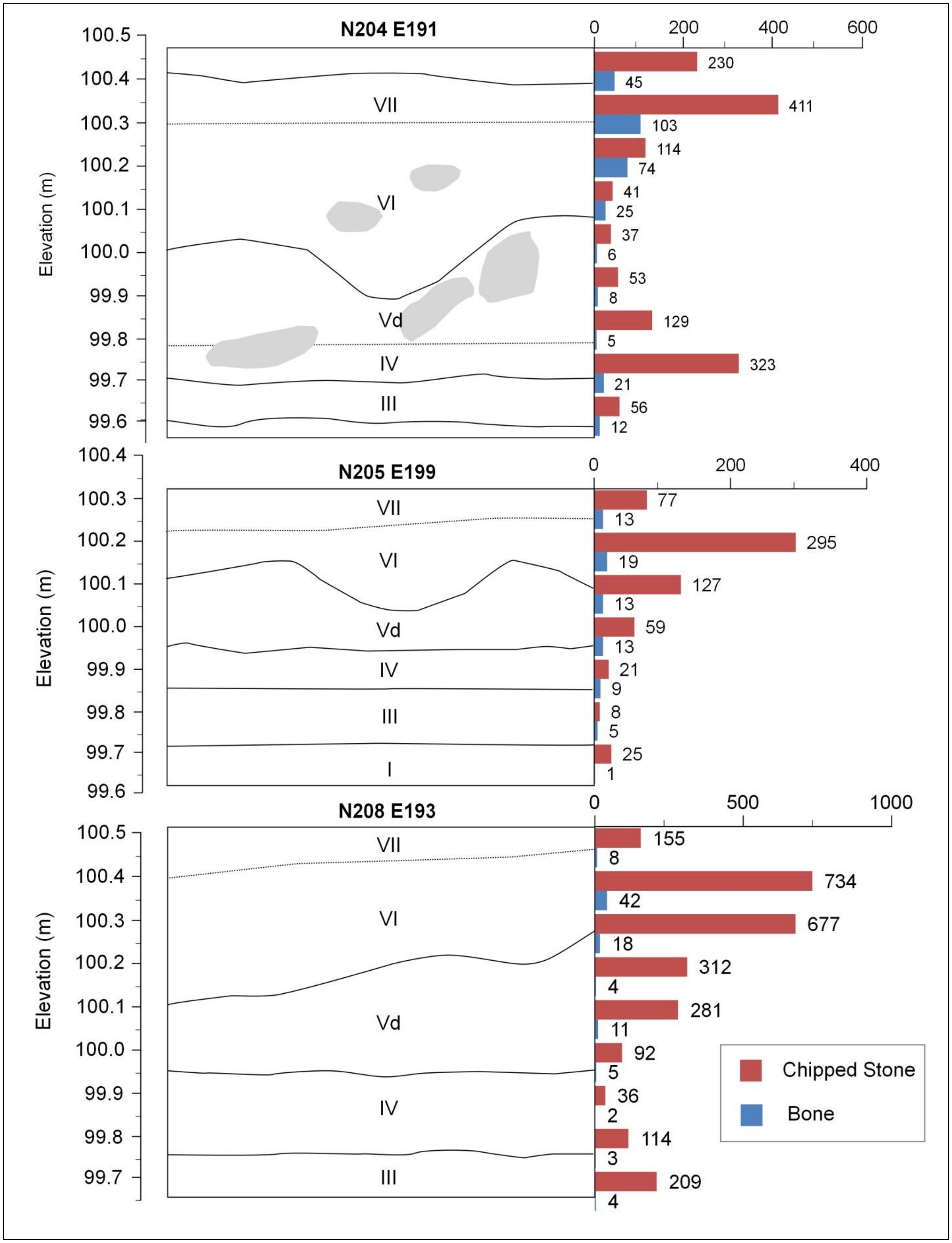


Figure 11-3 Illustrated profiles and artifact frequency graphs for units in south Area G.

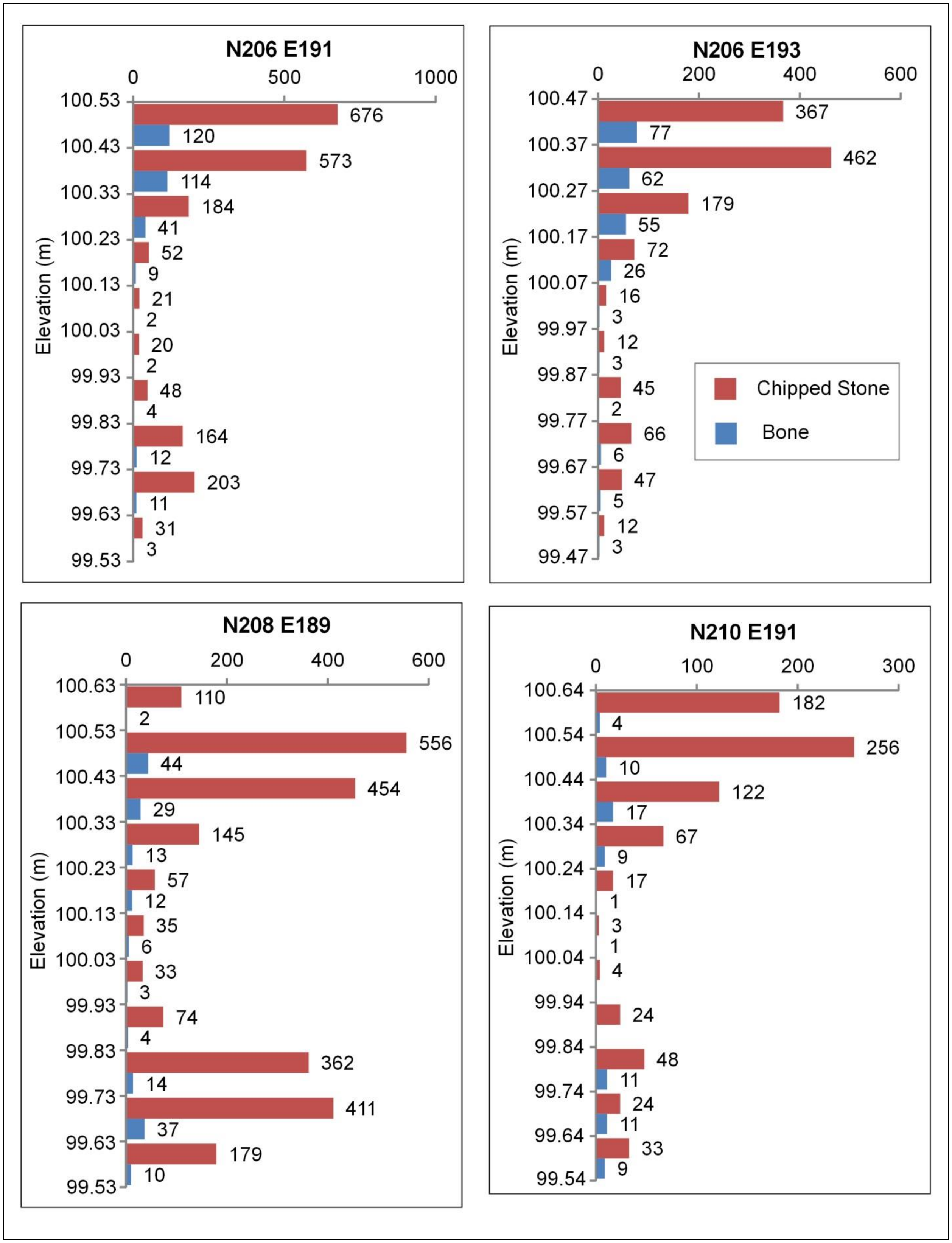


Figure 11-4 Graph showing the artifact frequency by depth from south Area G.

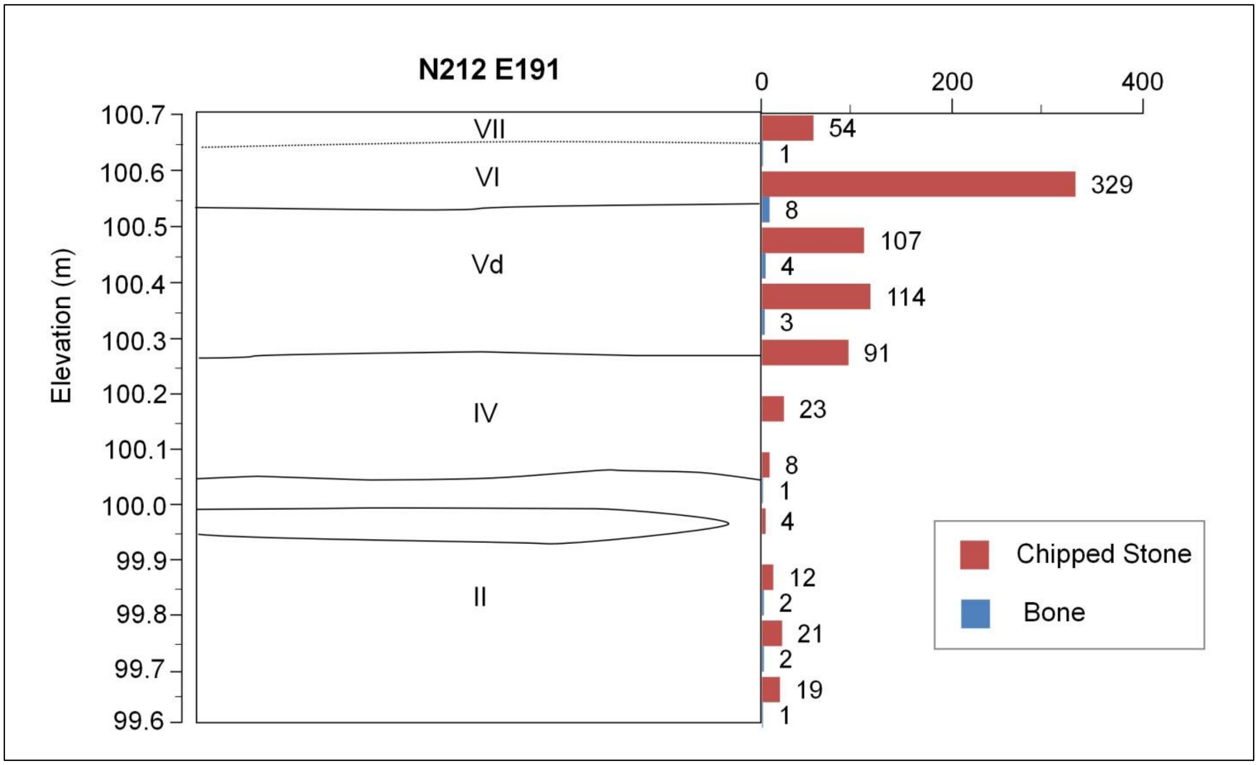


Figure 11-5 Illustrated profile and artifact frequency graph for unit N212 E191, south Area G.

Chipped Stone Assemblage

Cultural Level 2 in the southern portion of Area G produced 2,637 chipped stone artifacts, including three projectile points, three bifaces and nine expedient flake tools (Table 11-1). The largest sample of chipped stone from Area G came from Cultural Level 4 where 9,173 artifacts were recovered. A sizeable tool assemblage includes two projectile points, 14 bifaces, three drills and 22 flake tools (Table 11-2). The Cultural Level 4 assemblage from the northern portion of Area G produced only 832 pieces of chipped stone, including two bifaces and five flake tools (Table 11-2).

Raw Material Utilization

Lithic raw material utilization in Cultural Level 2 of Area G is similar in most respects to the Cultural Level 2 assemblages from Areas A and B. Locally available Eocene chert and silicified wood comprise the majority of the chipped stone assemblage (78.1%). Non-local cherts are fairly common, many of which were identified as Paleozoic. Obsidian is present, but in low frequency (4.3%).

Cultural Level 4 produced an assemblage that is unique to Goff Creek. Locally available stone comprises a significant majority of the chipped stone assemblage in every other block and cultural level at the site. However, local chert and silicified wood in Cultural Level 4 combined account for only a slight

Table 11-1 Area G Cultural Level 2 chipped stone artifacts by raw material type.

MATERIAL TYPE	ARTIFACT TYPE						
	Projectile Point	**Biface**	**Retouched Flake**	**Utilized Flake**	**Tools Total**	**Debitage**	**Material Total**
Local Chert		**2**	**2**	**5**	**9**	**1766**	**1,775**
%artifact		66.7	100	71.4	60.0	66.5	66.5
%material		0.1	0.1	0.3	0.5	99.5	
Non-Local Chert	**2**				**2**	**445**	**447**
%artifact	66.7				13.3	16.8	16.7
%material	0.4				0.4	99.6	
Silic. Wood				**2**	**2**	**302**	**304**
%artifact				28.6	13.3	11.4	11.4
%material				0.7	0.7	99.3	
Obsidian	**1**	**1**			**2**	**118**	**120**
%artifact	33.3	33.3			13.3	4.4	4.5
%material	0.8	0.8			1.7	98.3	
Misc. QTZ						**17**	**17**
%artifact						0.6	0.6
%material						100	
Unidentified chert						**4**	**4**
%artifact						0.2	0.1
%material						100	
Morrison QTZ						**3**	**3**
%artifact						0.1	0.1
%material						100	
Artifact Total	**3**	**3**	**2**	**7**	**15**	**2,655**	**2,670**

majority (55.2%) of the assemblage (Table 11-2). Nearly one-quarter (24.4%) of the chipped stone is non-local chert, almost twice the percentage as any other block and cultural level. Furthermore, Cultural Level 4 produced the highest proportion of obsidian (19%) at the site. The relative abundance of obsidian, as discussed in the previous chapter, is reflected in all the other Cultural Level 4 assemblages at Goff Creek as well as Layer 32 at Mummy Cave.

Table 11-2 Area G Cultural Level 4 chipped stone artifacts by raw material type.

MATERIAL TYPE	**ARTIFACT TYPE**									
	Projectile Point	**Biface**	**Drill**	**Retouched Flake**	**Utilized Flake**	**Tools Total**	**Core**	**Tested Cobble**	**Debitage**	**Material Total**
Local Chert		**5**	**1**	**3**	**6**	**15**	**1**	**2**	**4,700**	**4,718**
%artifact		31.3	33.3	27.3	37.5	32.6	20.0	66.7	47.2	47.2
%material		0.1	0.0	0.1	0.1	0.3	0.0	0.0	99.6	
Non-Local Chert		**3**		**4**	**2**	**9**			**2,309**	**2,318**
%artifact		18.8		36.4	12.5	19.6			23.2	23.2
%material		0.1		0.2	0.1	0.4			99.6	
Obsidian	**2**	**6**	**1**	**1**	**3**	**13**			**1,802**	**1,815**
%artifact	100	37.5	33.3	9.1	18.8	28.3			18.1	18.1
%material	0.1	0.3	0.1	0.1	0.2	0.7			99.3	
Silicified Wood		**2**		**2**	**3**	**7**	**4**	**1**	**784**	**796**
%artifact		12.5		18.2	18.8	15.2	80.0	33.3	7.9	8.0
%material		0.3		0.3	0.4	0.9	0.5	0.1	98.5	
Misc. Quartzite					**1**	**1**			**304**	**305**
%artifact					6.3	2.2			3.1	3.0
%material					0.3	0.3			99.7	
UID chert			**1**	**1**		**2**			**26**	**28**
%artifact			33.3	9.1		4.3			0.3	0.3
%material			3.6	3.6		7.1			92.9	
Morrison QTZ									**16**	**16**
%artifact									0.2	0.2
%material									100	
C-grained QTZ									**5**	**5**
%artifact									0.1	<.1
%material									100	
Basalt					**1**	**1**			**2**	**3**
%artifact					6.3	2.2			<.1	<.1
%material					33.3	33.3			66.7	
Quartz Crystal									**1**	**1**
%artifact									<.1	<.1
%material									100	
Artifact Total	**2**	**16**	**3**	**11**	**16**	**46**	**5**	**3**	**9,949**	**10,005**

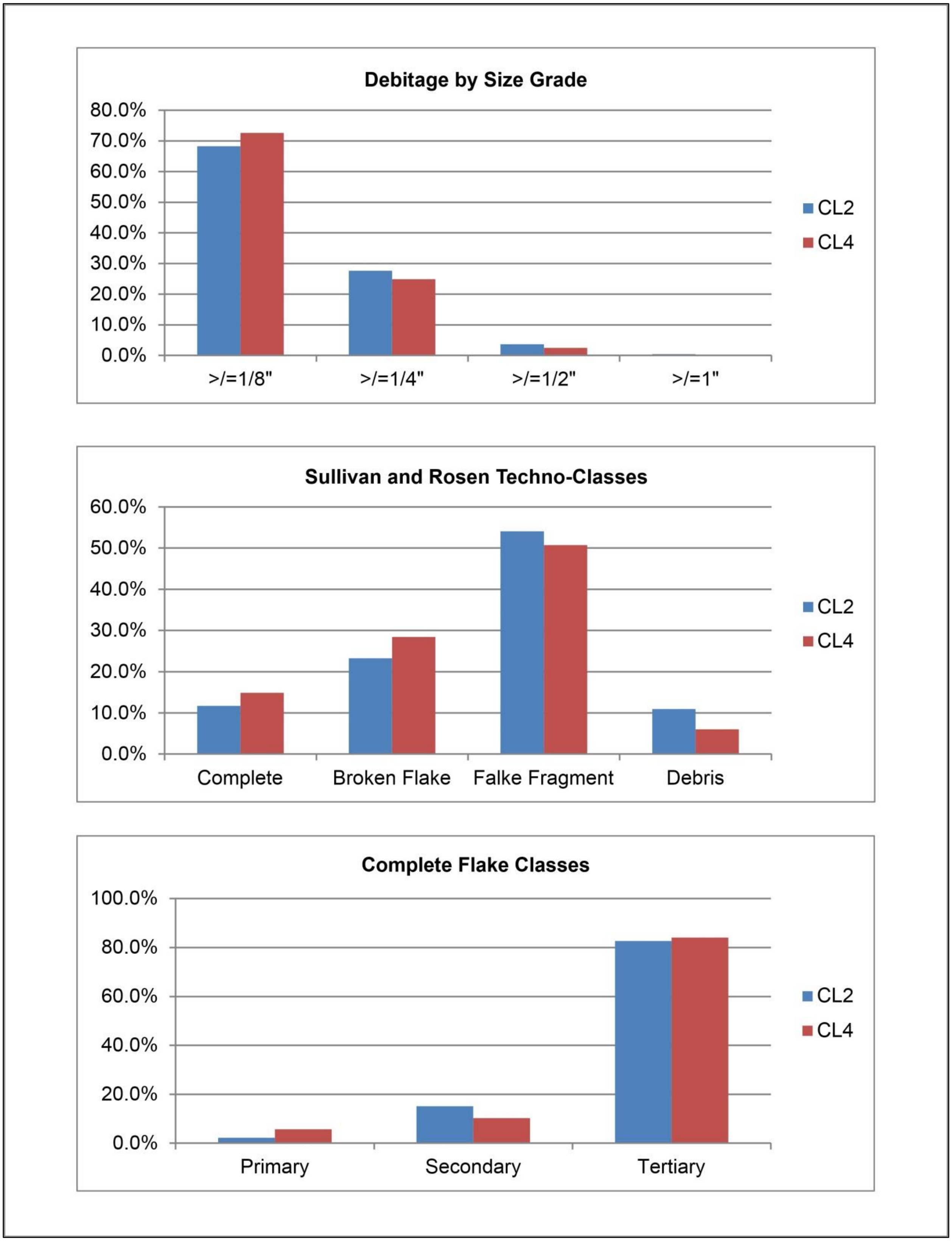


Figure 11-6 Graphs showing attributes of the debitage assemblages from Area G.

Debitage

The size and technological class composition of the debitage assemblage appears to predominantly reflect late stage tool production and maintenance (Sullivan and Rosen 1985). There are no significant differences in the compositions of the debitage assemblages from the two cultural levels identified in Area G (Figure 11-6). The majority of the debitage is less than ½" in maximum width, which is indicative of late stage tool production and maintenance. Furthermore, most of the flakes were classified as either broken or fragmentary, which again suggests late stage tool production and maintenance. Lastly, most of the complete flakes do not retain any portion of cortex. However, five cores and three tested cobbles from Cultural Level 4 evidence some degree of lithic procurement and early stage reduction.

Projectile Points

Five fragmentary projectile points were found in Area G (Table 11-4, Figure 11-7). Three of the specimens were recovered from Cultural Level 2, and two were found in Cultural Level 4. Only two of the Cultural Level 2 specimens are complete enough for identification to type, and one of these is only a small lateral base fragment. Point #891 has shallow corner notches and a short base and is similar to the Blackwater type that that was most common in Cultural Layer 16 at Mummy Cave (Husted and Edgar 2002). Point #919 appears to have come from a side-notched dart point, but given its fragmentary state there is little more that can be said about it. In short, both of the identifiable points from Cultural Level 2 likely date to the Early Archaic.

Table 11-3 Attributes of projectile points recovered from Area G.

Catalog #	Unit	Cultural Level	Elevation	Material	Period	Portion	Haft Type	Prox. Shld. Angle	Max. Length	Base Width	Haft Width	Max Thickness	Notch Depth	Notch Width
891	N208 E189	2	99.83-99.73	Paleozoic Chert	EA	BMS	CN	121	14.3	15.3	12.3	4.4	2.1	5.2
919	N208 E189	2	99.63-99.53	Obsidian	EA	ER	SN	148	7.2			3.2		
1266	N208 E193	2	99.72- 99.62	Paleozoic Chert	UN	ER	UN		9.8			3.4		
771	N208 E193	4	100.52-100.42	Obsidian	LPr	NC	SN	158	12.9	13.3	9.6	2.8	1.7	2.8
791	N208 E193	4	100.42-100.32	Obsidian	LPr	BA	SN	180	5.6	11.6	7.6	2.4		

Abbreviations: EA-Early Archaic, LPr-Late Prehistoric, UN-unknown, BMS-base and midsection, ER-ear, NC-nearly complete, BA-base, CN-corner-notched, SN-side-notched.

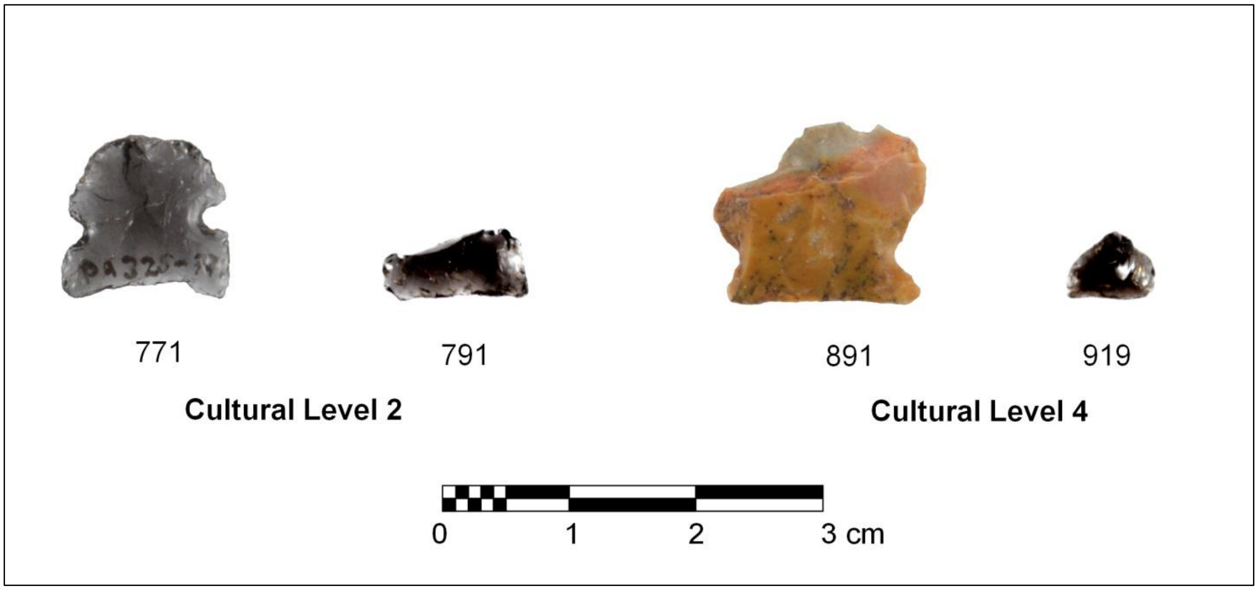


Figure 11-7 Photographs of projectile points recovered from Area G.

The two points recovered from Cultural Level 4 are side-notched arrow points, one of which (#771) is nearly complete. Both of the arrow points were found in the upper 10-20 cm of deposit within the same unit. Side-notched arrow points such as these have been recovered from numerous Late Prehistoric and Protohistoric contexts throughout the region and are often referred to as Desert Side-Notched type (Holmer 2009; Justice 2002; Kornfeld et al. 2010). At Mummy Cave, side-notched arrow points were recovered exclusively from Cultural Layer 37 (Husted and Edgar 2002).

Bifaces

A total of 19 bifaces, all but one of which is fragmentary, were found in Area G (Table 11-5, Figure 11-8). Most of the bifaces were recovered from Cultural Level 4 (n=16). The majority (68.4%) of the specimens are in the late stages (IV and V) of reduction. Five of the bifaces from Cultural Level 4 show evidence of use wear. Analysis of use wear indicates that four of the bifaces were used to scrape semi-hard material or dry hide and two were apparently used to cut a soft material.

Drills

Three drill tip fragments (#793, #834 and #853) were found in Cultural Level 4 (Appendix B, Figure 11-8). Specimen 793 is 11.5 mm in length, 7.7 mm in maximum width and 2.5 mm thick and made of an unidentified chert. The fragment is ovate in cross-section and appears to have been used to drill or ream a hard material. Drill 834 is made of locally available Eocene chert and is 21.5 mm in length, 13.1 mm in width and 5.2 mm thick with a diamond-shaped cross-section. This specimen was also last used to

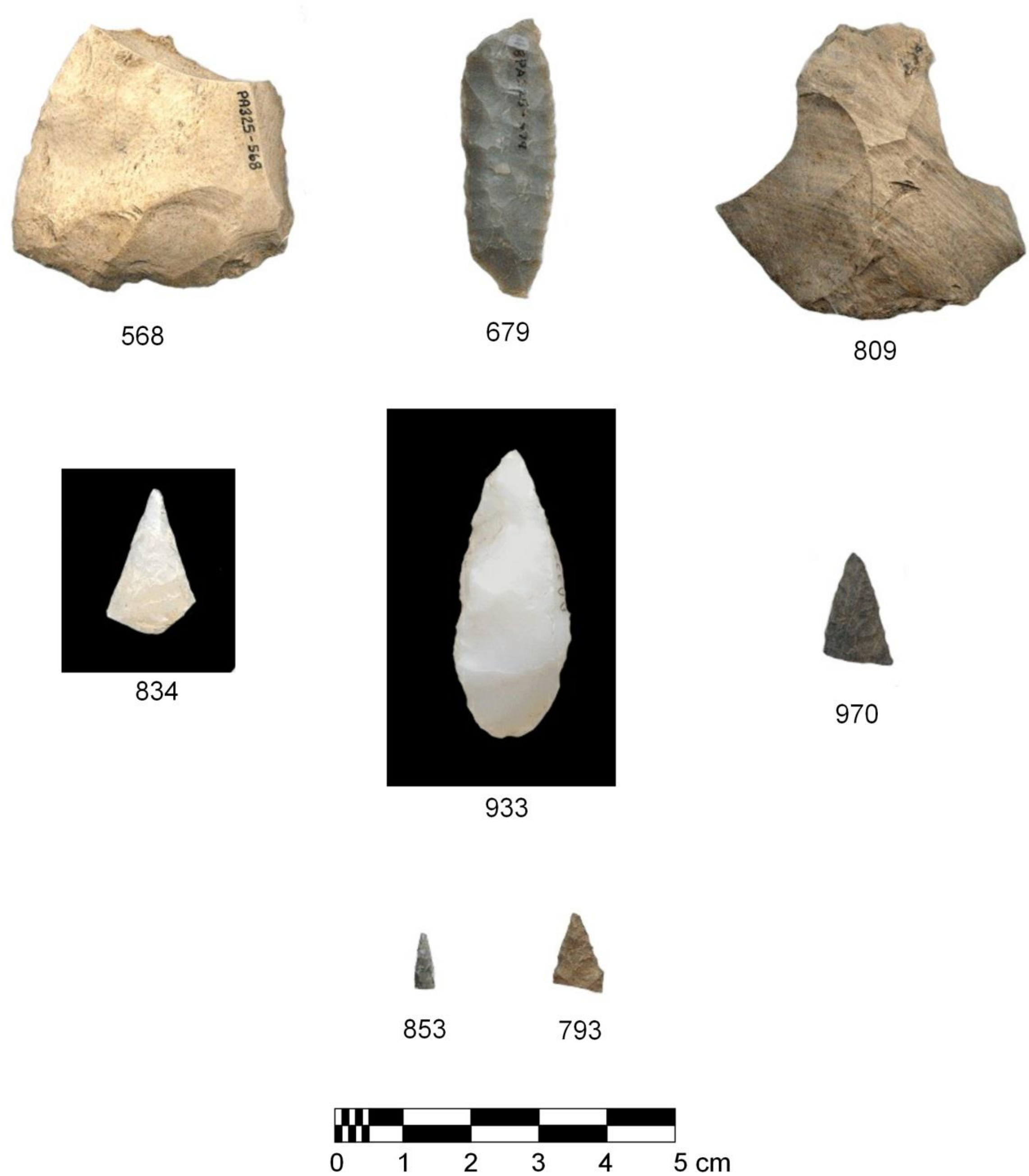


Figure 11-8 Photographs of chipped stone tools recovered from Area G.

Table 11-4 Attributes of bifaces recovered from Area G.

Cat#	Unit	Elevation (m)	Cultural Level	Portion	Material	Stage	Length	Width	Thickness	Use 1	Material 1	Use 2	Material 2
1046	N206 E191	99.73- 99.63	2	UN	Obsidian	V	6.4	10.7	3.1				
1129	N210 E191	99.64- 99.54	2	UN	Eocene Chert	V	7.6	3.1	1.8				
1185	N212 E191	99.80- 99.70	2	DS	Eocene Chert	V	9	8.5	2.2				
485	N205 E199	100.32-100.22	4	UN	Paleozoic Chert	V	4.7	4.4	2.6				
556	N206 E191	100.53-100.43	4	UN	Paleozoic Chert	V	5.1	3.3	1.5				
559	N206 E191	100.53-100.43	4	UN	Obsidian	V	7.2	5.5	2.1				
568	N206 E191	100.4	4	UN	Silic Wood	III	39.1	42.3	9.3	S	SH	C	S
577	N206 E191	100.43-100.33	4	UN	Eocene Chert	UN	6.2		4.4				
586	N206 E191	100.33-100.23	4	UN	Obsidian	IV	7.9	7.9	3.9				
679	N206 E193	100.41	4	CO	Eocene Chert	V	41.3	13.9	4.8	S	SH	S	SH
776	N208 E193	100.42-100.32	4	UN	Obsidian	V	12.3	4.7	2.1				
777	N208 E193	100.42-100.32	4	UN	Obsidian	IV	9.2	2.7	2.3				
787	N208 E193	100.42-100.32	4	DS	Eocene Chert	V	5.1	3.3	2.1				
809	N208 E189	100.51	4	LT	Silic Wood	III	44.1	46.1	12.5	S	HD		
1077	N210 E191	100.54-100.44	4	UN	Eocene Chert	III	9.6	15.4	7.4	C	S		
1150	N212 E191	100.50-100.40	4	UN	Paleozoic Chert	V	7	5.5	2.2				
1249	N208 E193	99.92- 99.82	4	MD	Obsidian	III	17.6	11.3	5.4				
933	N233 E201	100.51	4	LT	Eocene Chert	IV	44	17.2	7.3	C	S		
1406	N231 E199	100.62-100.52	4	UN	obsidian	III	6.9	9	2.5	S	SH		

Abbreviations: UN-unknown/unidentified, DS-distal, CO-complete, LT-lateral, MD-medial, C-cut, HD-hide, S-scrape, SH-semi-hard

drill or ream a hard material such as wood. Specimen 853 is 8.4 mm long, 3.2 mm wide and 2.1 mm thick. The small fragment is diamond-shaped in cross section. The obsidian drill appears to have been used to perforate a soft material such as finished hide.

Expedient Flake Tools

A relatively large assemblage of expedient flake tools was recovered from Area G (Appendix B). Utilized flakes were more numerous (n=24) than retouched flakes (n=13). Of the 37 specimens found, nine were recovered from Cultural Level 2 and 28 from Cultural Level 4. All of the specimens from Cultural Levels 2 are made of locally available chert, silicified wood or basalt. On the other hand, the Cultural Level 4 flake tool assemblage is comprised of 18.2 percent obsidian, and 22.7 percent Paleozoic chert. These data indicate that a significant number of flake tools, or the cores from which they were struck, were brought to Goff Creek in toolkits rather than acquired locally as needed. Use wear analysis revealed that utilized flakes were used to either cut (n=9) soft (n=7) and semi-hard (n=2) materials and scrape (n=10) hard (n=2) or semi-hard (n=8) materials. One utilized flake was used to groove a semi-hard substance and one was used as a wedge on a semi-hard material. The use and material could not be identified on three utilized flakes. The retouched flakes appear to have been used differently than the utilized flakes. Most of the retouched flakes (n=8) were used to scrape hard (n=3) or semi-hard (n=5) materials. The remaining five retouched flakes were used to cut (n=5) soft (n=4) or semi-hard (n=1) materials.

Faunal Assemblage

The faunal assemblage recovered from Area G is rather small and comprised predominantly (98.2%) of unidentifiable fragments (Table 11-6). Cultural Level 2 contained only 199 pieces of bone and tooth enamel, of which only three specimens could be identified to species or body class size, all of which were intrusive, non-cultural rodent bones. Most (n=1,163) of the bone from Area G came from Cultural Level 4, including three specimens identified as bighorn sheep and 16 identified as medium-sized artiodactyl.

Table 11-5 Faunal remains recovered from Area G.

CL	SPECIES	ELEMENT	PORTION	SIDE	NISP
2	unidentified	unidentified bone	fragment		112
2	unidentified	unidentified tooth	fragment		81
2	intrusive rodent	cervical vertebra	complete	axial	1
2	intrusive rodent	Maxilla	fragment	left	1
2	intrusive rodent	Femur	proximal, >1/2 shaft	not sided	1
2	unidentified	unidentified bone	fragment	not sided	3
Cultural Level 2 Subtotal					199
4	bighorn sheep	fused 2nd, 3rd carpal	complete		1
4	bighorn sheep	Mandible	ascending ramus	left	1
4	bighorn sheep	Metacarpal	proximal, <1/2 shaft	right	1
4	m. artiodactyl	Cranium	petrous	axial	1
4	m. artiodactyl	Incisor	distal		1
4	m. artiodactyl	long bone	medial shaft	not sided	2
4	m. artiodactyl	long bone	unidentified	not sided	1
4	m. artiodactyl	Metapodial	medial shaft	not sided	1
4	m. artiodactyl	Radius	diaphysis	not sided	1
4	m. artiodactyl	unidentified tooth	unidentified		9
4	intrusive rodent	unidentified bone	unidentified		2
4	intrusive rodent	radius-ulna	proximal, >1/2 shaft	not sided	1
4	unidentified	long bone	proximal end	not sided	1
4	unidentified	long bone	diaphysis		4
4	unidentified	unidentified bone	diaphysis		1
4	unidentified	unidentified bone	unidentified		827
4	unidentified	unidentified tooth	unidentified		308
Cultural Level 4 Subtotal					1,163
Area G Total					1,362

Table 11-6 Area G faunal breakage morphology, presence of cut/impact marks and burning.

CL	Species	Break	Cut/Impact	Burned	NISP
2	medium artiodactyl	green	X	X	1
2	unidentified	unidentified		X	35
2	unidentified	unidentified			80
2	unidentified	dry		X	2
2	unidentified	dry			1
4	bighorn sheep	dry			1
4	bighorn sheep	green			1
4	bighorn sheep	unidentified			1
4	medium artiodactyl	unidentified			1
4	medium artiodactyl	dry			1
4	medium artiodactyl	green	X		3
4	medium artiodactyl	green			2
4	unidentified	unidentified		X	336
4	unidentified	unidentified			481
4	unidentified	unidentified			4
4	unidentified	dry			1
4	unidentified	green		X	1
4	unidentified	green			9
4	unidentified	green	X	X	1

The assemblages from all three cultural levels showed evidence of intensive processing for bone grease extraction (Table 11-7). Green bone fracture patterns were identified on 18 specimens, five of which also had evidence of cut marks or crushing from impact. A significant number (27.6%) of bones also appear to have been burned.

Summary and Discussion

Two cultural levels were identified in Area G. Artifacts assigned to Cultural Levels 2 and 4 were encountered in the southern portion of Area G in strata III and VI, respectively. In the northern portion of Area G cultural material believed to be affiliated with Cultural Level 4 was recovered in stratum VII. The contextual integrity of cultural deposits appears to have been compromised to some extent by the burrowing of fossorial rodents, occupational trampling, slope wash, creep and stream incision. These factors combined with what appears to have been low depositional rates led to a mixing of artifacts from different aged components, particularly in Cultural Level 4 where there is evidence for both Late Archaic and Late Prehistoric occupations. The data are limited, but as with most of the other area samples there is clear evidence for bighorn sheep procurement and intensive processing. An emphasis on hunting is also evident in the chipped stone tool assemblage. No groundstone artifacts were recovered and relatively little fire-cracked rock was reported.

The Cultural Level 2 assemblage from stratum III contained a small assemblage of chipped stone and bone. Area G appears to have been on the periphery of the Early Archaic occupations at Goff Creek. The lithic raw material composition of Cultural Level 2 is quite similar to that recorded in Areas A and B. The two temporally diagnostic projectile points found in Cultural Level 2 are also consistent with the projectile points found in Areas A and B a relatively short distance to the west. No features were found and no organic remains were submitted for radiocarbon dating. Unfortunately, the radiocarbon dates from Cultural Level 2 (stratum III) span nearly a thousand years, which indicates either contamination or very low rates site burial.

Cultural Level 4 produced a sizeable assemblage of chipped stone and bone. The high percentage of obsidian artifacts found in the level provides the primary evidence for assigning the component to the Late Archaic. The presence of two Late Prehistoric side-notched arrow points indicates that a later occupation is mixed with the Late Archaic material. No features were identified in the Area G Cultural Level 4 deposits and no radiocarbon dates are available. The faunal assemblage is highly fragmentary suggesting intensive processing of animal bone for grease extraction. Most of the faunal remains likely originated from bighorn sheep, although relatively few could be positively identified to species.

CHAPTER 12DISCUSSION AND CONCLUSIONS

Michael K. Page

Excavations at Goff Creek produced one of the largest prehistoric artifact assemblages in the Central Rocky Mountain region (Table 12-1). Seven areas, A-G, that included six excavation blocks ranging in size from 15 m^2 to 51 m^2, were excavated over the course of two field seasons. Results of the investigation, presented in detail in the preceding chapters, revealed four cultural levels. These levels do not represent individual components, but are chronostratigraphic units (Cremeens and Hart 1995) demarcated by stratigraphic boundaries. Overall contextual integrity of cultural deposits was poor. Low depositional rates combined with bioturbation and occupational disturbances led to considerable post-depositional mixing, especially in Cultural Levels 1 and 4 in blocks D, E and F, where artifacts diagnostic of several periods, spanning thousands of years, were found in the same context (Figure 12-1). Despite these limitations, the investigations at Goff Creek produced a considerable amount of data relevant to the questions and goals outlined in the data recovery plan (Eakin 1994).

Table 12-1 Artifact inventory by Cultural Level from Goff Creek (48PA325).

ARTIFACT TYPE	**CULTURAL LEVEL**					**Artifact Total**
	1	2	3	4	Unknown	
Bone	6,919	12,867	2,381	9,232	41	31,440
Bone Tool	3	12	1	3		19
Carbonized Seeds	8	23	3	2		36
Charcoal (grams)	2.57	2.582	.076	80.148		85.313 g
Projectile Point	30	29	5	60	1	125
Hafted Knife	1	1	1	1		4
Biface	57	88	18	139	4	306
Drill	1	4	1	11		17
Scraper	12	9	3	18		42
Flake Tools	149	265	37	279	2	732
Core	14	10	4	32		60
Tested Cobble	12	10	1	17		40
Debitage	39,948	66,561	11,779	52,114	449	170,851
Mano		1	1			2
Metate		2	4	2		8
Ochre	9	14	2	17		42
Steatite Bead				1		1
Talc Artifact				1		1
Hammerstone	1	3		1		5
Incised Stone	1			1		2
Historic				13		13
CL Total	47,184	80,012	14,241	62,041	498	203,746
% of assemblage	23.1%	39.2%	7.0%	30.4%	0.2%	

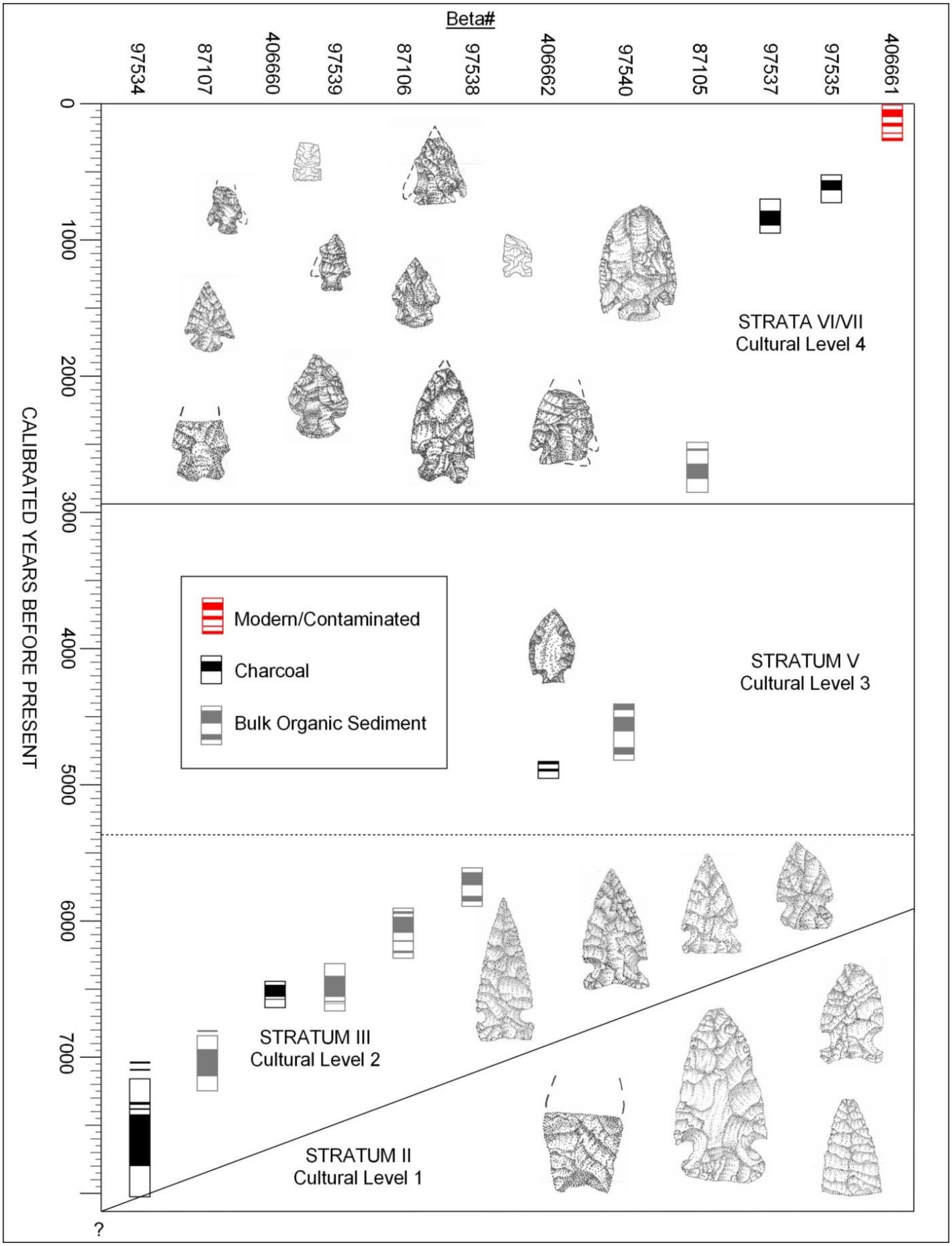


Figure 12-1 Simplified chronostratigraphy at the Goff Creek site showing calibrated (2-sigma) radiocarbon dates and diagnostic artifacts.

Overview of Occupational History

Cultural Level 1 was identified within stratum II in Areas A, B and D. In all, 82 m^2 of deposit containing Cultural Level 1 was sampled. In Areas A and B stratum II is overlain by stratum III, which contains Cultural Level 2, but it is absent from Block D. It is unclear whether the accretion of stratum II ceased at the same time across the landform. It is therefore possible that Cultural Level 1 in Area D contains artifacts from the occupations assigned to Cultural Level 2 in Areas A and B. Cultural Level 1 contained projectile points diagnostic of the Paleoindian and Early Archaic periods. Seven features, six in Block B (Feature# 3-5, 9, 12, 14) and one (#17) in Block D were recorded in Cultural Level 1.

Based on temporally diagnostic artifacts recovered, Cultural Level 1 appears to be a mixed palimpsest of multiple occupations spanning several thousand years. One midsection and tip fragment of a Cody Complex Point was found in Block B. The serial comedial flaking pattern is consistent with either the Alberta/Cody type II points defined by Bradley and Frison (1987) in the Horner II assemblage or the Scottsbluff type. Alberta/Cody type II points date to circa 9875±85 BP at the Horner site. Eden and Scottsbluff point types have been recovered from sites dating from 9400-8300 BP (Pitblado 2003). The Angostura/Ruby Valley point base and midsection fragment found in Block D is lanceolate in form with a contracting base and parallel-oblique flaking pattern consistent with the Angostura type as defined by Pitblado (2003) and Bradley (2013) or the Ruby Valley type described by Davis et al. (1988). Angostura points have been dated at other sites in the region, such as Cultural Layers 8-12 at Mummy Cave (Husted and Edgar 2002), Helen Lookingbill (Kornfeld et al. 2001) and Game Creek (Page 2016b) from circa 8800 BP to 7860 BP. There are a variety corner and side-notched point styles present in the Early Archaic assemblage from Cultural Level 1. Most of these conform to the Pahaska and Blackwater types as loosely defined by Husted and Edgar (2002), but there was a much higher incidence of corner-notched forms than at Mummy Cave. The wide range of morphological variability in projectile points from Cultural Level 1 suggests multiple temporal components dating between 9800 BP and 5000 BP.

Cultural Level 2 was the best preserved and most productive occupational layer identified during data recovery excavations. In part this was due to the sampling effort as approximately 85 m^2 of deposit was excavated. The level was coterminous with stratum III in Areas A, B and G. Eight features, two (Feature# 1-2) in Block A and six (#6-8, 10-11, 13) in Block B, were identified in the level. Although there is only one reliable radiocarbon date from the level (5730±30 BP), all of the temporally diagnostic artifacts are Early Archaic (ca. 7800-5000 BP) in age. Artifact backplots from Block A reveal two components, separated by 5-10 cm of nearly sterile deposit. Unfortunately, the two components appear to have been mixed in many places and the 10-cm thick levels used during excavation subsumed portions of each component, which precluded complete segregation of the occupations. Most of the identifiable projectile points conform rather closely to Husted and Edgar's (2002) Pahaska and Blackwater types, but there is a higher incidence of corner-notching (53%) than in any of the Early Archaic Levels at Mummy Cave. At Mummy Cave Blackwater points, which are frequently corner-notched, were only recovered from the earliest Early Archaic component in Cultural Layer 16, dated to 7630±170 BP. The later (ca. 6780-5610 BP) Early Archaic occupations at Mummy Cave (Cultural Layers 17-18) produced, almost exclusively, Pahaska style points. However, the Cultural Level 2 assemblage from Goff Creek contained a mix of both Pahaska and Blackwater types and gave no indication that the types varied in proportion through time. It is possible that the Blackwater type was produced in the area for a significantly longer period of time than suggested by the Mummy Cave deposits. However, it is also possible that Cultural Level 2 contained far more occupations, spanning a much longer period of time, than is suggested by the meager radiocarbon evidence. As is discussed further below, hunting of bighorn sheep and intensive bone marrow and grease processing appears to have been the primary subsistence focus of the Cultural Level 2 inhabitants.

Cultural Level 3 was identified in Areas C, E and F, stratum Va. Cultural Level 3 produced the smallest cultural level assemblage (Table 1), in large part due to limited sampling effort as only 11 m^2 of Cultural Level 3 was excavated. Only one feature (Feature# 23) in Block F was found. Only one potentially diagnostic artifact was recovered from Cultural Level 3, but it does not closely resemble any named type and moreover is within the size class of an arrow point. It is possible that the specimen was out of context given the amount of post-depositional disturbance documented in the area. An AMS radiocarbon date (4310±30 BP) from Feature 23 in Block F indicates that Cultural Level 3 dates to the Middle Archaic Period. The marked increase in groundstone tools, which may reflect a change in subsistence strategies, provides supporting evidence of a Middle Archaic affiliation of Cultural Level 3.

Cultural Level 4 was sampled from 60 m^2 of excavation in Areas C, D, E, F and G. This cultural level encompasses strata VI and VII. Seven features were recorded in Cultural Level 4, including one each in Blocks C (Feature# 15) and D (#16), two in Block E (#18-19) and three (#20-22) in Block F. A wide variety of diagnostic artifacts from multiple periods were found in Cultural Level 4, but there was no evidence that these artifacts were in any way stratified. Of the 40 identifiable points, 29 are Pelican Lake corner-notched darts which are most common in the Late Archaic (ca. 3200-1500 BP). However, two Middle Archaic (ca. 5200-3200 BP) Hanna points and two Duncan points, three Late Prehistoric Rose Spring corner-notched (ca. 1700-500 BP), four Late Prehistoric Desert side-notched (ca. 1200-100 BP) and one tri-notched point (ca. 750-100 BP) were also recovered. Based solely on the diagnostic material, it is likely that artifacts deposited over several thousand years have been incorporated into Cultural Level 4.

Stratigraphic Evaluation and Dating

The geomorphology of the Goff Creek site is complex. During the initial testing it was revealed that the site has witnessed episodes of channel cutting, mass wasting and bioturbation. At that time it was unclear whether or how these geological episodes and processes affected the contextual integrity of the archaeological remains. Consequently, one goal outlined in the research design was to determine if the cultural deposits identified during testing retain integrity. This goal was addressed in two ways. First, Eckerle conducted pedological analyses in order to identify the stratigraphic history and determine the presence and extent of potentially destructive geomorphic processes such as channel cutting and bioturbation. Second, it was hoped that the acquisition of numerous and carefully selected samples for radiocarbon dating would provide temporal boundaries to the stratigraphic units as well as the prehistoric human occupations.

The first of these approaches resulted in a much clearer understanding of the geomorphology of the site and allowed for the identification of chronostratigraphic units with which to analyze, compare and contrast the occupational history of the site. However, the goal of obtaining multiple reliable dates to assess the temporal relationships of strata and human occupations was largely unattained. Six of the 12 radiocarbon dates obtained during the investigations were from bulk organic sediment samples that are known to produce inaccurate and unreliable dates (Birkland 1984; Pessenda et al. 2001; Stein 1992). It is a mystery why so many samples were submitted for this method of dating because it was common knowledge at the time of excavation that bulk organic sediment, especially samples containing soils rich in organic material, are inappropriate for all but the coarsest of temporal assessments. Of the remaining six dates, one is essentially modern and likely in error and one date produced such a large standard deviation that it is of limited interpretive value (Figure 12-2). Furthermore, one of the four apparently reliable dates (660±80 BP) came from a portion of the site that was not even excavated. In short, the radiocarbon dates provide little reliable data with which to assess the age of stratigraphic boundaries or occupations present at the site.

Stratum II: Cultural Level 1, Paleoindian and Early Archaic Cultural Materials

Stratum II contains both Paleoindian and Early Archaic diagnostic projectile points as well as chipped stone debitage and bone that were assigned to Cultural Level 1. This unit is a slope wash/sheet wash deposit that, given the number of intrusive fossorial rodent bones, has been heavily bioturbated. Stratum II is overlain by Middle Holocene age fan and overbank deposits (stratum III), and underlain by Pleistocene to Holocene-age channel gravels (stratum I). Radiocarbon dates in stratum II range from 6700±230 BP to 5000±70 BP (Table 12-2), but all of these dates are suspect because they are from bulk organic sediment samples. If the Cody Complex and Angostura points are in primary context, then

Table 12-2 Radiocarbon dates from Goff Creek (48PA325).

Beta #	Strat	Provenience	CL	C14 Age BP	C13/C12 o/oo	Calibrated Years BP 2σ	Material
406661	VI	Blk F, N233 E278, F.21 98.01-97.96 m	4	130±30	-25.9	9-45 [.16], 57-151 [.44], 173-275 [.40]	Charred material
97535	VII	Organic lens in cut bank	4	660±80	-25.0	527-728	Charred material
97537	VII	Blk D, N232 E255, F.16, 98.82-98.66 m	4	920±70	-25.0	697-938 [.99], 946-952 [.01]	Charred material
87105	VI	Trench 1/2 Join, ~100.75 m	4	2600±60	-25.0	2490-2643 [.33], 2654-2667 [.01], 2676-2849 [.66]	Organic sediment
97540	V	Blk D, N231 E254, SE quad, 98.24-98.21 m	3	4070±70	-25.0	4420-4729 [.82], 4734-4743 [.01], 4747-4820 [.17]	Organic sediment
406662	V	Blk F, N231 E278, F.23 97.67-97.53 m	3	4310±30	-22.9	4835-4893 [.77], 4898-4960 [.23]	Charred material
97538	II	Blk D, N235 E256, F.17, 98.07-97.97 m	1	5000±70	-25.0	5609-5898	Organic sediment
87106	III	Trench 1 in Block A, Akb3	2	5270±80	-25.0	5906-6218 [.96], 6236-6273 [.04]	Organic sediment
97539	II	Blk B, N224 E176, F.5, 98.84-99.78 m	1	5700±80	-25.0	6316-6660	Organic sediment
406660	III	Blk A, N223 E154, F.1 100.37 m	2	5730±30	-26.4	6445-6573 [.83], 6579-6632 [.17]	Charred material
87107	II/III	Blk B, N229 E176, F.14 99.93-99.67 m	1	6150±80	-25.0	6804-6813 [.01], 6849-7251 [.99]	Organic sediment
97534	II	Blk B, N222 E176, F.3 99.83-99.71 m	1	6700±230	-25.0	7032-7040 [.01], 7156-8014 [.99]	Charred material

stratum II(a) aggradation probably began no later than 9000 BP and continued (stratum IIb) until about 5000 BP.

Stratum II is predominantly a sandy loam (silty to muddy sand), which would have formed a <5 cm thick churn zone. The actual thickness of cultural zones within stratum II varies from 5-50 cm. Vertical dispersion is more pronounced in Area D than it is in Areas A and B. Given the predicted depositional environment, post-occupational dispersal (by slope wash, creep, and eolian transport) and burial dispersal (by slope wash deposition) are characterized as moderate. The effects of burial and post-burial processes are moderate to severe, respectively. The difference between the predicted and actual thickness of the cultural zones differs markedly, and is probably the result of bioturbation, possibly tree tip-out. The vertical artifact dispersion of stratum IIa is more pronounced than in IIb, and this may be the result of differential tree tip-out.

Strata IIIa, IIIb, and IIIc: Cultural Level 2, Early Archaic Component

Stratum IIIc contains Early Archaic diagnostic material associated with a feature (#1) that produced a date of 5730±30 BP (Table 12-2). The component is best expressed in Area A where it is a 5-20 cm thick zone of staining and occupational debris. Smaller amounts of Early Archaic cultural debris are present above and below this component within stratum III, especially in IIIa, IIIb, and IIIc. All of these strata are alluvial fan overbank deposits. Thus, they were deposited in a relatively low energy depositional environment.

Strata IIIa, IIIb, and IIIc have silt loam texture, which is predicted to have formed a <5 cm thick churn zone. As mentioned above, artifacts are less easily lost in firm substrates than in soft ones. Stratum III would have provided a firm occupation substrate and thus has a low potential of concealing items after trampling. Since items which are not hidden in the churn zone are available for secondary refuse disposal, potential discrimination of high primary discard areas from low ones is impaired (i.e., low). Another implication of substrate texture is that the identification of domestic areas that were cleaned is enhanced. This is because many artifacts were available for domestic area cleanup by the site occupants as they were not trampled into the churn zone. Thus, there is a high potential for discriminating these zones based on the substrate texture. The effects of scuffage on the integrity of the stratum III archaeological materials would be high, leading to lessened integrity. Post-occupational dispersal (by slope wash, creep, and eolian transport) and burial dispersal (by alluvial fan processes) are characterized as moderate, and the effects of post-burial processes are moderate as well. Stratification of the overbank deposits is well preserved, thus tree tip-out is not considered to be as severe in these cultural zones. At least two occupations are apparent in the artifact backplots, each of which approaches 5 cm in thickness. However, portions of the deposit experienced post-depositional disturbances that mixed the two occupations precluding assignment of separate cultural levels. Nevertheless, the Early Archaic occupations represented in these strata are the best preserved and potentially informative cultural deposits found at Goff Creek.

Stratum V: Cultural Level 3, Middle Archaic Occupation(s)

Relatively little of stratum V was excavated, but charcoal from Feature 23 returned an AMS date of 4310±30 BP. No diagnostic artifacts were found in the level, but based on the date, the occupation(s) likely occurred during the Middle Archaic period. Stratum V consists of gravelly silt or sand deposited by alluvial and colluvial processes on the Goff Creek alluvial fan. There are five separate beds (a-e) within stratum V, but no single profile contained all of the beds. There is a buried soil present in stratum Va that was best documented in Block C. The cultural deposits occurred in a 10-25 cm thick zone that coincided with the buried A horizon. Churn zone thickness for stratum V is predicted to be <5 cm based on sediment composition. However, bioturbation, a natural component of pedogenesis, likely led to artifact dispersal that resulted in an over-thickened cultural horizon.

Strata VI and VII: Cultural Level 4, Late Archaic and Late Prehistoric Occupation(s)

A mixture of Archaic and Late Prehistoric cultural materials occurred within Strata VI and VII at the east end of the site. Diagnostic projectile points indicate that the Middle Archaic, Late Archaic and Late Prehistoric diagnostic materials are mixed in this area. Stratum VI disconformably overlies stratum V and is conformably overlain by stratum VII in all areas except Area D, where it is largely absent. Strata VI and VII were not clearly demarcated in Areas E, F and G because stratum VII was very thin or not present. Only one radiocarbon date is available for stratum VI, but the 2600±60 BP date is from a bulk soil sample and is therefore probably too young. A date of 920±70 BP was procured from a hearth in the sod zone within stratum VII of Area D (Table 12-2). Where present, stratum VII is coincident with a surface soil A horizon. The zone is a sandy loam and formed as an alluvial fan overbank/slope wash deposit. Interbedded debris flows are present in the stratum within the western portion of the site. The Archaic and Late Prehistoric cultural deposits are about 30-80 cm thick (12-31 in) and thus are thicker than the predicted churn zone thickness of <5 cm (<2 in). This A horizon developed in a meadow environment, and thus rodent turbation could easily account for the overthickening and the mixing of artifacts of different ages.

HT1 Terrace: Late Prehistoric Occupations

Several occupation zones occur in the cutbank of the Ht1 fluvial terrace that abuts the river on the south margin of the site. These occupations are buried 60-80 cmbs and are each about 5 cm in thickness. The deposits are stratified fluvial overbank sediments, classified as well sorted silt loam. This substrate texture would have produced a thin churn zone of <5 cm. Discrimination of high vs. low primary discard would be low, but potential discrimination of cleaned domestic areas should be high for such a substrate. A radiocarbon date of 660±80 BP was procured from the uppermost of these occupations. Both occupations contain cultural organics including charcoal, chipped stone, FCR, and bone. The context of these occupations is excellent (i.e., high geoarchaeological contextual integrity) with each approximating the predicted churn zone thickness. This area was not excavated during the data recovery phase, and these deposits were not affected by the highway construction.

In summary, results of the geoarchaeological analysis indicate that strata II, V, VI and VII have experienced moderate to severe post-depositional mixing that led to the over-thickening of Cultural Levels 1, 3 and 4. However, stratum III contained the remains of at least two Early Archaic occupations with good to excellent contextual integrity that approaches the predicted 5 cm thickness. Although there are only four reliable radiocarbon dates, they provide evidence for occupations at 5730±30 BP, 4310±30 BP, 920±70 BP and 660±80 BP, which provides absolute dates for Cultural Levels 2, 3 and 4.

Subsistence Practices

The data recovered from the excavations at Goff Creek shed considerable light on the subsistence practices of the prehistoric inhabitants of the Central Rockies. Evidence for subsistence came largely from the sizeable faunal assemblages found in Cultural Levels 1, 2 and 4. Cultural Level 3 produced only a couple thousand pieces of bone, of which only 13 were identifiable. Of the over 31,000 pieces of bone and teeth found at Goff Creek, only 838 specimens were identifiable to species or body class size. This pattern is evident in all cultural levels. The highly fragmented nature of the faunal assemblage highlights the persistent practice of intensive marrow and bone grease extraction. The high incidence of burned faunal specimens and ubiquitous presence of bones bearing green bone fracture patterns and cut and impact marks (Table 12-3) leave little doubt that the faunal assemblages are the result of human predation. What effects taphonomic processes, such as weathering and root etching had on the assemblages is difficult to assess because such data were not recorded during the faunal analysis. However, only 11 specimens show any evidence of carnivore gnawing (Table 12-3), which indicates there is a low probability that the faunal assemblages have been modified through scavenging.

Table 12-3 Summary data on cultural and taphonomic modifications to the faunal assemblages at Goff Creek.

Cultural Level	Percentage Identifiable	Percentage Burned	Specimens with Green Bone Fractures	Specimens with Cut/Impact Marks	Carnivore-Gnawed Specimens
1	3.3%	48.7%	151	5	2
2	3.6%	56.2%	311	13	5
3	0.5%	43.3%	5	1	
4	1.5%	36.2%	76	11	4
Combined	2.7%	47.7%	543	30	11

Faunal Assemblages

Most (90.7%) of the 838 identifiable faunal specimens recovered from Goff Creek came from medium-sized artiodactyls (Table 12-4). Since there are significantly more specimens positively identified as sheep than deer, it is likely that most of the bones in the medium artiodactyl category are from bighorn sheep rather than deer. Cultural Levels 1 and 2 were markedly similar to each other with relatively low diversity, .66 and .65, respectively, as measured by the Shannon Diversity Index (Table 12-4). Both assemblages contained deer as well as a variety of smaller mammals such as beaver, porcupine, river otter, marmot and rabbit, each of which are represented by a small number (n=1-3) of identifiable specimens. Conversely, the Cultural Level 4 faunal assemblage was far more diverse (1.34) than the earlier levels and included bison, elk porcupine, beaver

Table 12-4 Number of identifiable faunal specimens (NISP) by cultural level.

SPECIES	CULTURAL LEVEL				Total
	1	2	3	4	
medium artiodactyl (sheep or deer)	192	364	4	87	647
bighorn sheep (*Ovis canadensis*)	26	77	7	26	136
elk (*Cervus elaphas*)				10	10
beaver (*Castor candensis*)		2	1	5	8
small mammal	3	5			8
deer (*Odocoileus sp*.)	1	2		4	7
river otter (*Lontra candensis*)	1	2	1	1	5
Carnivore		1		2	3
marmot (*Marmota sp.*)		3			3
mustelid (*Mustelidae family*)		3			3
porcupine (*Erethizon dorsatum*)	1	1		1	3
canid (*Canis sp*.)	2				2
bison (*Bison bison*)				1	1
cottontail rabbit (*Sylvilagus sp.*)		1			1
pine martin (*Martes sp.*)		1			1
Cultural Level Total	226	462	13	137	838
Shannon Diversity Index*	.66	.65	.68	1.34	1.00
Artiodactyl Index	.97	.96	.85	.86	.91
intrusive rodent	43	8	5	16	72

* medium artiodactyl, carnivore, mustelid and small mammal categories excluded from calculation

Table 12-5 Minimum number of individuals (MNI) by species and cultural level.

SPECIES	CULTURAL LEVEL				Total
	1	2	3	4	
bighorn sheep (*Ovis canadensis*)	2	2	1	2	7
beaver (*Castor candensis*)		1	1	2	4
deer (*Odocoileus sp*.)	1	1		1	3
porcupine (*Erethizon dorsatum*)	1	1		1	3
river otter (*Lontra candensis*)	1	1	1	1	3
bison (*Bison bison*)				1	1
elk (*Cervus elaphas*)				1	1
canid (*Canis sp*.)	1				1
pine martin (*Martes sp.*)		1			1
cottontail rabbit (*Sylvilagus sp.*)		1			1
marmot (*Marmota sp.*)		1			1

and river otter (Table 12-4). Although bighorn sheep was the dominant species present in each assemblage, the artiodactyl index, a summary statistic used to assess the relative importance of high-value prey species (Grayson 1991; Janetski 1997), was higher in Cultural Levels 1 and 2 than in Cultural Level 4 (Table 12-4). These findings suggest that bighorn sheep was the focal prey species during all periods of occupation at Goff Creek. However, the data indicate that there was an increase in diet breadth during the Late Archaic and or Late Prehistoric periods, a finding that is somewhat at odds with temporal subsistence trends at Mummy Cave (Hughes 2003).

Mummy Cave is located only 8.8 km downstream from Goff Creek. Generally speaking, the occupations documented at Goff Creek share many similarities with the Mummy Cave cultural levels, such as nearly identical suites of diagnostic projectile points, lithic raw material utilization and faunal assemblages dominated by bighorn sheep remains. The two sites were almost certainly occupied by some of the same people. Yet, unlike Goff Creek, Hughes (2003) found that there was persistently low species diversity and high artiodactyl indices in each of the cultural layers post-dating circa 6000 BP (Cultural Layer 19 [Husted and Edgar 2002]). This same pattern is apparent in Cultural Levels 1 and 2 at Goff Creek, but the predominantly Late Archaic-aged occupations of Cultural Level 4 are significantly more diverse than all of the cultural layers at Mummy Cave. This pattern may be due to season of occupation. The lower elevations of the North Fork valley are currently used as winter range by several herds of bighorn sheep. During the summer sheep typically migrate to higher elevations making them, at least in theory, less vulnerable to human predation (Hughes 2003).

The evidence from Mummy Cave indicates that 11 of 15 cultural layers with sufficient faunal remains were winter season occupations (Hughes 2003). Similarly, Eakin (1988) found that both of the Late Archaic occupations at Pagoda Creek, located approximately 22 km downstream from Goff Creek, also occurred during the winter. Only Cultural Layers 30 (ca. 4420-4090 BP) and 36 (ca. 1230 BP) at Mummy Cave were summer occupations. Yet, if season of site use was a causal force for an increase in diet breadth, then the Cultural Layer 30 and 36 occupations at Mummy Cave should also have produced a high diversity index and lower artiodactyl index. This was not the case. In the end, the poor contextual integrity and lack of reliable absolute dates from Cultural Level 4 hinder attempts at isolating the cause or causes of an increase in diet breadth at Goff Creek.

Butchering Practices

Hunting and butchering practices varied through time, across space and between different species. The strategies used to procure and process game are as important to our understanding of prehistoric subsistence as the identity of the preferred prey (Eakin 1989; Grayson 1991; Janetski 1997; Rapson 1990). Previous research along the North Fork and in surrounding areas of the Central Rockies has shown that bighorn sheep (Eakin 1989; Frison and Walker 1984; Hughes 2003; Rapson 2000) and deer (Fisher 1984; Kornfeld et al. 2001) were the primary high-ranked prey in the region. There is evidence from the Dead Indian Creek site, a McKean Complex winter base camp, that deer and sheep were butchered differently, though the reason(s) remain obscure (Fisher 1984). Kornfeld et al. (2001) also found several differences in butchering in their comparison of the Helen Lookingbill deer assemblage with the Bugas-Holding sheep assemblage. Thus, the following discussion will deal exclusively with the bighorn sheep and the medium artiodactyl remains thought to predominantly represent sheep. The low frequency of bison, elk, deer and smaller mammals prevents a detailed study of the butchering or hunting practices used at Goff Creek.

Both axial and appendicular elements are present in the sample, but the former are quite rare (Table 12-6, Figure 12-2). Crania, vertebrae, and ribs are absent or poorly represented in the Cultural Levels 1 and 2 assemblages, with the exception of axis vertebrae in Cultural Level 1 and atlas vertebrae in Cultural Level 2. Cranial fragments are much more common in Cultural Level 4, but again there are few to no vertebrae or ribs in the sample. Of the axial elements, only mandibles are consistently represented in the assemblages. The presence of appendicular elements was variable (Table 12-6, Figure 12-2), in part due to the highly fragmented nature of the remains. Few of the appendicular elements from any of the levels were represented by articular ends. In Cultural Level 1 metacarpals, radii and pelvises were the most commonly represented appendicular elements, but tibiae were also present with a ratio MAU of 50. Humeri, radii, metacarpals and metatarsals showed the highest representation in Cultural Level 2. The Cultural Level 4 assemblage contained few forelimb elements with the exception of metacarpals and carpals. Hind limb bones, such as tibiae, astragali, femora, calcanei and pelvises were less common than forelimb elements but present.

Relatively few cut marks were identified during the faunal analysis (Table 12-3). Of the 28 such marks identified on bighorn sheep and medium artiodactyls, 26 were found on the shafts of longbones, suggesting that meat was filleted off the bone on site. Unlike the deer assemblage from Helen Lookingbill, there were no cut marks identified on carpals, tarsals or third phalanges (Kornfeld et al. 2001). Kornfeld and colleagues (2001) suggest that the cut marks on these elements indicate that these low-utility elements were intentionally removed and discarded to facilitate transport of the hind limbs to a location where they could be further processed. This pattern is contrasted with that observed in the sheep assemblage from Bugas-Holding where it would appear entire limb units were transported to the base camp (Kornfeld et al. 2001). Kornfeld and colleagues (2001) argue that the butchering pattern documented at Helen Lookingbill is consistent with a kill-butchery location at a relatively short-term hunting camp. The elements missing or poorly represented in the Helen Lookingbill assemblage are high-utility parts, such as cervical and thoracic vertebrae, ribs, pelvises and femora. It is argued that these parts were removed from the site in manageable units and taken to a logistical base camp for further processing. However, the presence of low-utility elements and the absence or poor representation of axial elements and/or high utility body parts of medium artiodactyls is a pattern seen not only at kill-butchery sites, but also residential base camps and even permanent villages (Eakin 1989; Fisher 1984; Janetski 1997).

Table 12-6 Minimum number of elements (MNE), minimum animal units (MAU) and ratio of minimum animal units (%MAU) recorded for Cultural Levels 1, 2 and 4.

Skeletal Element	Cultural Level 1			Cultural Level 2			Cultural Level 4		
	MNE	MAU	%MAU	MNE	MAU	%MAU	MNE	MAU	%MAU
Cranium				2	1	22	2	2	80
Mandible	4	2	100	9	4.5	100	2	1	40
Atlas				1	1	22			
Axis	1	1	50	1	1	22			
Cervical Vertebra 3-7				2	0.2	4	1	0.2	8
Pelvis	3	1.5	75	3	1.5	33	2	1	40
Rib	1	0.04	2	2	0.08	2	1	0.04	2
Scapula	1	0.5	25	4	2	44			
Humerus	1	0.5	25	9	4.5	100	1	0.5	20
Radius	3	1.5	75	8	4	89	1	0.5	20
Ulna	1	0.5	25	2	1	22	1	0.5	20
Carpal	1	0.5	25	2	1	22	5	2.5	100
Metacarpal	3	1.5	75	9	4.5	100	5	2.5	100
Femur	1	0.5	25	1	0.5	11	2	1	40
Tibia	2	1	50	1	0.5	11	3	1.5	60
Patella							1	0.5	20
Astragalus	1	0.5	25	1	0.5	11	3	1.5	60
Calcaneus	1	0.5	25	2	1	22	2	1	40
Tarsal							1	0.2	7
Metatarsal	1	0.5	25	9	4.5	100	1	0.5	20
Phalanx	5	0.625	31.25	18	2.25	50	7	0.875	35
Sesamoid	2	0.25	12.5	4	0.5	11	1	0.25	10

The faunal assemblages from Goff Creek display several patterns that have been documented at many sites, most notably Pagoda Creek (Eakin 1989). First, the assemblages are highly fragmentary, which is a likely result of intensive processing of bone for marrow and grease extraction. Second, with the exception of mandibles and in Cultural Level 4 cranial elements, there is a near absence of axial elements. Third, high-utility long-bones, those that contain the largest amount of marrow, are represented almost entirely by shaft fragments. These patterns led Eakin to propose the following butchering and processing hypothesis for the Pagoda Creek assemblages:

> *1) Complete carcasses of mule deer or mountain sheep were returned to the . . . site where they were systematically butchered.*
> *2) Portions of the carcasses were either divided up among hearth groups, or after meat stripping . . . deposited in an area for further processing or disposal.*
> *3) Cracking of longbones and segregation and collection of longbone articular ends occurred.*
> *4) Pulverizing and rendering of collagenous bone of both longbones and vertebrae [Eakin 1989:95].*

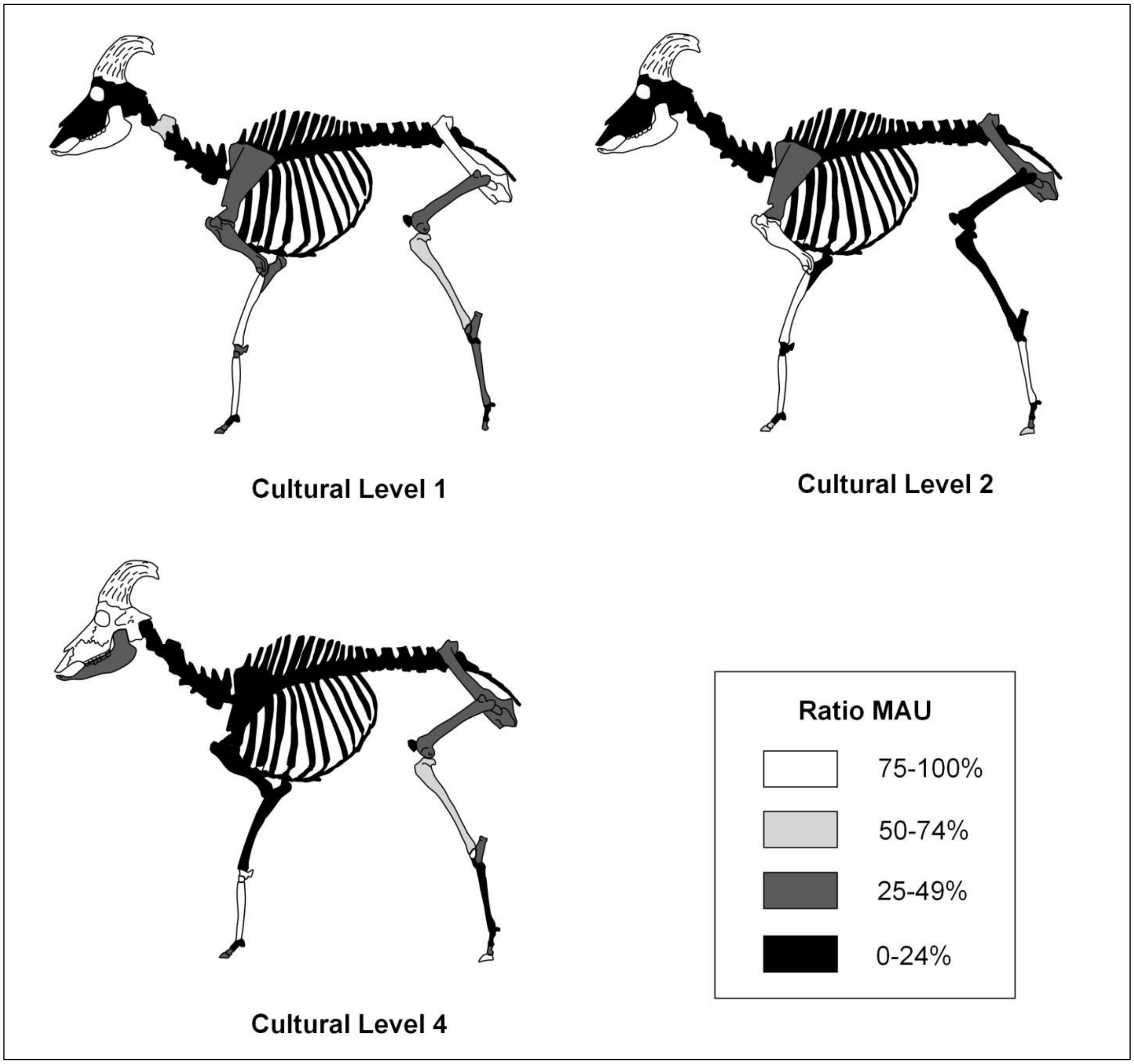


Figure 12-2 Standardized minimum animal units (ratio MAU) values for faunal remains of bighorn sheep/medium artiodactyls from Cultural Levels 1, 2 and 4.

Unlike bison, medium artiodactyls, in particular sheep, are small enough that they can be transported whole with relatively little effort (Eakin 1989). Of course logistical constraints at times would require that the carcass be divided, if for instance a lone hunter made a kill or if the kill site was several miles or more from the base camp. Yet, even if the carcasses were dismembered at the kill, it does not necessarily follow that the vertebral column and rib cage were invariably abandoned. The presence of cranial fragments and the occasional vertebra and rib in the Goff Creek assemblages provides some evidence that at least occasionally whole animals, be they in parts or complete, were brought back to camp.

The excavations at Pagoda Creek were too limited to allow a complete test of Eakin's hypothesis. In particular, locations were pulverized vertebrae and articular ends of long bone were dumped after rendering were not identified. However, at Goff Creek 10 dense concentrations of highly fragmented bone were identified within close proximity to thermal features. The bone was too fragmentary to allow identification, but that is precisely what would be expected if vertebrae, ribs and long bone ends were pulverized, boiled and dumped. A systematic butchering and processing strategy that resulted in the near complete destruction of axial elements and collagenous long bone ends would account for the absence of these elements at both kill-butchery sites as well as residential camps.

Hunting Strategies

It is not known whether the sheep present at Goff Creek were taken by encounter hunting or mass kill events. The relatively large number of projectile points, many of which appear to have broken on impact, provides some evidence for encounter hunting. However, it is also possible that sheep were taken communally with the use of traps. Eakin (2011) recently recorded two sheep traps (48PA3209 and 48PA3210) approximately 2.2 km east-southeast of the Goff Creek site. These structures likely date to the Protohistoric or Early Historic periods and are probably the work of the Shoshone (Eakin 2011; Kornfeld et al. 2010).

There is evidence that sheep were trapped using nets as far back as the Late Paleoindian period. A large net, 50-65 m in length and 1.5-2 m in height, made of juniper bark was found in a dry cave on Sheep Mountain, about 42 km downstream from Goff Creek (Frison 2004; Kornfeld et al. 2010). Frison (2004) argues that the nets were suspended across paths and sheep were driven into them. Once entangled, the sheep, which have a natural tendency to simply lie down rather than struggle, were killed with clubs. A piece of the net was radiocarbon dated to 8800 BP, or about the time Goff Creek was first inhabited (Frison 2004; Kornfeld et al 2010). A fragment of a similar net was also recovered at Mummy Cave from Cultural Layer 30, dated to circa 4200 BP.

If sheep were taken in traps and/or nets and bludgeoned rather than impaled with darts or arrows by solitary hunters (Frison 2004; Kornfeld et al. 2010), then one would expect to find a lower proportion of projectile points to sheep in assemblages where some or all of the sheep were trapped. Mummy Cave, the only site in the region from which a diachronic analysis is possible (Hughes 2003; Husted and Edgar 2002), does show an interesting pattern in proportion of points to identifiable sheep elements (Figure 12-3). Throughout the Foothills-Mountain Paleoindian period there are low point to NISP ratios followed by a dramatic increase during the Early Archaic. The ratios again decline in the Middle Archaic followed by an increase in the Late Archaic. The Late Prehistoric is somewhat difficult to assess because the acquisition of the bow and arrow may have led to an overall increase in the number of projectiles

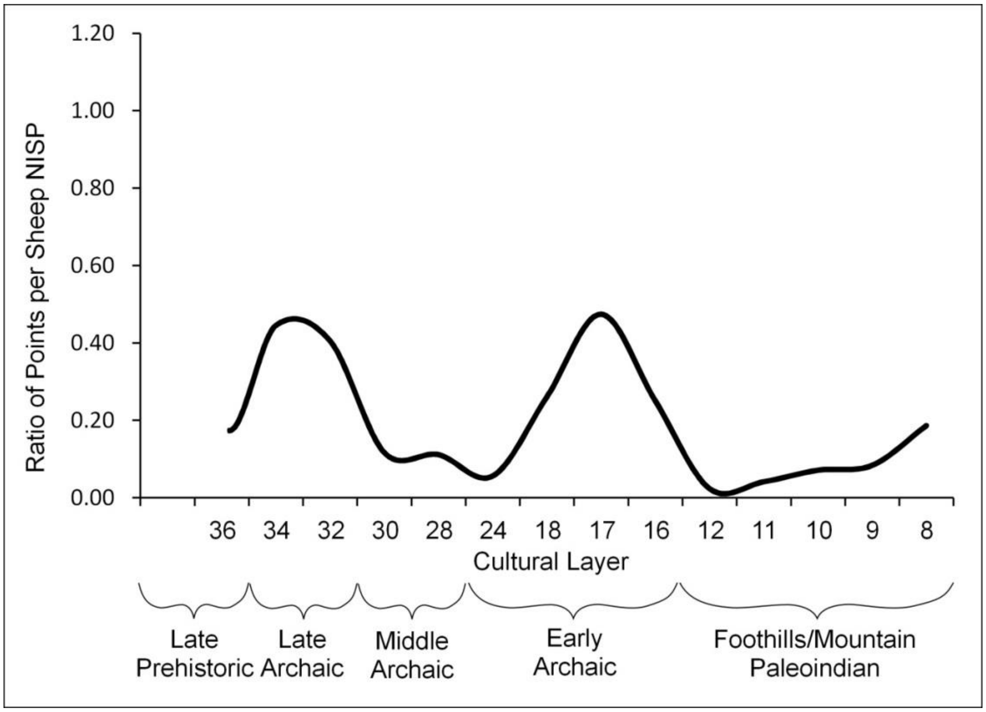


Figure 12-3 Ratio of projectile points to bighorn sheep NISP at Mummy Cave (48PA201 [Hughes 2003; Husted and Edgar 2002]).

produced by any one hunter. Even if that were so, there was a dramatic decrease in the points to NISP ratio during the early part of the Late Prehistoric Period. The two periods for which we have evidence, albeit limited, of sheep procurement using nets, circa 8800 BP and 4200 BP, coincide with decreases in the proportion of projectile points to sheep NISP at Mummy Cave. Unfortunately, Cultural Layers 37 and 38, which are thought to be affiliated with the Shoshone, produced very little bone preventing their inclusion in this analysis. Thus, it is unclear what if any effect the use of sheep traps had the composition of lithic assemblages.

The pattern apparent in the Mummy Cave assemblages is not repeated at Goff Creek, however. Cultural Levels 1 and 2, which likely represent predominantly Early Archaic-aged occupations, had the lowest ratio of points at .14 and .07, respectively. The ratio in Cultural Level 4 was nearly three times (.53) that observed in the earlier levels. The post-depositional mixing of Late Archaic and Late Prehistoric occupational debris at Goff Creek likely precludes a more refined assessment of the point to NISP ratios or if there were any significant differences between the Late Archaic and Late Prehistoric occupations. Although this inquiry is inconclusive in the case of Goff Creek, these findings do warrant further research.

In summary, the faunal assemblages from Goff Creek clearly show that there was a continuing focus on bighorn sheep procurement at Goff Creek during all periods of occupation. It is unclear whether communal hunting, performed with the aid of sheep traps or nets, was used to acquire any of the animals identified at the site, but given other lines of evidence, it seems likely these methods were used at least occasionally. Once killed, the sheep were either brought to the site whole or field dressed into smaller more easily transported portions. The dearth of axial skeletal elements in the assemblages is believed to have been the result of intensive processing of these fatty bones for marrow and grease extraction. This interpretation is supported by discrete clusters of pulverized bone that were identified throughout the excavations and in every cultural level. One marmot is represented in the Cultural Level 2 assemblage, and at least one of its elements is burned indicating cultural modification. Since marmots hibernate, the presence of their remains do indicate a late spring through early fall occupation within Cultural Level 2. There are no other data from the faunal assemblages with which to make a seasonality assessment.

Plant Use

Although 126 liters of sediment from 16 features were floated for recovery of macrofloral remains, only nine carbonized seeds, 14 pieces of unidentified carbonized starchy tuber and five pieces of carbonized cactus were recovered from six features (Table 12-7). Bach (Appendix C) and Havener (Appendix D) suggest that the presence of these seeds and tubers suggests an occupation ranging from spring through the fall. However, seeds, berries and tubers were frequently processed, dried and stored for winter consumption (Reeve 1986; Wright 1984). Thus, the mere presence of these food items, especially in such low frequency, does not unequivocally substantiate a warm season occupation or the targeted exploitation of plant resources.

Table 12-7 Potentially edible carbonized plant remains identified in floated feature fill.

Feature	**Block**	**Cultural Level**	**Buffaloberry**	**Sunflower**	**Cheno-Am**	**Wild Buckwheat**	**Unidentified Seeds**	**Unidentified Tuber**	**Cactus**	**Feature Total**
20	F	4						2		2
23	F	3						3		3
1	A	2	1				2	4		7
2	A	2	1				5		5	11
8	B	2						5		5
14	B	1		1	6	1				8
Total			2	1	6	1	7	14	5	36

Other evidence for the exploitation of plants comes from the small groundstone assemblage. Groundstone was found in each cultural level at Goff Creek except Cultural Level 1. This indicates some processing of plant resources occurred, at least sporadically, throughout the human occupation of the site. However, the distribution of groundstone may reflect a pattern of increased exploitation of plant resources during the Middle Archaic. Of the 10 pieces of groundstone recovered, half were found in Cultural Level 3, this despite the fact that only 11 m^2 of the level were excavated. At Mummy Cave only two levels, Cultural Layers 30 and 36, produced groundstone tools (Husted and Edgar 2002). It would seem more than a coincidence that Cultural Layers 30 and 36 were also the only layers found to contain summer occupations (Hughes 2003). However, a large assemblage of groundstone was also recovered from the Dead Indian Creek site, but the evidence there indicates winter occupations (Miller and Bedord 1984). Cultural Level 3 at Goff Creek was dated to 4310±30 BP, which is statistically within the age range of the dates from Cultural Layer 30 (4420±150 BP – 4090±140 BP [Husted and Edgar 2002]). An increase in the exploitation and processing of plant resources, such as small seeds, roots and tubers, is a hallmark of the McKean Complex of the Middle Archaic period (Kornfeld et al 2010). The data from Cultural Level 3 lend additional support to an increase in the emphasis on plant exploitation.

It is unlikely, given the small quantity of carbonized seeds and potentially edible tubers, that plant harvesting or processing played a significant role in the subsistence strategy of the site's inhabitants. It may be that plant resources contributed a greater part to the diet during the Middle Archaic period, but the Cultural Level 3 sample from Goff Creek is too limited to make such an assessment with any confidence.

Activity Area Analysis and Site Function

Spatial analyses were performed for most of the cultural levels and excavation blocks at Goff Creek. The purpose of these analyses was to identify activity loci reflected in concentrations of artifact types. Similar studies have proved invaluable in identifying hearth centered activity areas (Binford 1978; Rapson 1990; Stapert 1989), and the presence of structures or thermal features that were otherwise not visible (Page 2016b; Surovell and Waguespack 2007). Ethnoarchaeological studies have shown that people working around a hearth typically position themselves upwind to avoid smoke from the fire (Binford 1978; Rapson 1990). Large pieces of bone or rock are often discarded away from the upwind side of the hearth in areas referred to as "toss zones" (Binford 1978, 1983). These activities have been found to produce asymmetrical distributions of artifacts around a hearth with concentration of smaller artifacts occurring on the upwind side. Wind and smoke are less of a concern when a hearth is positioned within a shelter, but still larger pieces of trash are typically discarded outside, often adjacent to the door in a "drop zone" (Stapert 1989; Surovell and Waguespack 2007). Moreover, asymmetrical distributions of artifacts may also occur within structures due to a tendency of hunter-gatherers to divide interior space into task-specific areas (Binford 1983; Surovell and Waguespack 2007). Smaller artifacts, such as debitage or stone tools will then accumulate around the circumference of the hearth up to the edge of the structure often creating a clear demarcation between interior and exterior space. Site maintenance activities, such as the cleaning of hearths, roasting or boiling pits, also produce discernable patterns when refuse is dumped into piles.

The spatial analyses of the cultural levels at Goff Creek revealed a number of patterns in the distribution of artifacts that can be used to infer site function and perhaps season of occupation. However, not all excavation blocks and cultural levels produced interpretable results. The limited samples from Cultural Level 1 of Block A, and all of Cultural Level 3 in Blocks C, E and F prevent any meaningful analysis of spatial patterning. Cultural Level 1 of Block D and all of Cultural Level 4 contained mixed deposits and/or failed to reveal any clear spatial patterning. For these reasons the following discussion will focus on Block A Cultural Level 2 and Block B Cultural Levels 1 and 2.

Cultural Level 1

Six features and three lithic concentrations were identified in Cultural Level 1 of Block B. There were relatively few artifacts found in association with the three features (9, 12, and 14) in the northern half of the block. However, two small concentrations of debitage and bone, as well as a flake tool and a hafted knife were identified immediately south of Feature 14 and west of Feature 12. A dense concentration of debitage, designated Lithic Concentration 3 was located approximately one meter south of Feature 9. These artifact clusters appear to represent stone tool manufacturing or maintenance loci. The prevailing winds are typically out of the west (down-valley) along the North Fork (Eakin 2012). Thus, the lithic concentrations, and the knapper who produced them, would have been positioned out of the prevailing direction of smoke from the hearths. This may indicate that the hearths were exterior features and the limited number of artifacts would indicate a short-term use of the space. One dense cluster of highly fragmented bone that probably represents a hearth or boiling pit clean-out was found just south of Feature 12. As noted above, the presence of such dumps is a predictable result of intensive bone grease production.

The southern half of Block B also contained three features (3, 4 and 5) and two lithic concentrations (1 and 2). Lithic Concentration 1 was identified less than a meter east of Feature 3 and west-southwest of Feature 4 and likely represents an episode of stone tool production. A small cluster of flake tools and bone were identified on the west and northwest side of Feature 3 as well. What appears to be a cache of stone tools, containing 13 utilized or retouched flakes and two scrapers was found 40-60 cm northeast of Feature 5. Some bone was also found in the immediate vicinity. A debitage concentration containing a diffuse scatter of five bifaces and a scraper was found one meter to the east of the cache and

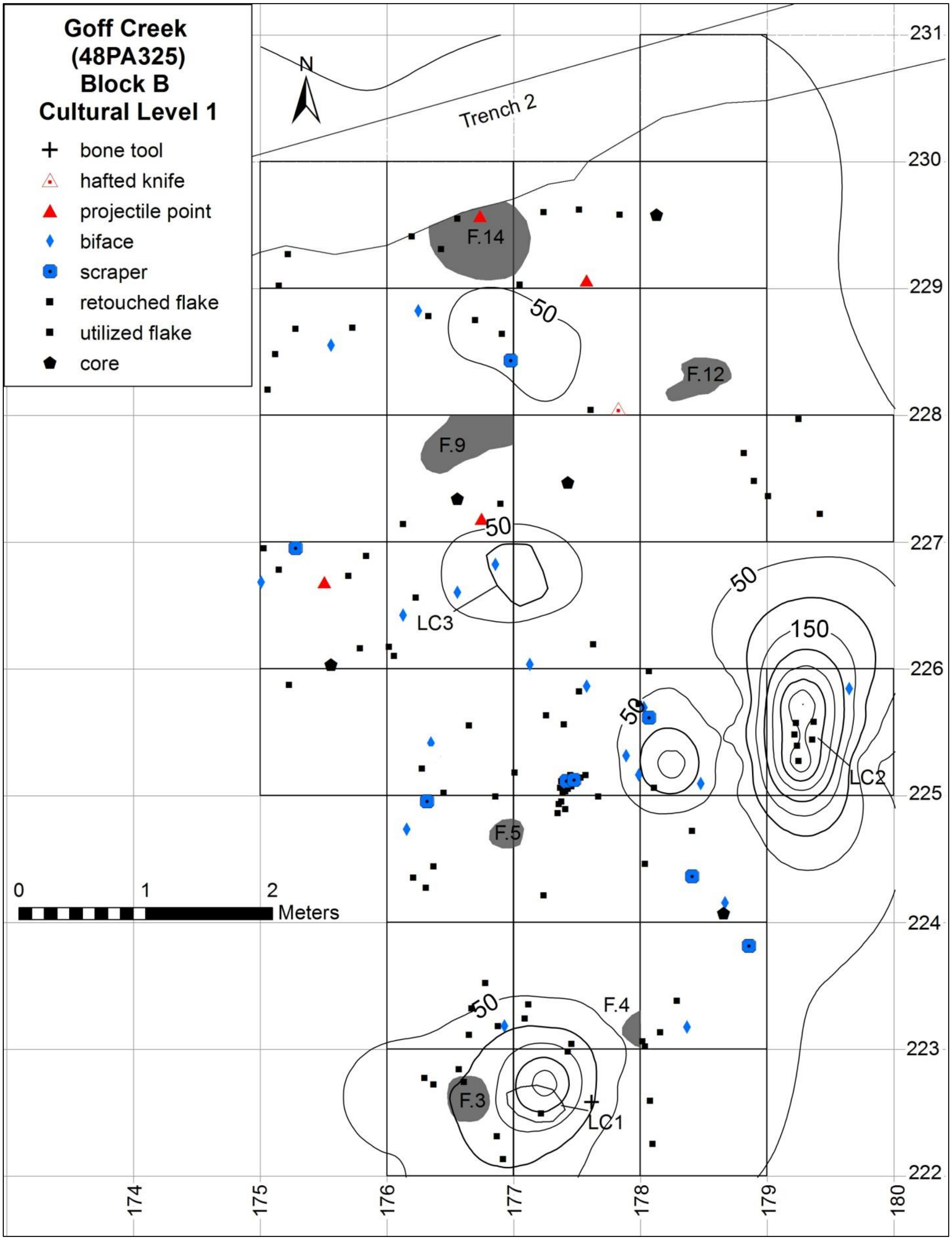


Figure 12-4 Piece plotted tools and debitage frequency contours for Block B Cultural Level 1.

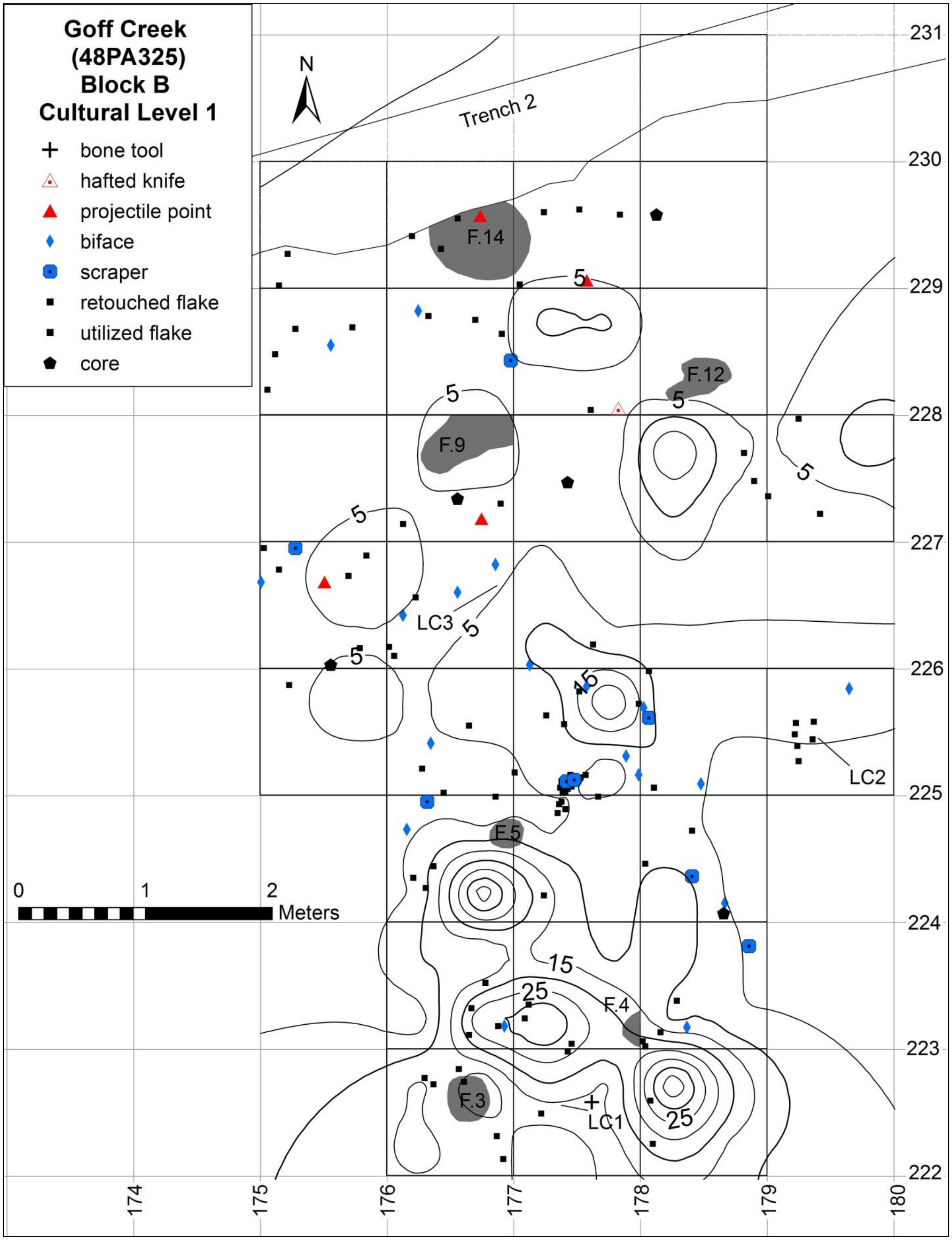


Figure 12-5 Features, piece plotted tools and bone frequency contours for Block B Cultural Level 1.

one meter west of Lithic Concentration 2 (Figure 12-4). Four clusters of pulverized bone were found adjacent to Features 3, 4 and 5, which again suggest the cleaning and reuse of hearths or boiling pits for bone grease processing. Three of the four bone clusters were located east and at least a half of a meter away from Feature 3. Unlike the northern features, artifacts were found clustered upwind and downwind of the hearth, and there is an asymmetrical patterning of artifacts by type with bone and flake tools found to the west and debitage to the east. Similar patterning of artifacts was found at the Barger Gulch site and was interpreted as hearth-centered use of space within a structure (Surovell and Waguespack 2007). Unfortunately, the boundary of the excavation block was less than a meter from Feature 3, which prevents a more detailed analysis of spatial patterning.

Cultural Level 2

Block A Cultural Level 2 contained two features, 1 and 2, the latter of which probably represents a clean-out of the former. Seven lithic concentrations were identified, three (1-3) of which were clustered within one square meter and merge into one large cluster on the debitage frequency contours (Figure 12-6). All of the lithic concentrations were more than a meter from the features and do not appear to represent hearth-centered activities. There was a somewhat diffuse concentration of debitage and flake tools south of Feature 1, however, that may reflect one or more flint knapping episodes adjacent to the fire. Tools in this level appeared to be scattered in no particular pattern through the excavation block. A dense concentration of crushed bone was located less than a meter north of Feature 1 and again probably reflects a dump of grease-rendered bone (Figure 12-7). There are three apparent toss zones to the north, south and east of Feature 1 represented by scatters of fire-cracked rocks, cores and broken tools. There are at least two occupations in Cultural Level 2 with features 1 and 2 associated with the upper component. Thus, it is unclear which of the artifact clusters are associated with which component.

Five features were identified in Block B Cultural Level 2 (Figures 12-8 and 12-9). Features 6 and 7 were in the southern portion of the block located adjacent to each other. It is likely that Feature 6 represents a clean-out of Feature 7. Features 10, 11 and 13 located in the northern portion of Block B are probably related to the same event, but it is unclear which, if any, are hearths and which are dumps associated with the site maintenance activities. There were two clusters of debitage located east and southeast of Features 10, 11 and 13 (Figure 12-8). A small number of flake tools, a scraper, two bifaces, two projectile points and a cluster of pulverized grease-rendered bone are associated with this activity area. It is unclear whether these artifacts are asymmetrically distributed around the features because Trench 2 removed all the material to the north and no excavations were carried out to the west. Another activity area is apparent adjacent to Features 6 and 7 where two concentrations of debitage were found immediately to the northwest and southeast. Feature 6 contained a several large fire-cracked

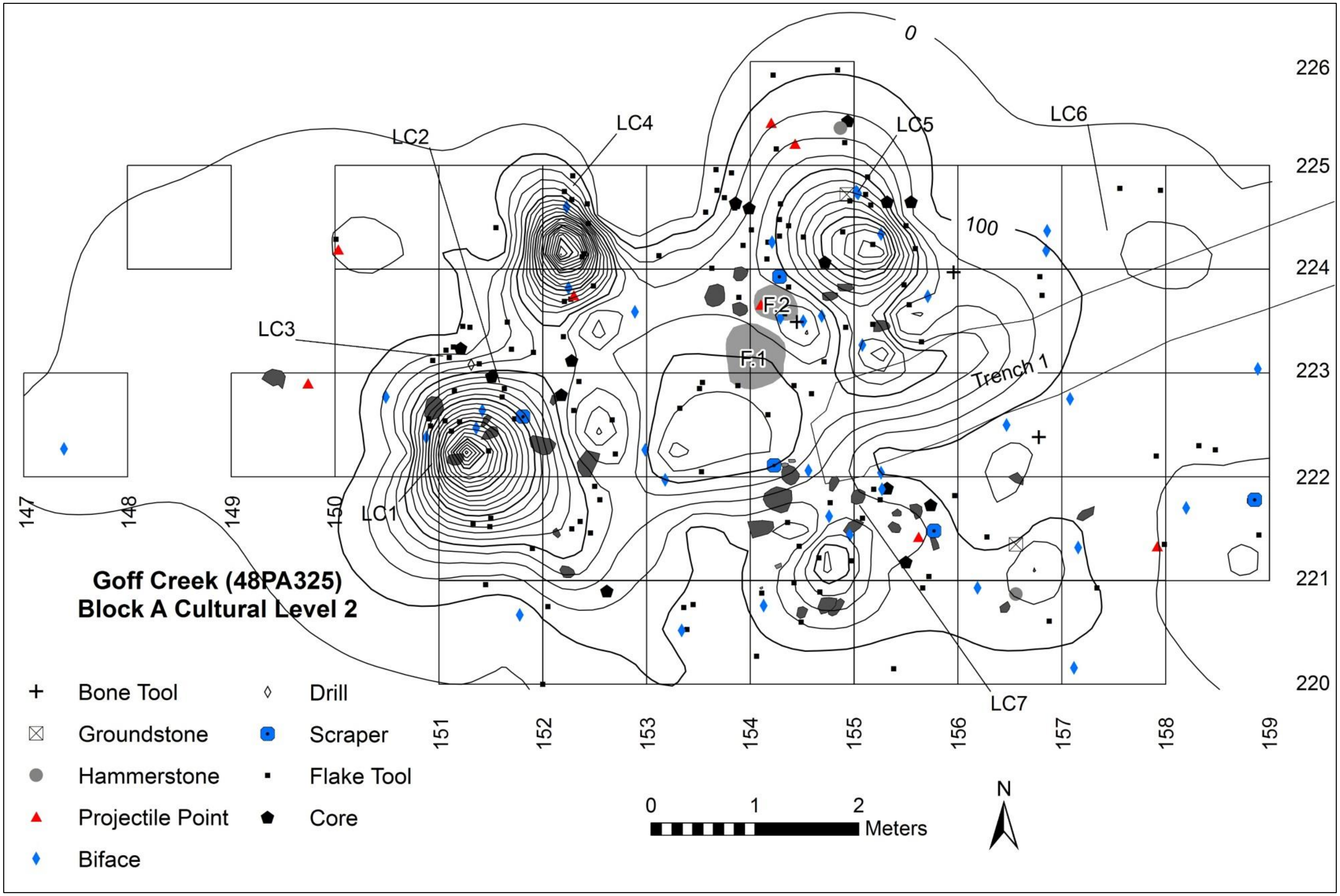


Figure 12-6 Features, piece plotted tools and debitage frequency contours for Block A Cultural Level 2.

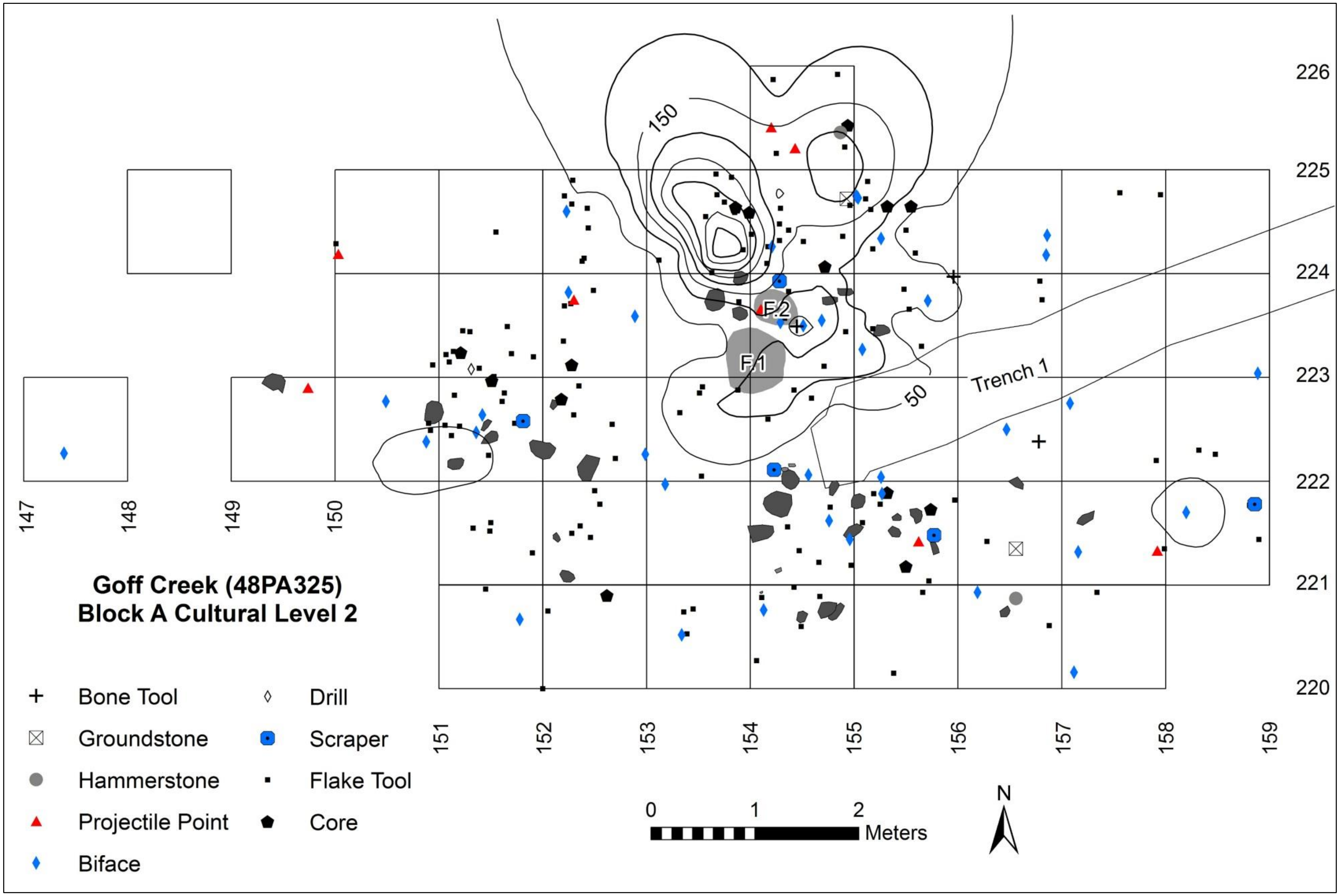


Figure 12-7 Features, piece plotted tools and bone frequency contours for Block A Cultural Level 2.

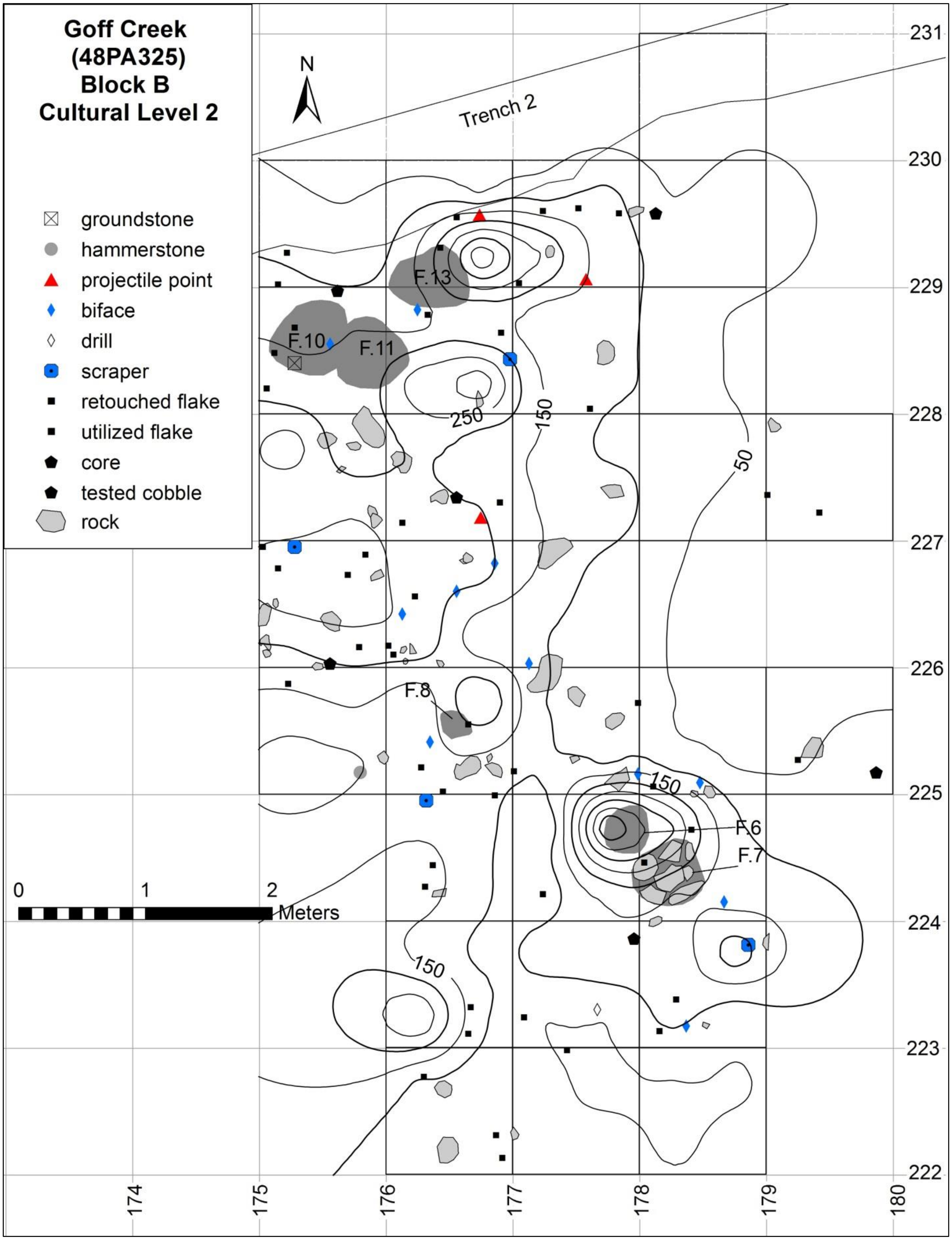


Figure 12-8 Features, piece plotted tools and debitage frequency contours for Block B Cultural Level 2.

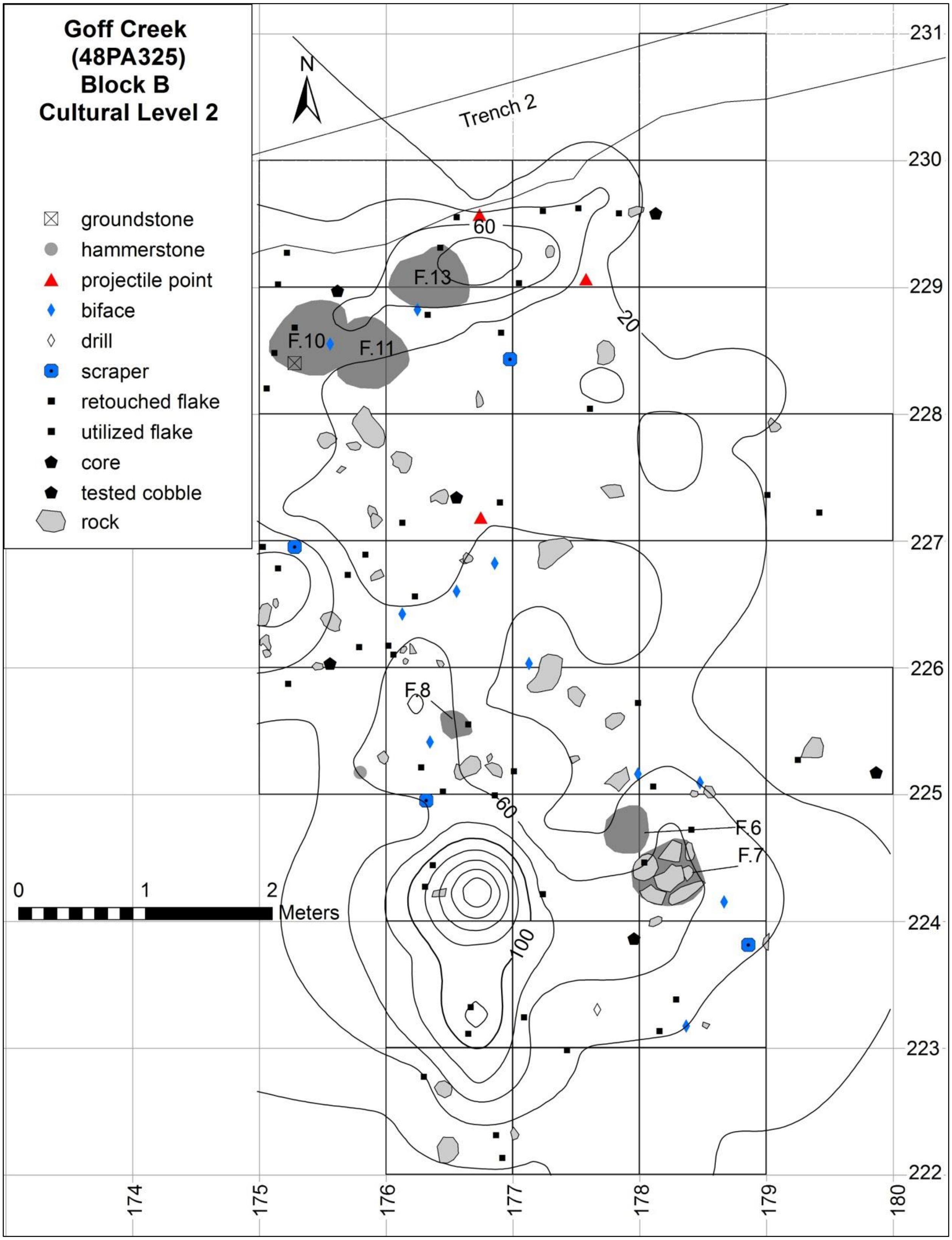


Figure 12-9 Features, piece plotted tools and bone frequency contours for Block B Cultural Level 2.

cobbles, but its shallow depth suggests that it was not a roasting pit. It would seem more likely that the hearth was used to heat stones that were then used to boil water in a skin or stomach-lined pit or platform. There was a dense concentration of pulverized bone, located a little more than a meter west of Feature 6 and 7, which appears to be a refuse dump. There was a diffuse scatter of fire-cracked rock between the northern and southern activity areas that may represent a toss zone.

Cultural Levels 3 and 4.

The limited and non-contiguous extent of the Cultural Level 3 excavations precludes a spatial analysis. Nevertheless, one unit in Block C produced a concentration of crushed bone that likely represents a dump of rendered bone. Similar concentrations of highly fragmented bone were also found in Cultural Level 4 of Block E, adjacent to Features 18 and 19, and in Block F next to Feature 21. Low depositional rates and post depositional mixing has have prevented or destroyed the spatial patterning of debitage, if any existed to begin with, in most of Block F. Block E did contain a large feature, but there were no indications that it was the center of stone tool production or maintenance. There were several concentrations of chipped stone surrounding Feature 15 in Block C, as well as two boiled bone dumps, but the sampling was limited and the artifact distributions largely ambiguous. Nevertheless, it would appear that these later occupations reflect the same focus on bighorn sheep procurement and intensive processing of bone for marrow and grease.

Summary

There is no clear evidence that any of the features identified were enclosed within a structure. Some of the hearth-centered activity areas are in places that would have been downwind on the average day. Yet, as anyone who has sat around a campfire can attest, wind direction is highly variable. Many of the activity loci were within close proximity to hearths, but others were not. In the end, the data are equivocal as to whether structures covered some or any of the hearths, but they very likely did. Perhaps future research employing a ring and sector analysis could clarify some of the ambiguity. There was clear evidence of toss zones in both Blocks A and B. The presence of dense concentrations of pulverized bone is the only ubiquitous pattern observed in the spatial analysis at Goff, which attests to the importance of the intensive and persistent focus on bighorn sheep procurement. The primary activities in evidence for all of the cultural levels include tool production and maintenance, butchering, marrow extraction and bone grease production, hide preparation, clothing and shelter manufacturing, repair and maintenance and food production. The range and intensity of activities and spatial patterns they left strongly suggest that Goff Creek served as a secondary base camp for hunter-gatherers who used the location for the primary purpose of procuring bighorn sheep. The evidence pertaining to season of occupation is ambiguous, but since there were multiple occupations spanning at least 5,000 years it is probable that people camped there, one time or another, during all seasons.

Inferences on Mobility: Lithic Raw Material Utilization

The raw material composition of chipped stone assemblages at Goff Creek differed significantly between cultural levels. Although locally available Eocene-aged chert and silicified wood comprised the majority of the raw material in each cultural level, there were significant quantities (>20%) of non-local stone in Cultural Levels 1, 3 and 4. There are multiple hypotheses that could account for this variation. One hypothesis, which extends from Bender and Wright's (1988) High Country Adaptation Model, is tied to the seasonal exploitation of plant and animal resources in high elevation environments. To briefly summarize, the model retrodicts that groups of hunter-gatherers scheduled their movements to coincide with the elevationally-delayed maturation, or *periodicity*, of high value plant and animal resources. According to Bender and Wright (1988) people wintered at lower elevation in the basins and foothills surrounding the Central Rockies. Several examples of these winter base camps have been identified, such as the Dead Indian Creek and Bugas-Holding sites (Kornfeld et al. 2010). When spring arrived, people moved into the high country to gather ripening roots and tubers and perhaps following migratory herds of big game that also wintered in the foothills. Throughout the summer bands moved higher into the Central Rockies where they likely focused on particular resource rich patches, such as the camas meadows around Yellowstone Lake (Reeve 1986). In the late summer and fall, according to the model, people would move back to the lower elevations of the foothills and basins.

Applying the data from Goff Creek to the model, bands of hunter-gathers who had wintered in the foothills of the Absaroka Mountains ascended the North Fork of the Shoshone in the spring and early summer bringing with them tool kits stocked with stone acquired in the Bighorn Basin and foothills, such as quartzite from the Tensleep and Morrison formations and chert from the Madison, Morrison and Phosphoria (and related) formations (Figure 12-10). During the course of their travels, as tools were lost to attrition, Eocene-aged chert and silicified wood, found throughout the valley, were used to replenish the tool kits. By the time the band reached Goff Creek, most of the Bighorn Basin/foothill-derived stone was expended. Assuming that the camas meadows of Yellowstone Lake, or some similarly rich resource patch in the Yellowstone Plateau was the target destination, then people probably arrived with tool kits containing high percentages of Eocene chert and silicified wood. On their return down the North Fork in the late summer or fall toolkits would have been replenished with stone from the Yellowstone Plateau, the most conspicuous of which was obsidian. Again by the time these people reached Goff Creek much of the obsidian was exhausted and replaced with local chert and silicified wood. Based on this model, components containing significant quantities of obsidian are from late summer through early winter occupations and components with significant amounts of Bighorn Basin/foothills-derived chert and

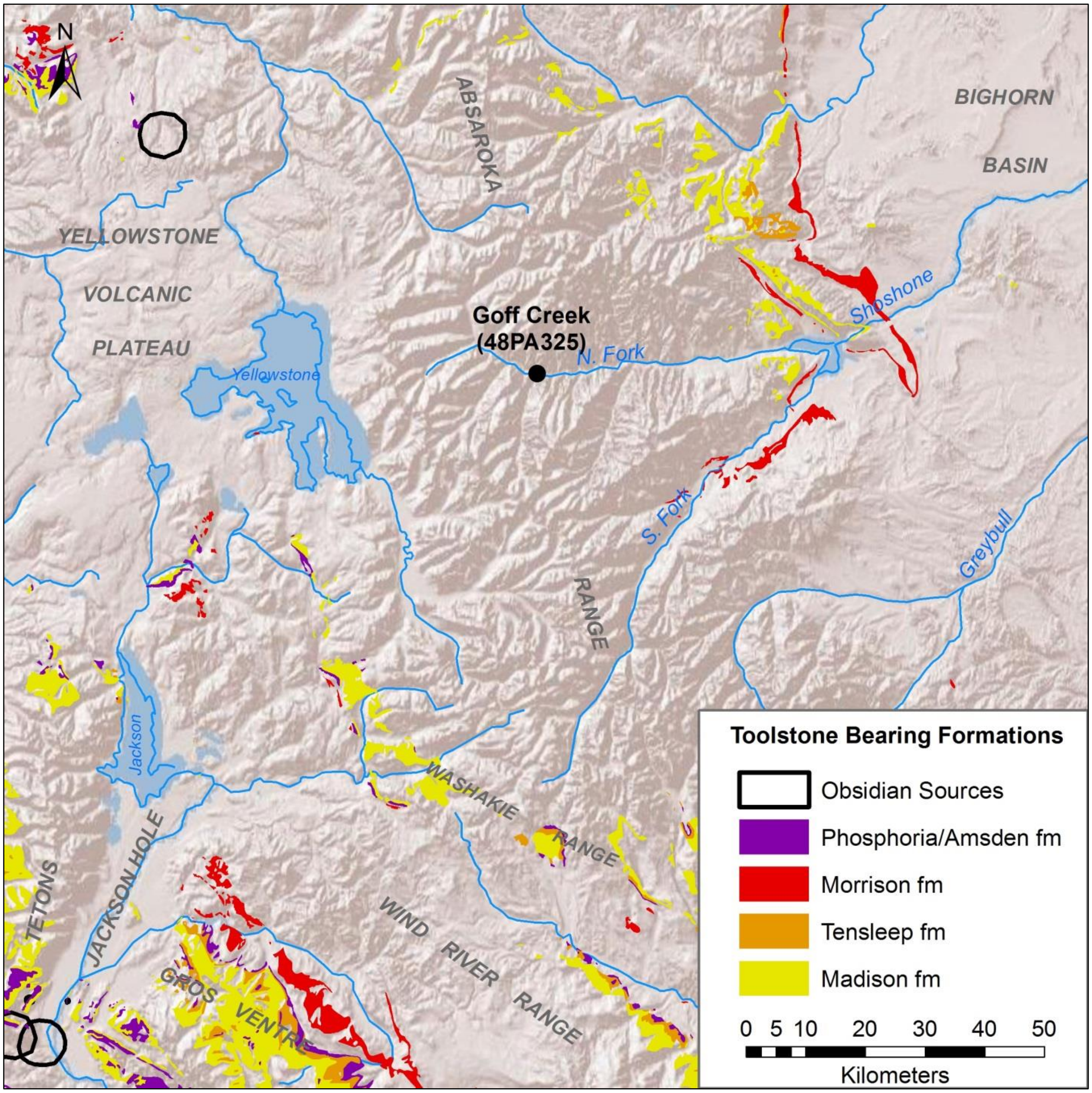


Figure 12-10 Potential sources of non-local stone found in the Goff Creek chipped stone assemblage. After, Love and Christiansen 1985.

quartzite are from occupations that occurred in the spring through mid-summer (Figure 12-11).

The data from Goff Creek conform to the High Country Adaptation Model. Since the cultural levels at Goff Creek are palimpsests spanning centuries or even millennia and containing multiple occupations, it is highly unlikely that any of the cultural levels accurately reflects the raw material utilization during any one component. Nevertheless, the cultural level assemblages should roughly reflect the combined accumulation of occupations from people heading in both directions, if Goff Creek

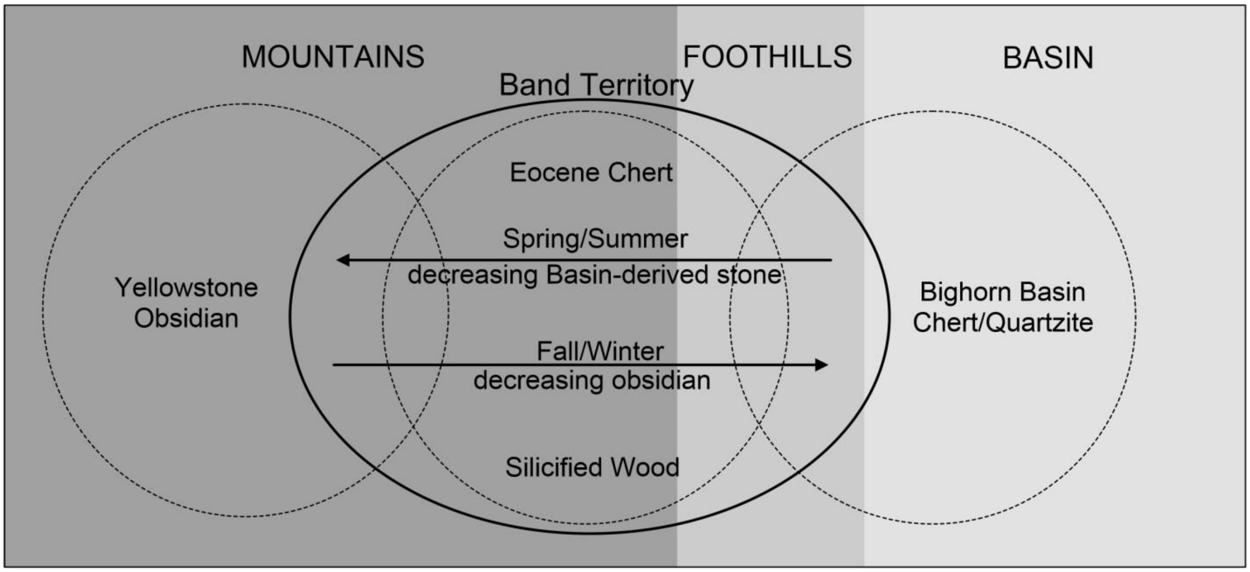


Figure 12-11 Model of stone use and attrition adapted from the Bender and Wright (1988) High Country Adaptation Model.

served as a camp along the route most traveled during the annual subsistence round. Since Goff Creek is roughly midway between the Bighorn Basin and the Yellowstone Plateau, the model would retrodict roughly equal proportions of basin/foothills-derived stone and Yellowstone obsidian. As would be expected the cultural levels contain about equal percentages of basin/foothills-derived stone (eastern) and obsidian (Table 12-8). Cultural Level 1 contained roughly twice the eastern stone than obsidian, but much of the eastern non-local stone came from a single Tensleep quartzite nodule in Block B. These data suggest that the various people who camped at Goff Creek maintained a similar seasonal subsistence and mobility pattern for thousands of years.

Table 12-8 Percentages of local and non-local stone by cultural level at Goff Creek.

Cultural Level	Local Stone	Eastern Stone	Obsidian
1	76.4%	15.6%	8.1%
2	91.5%	4.6%	4.0%
3	77.7%	9.9%	12.5%
4	69.8%	13.4%	16.8%

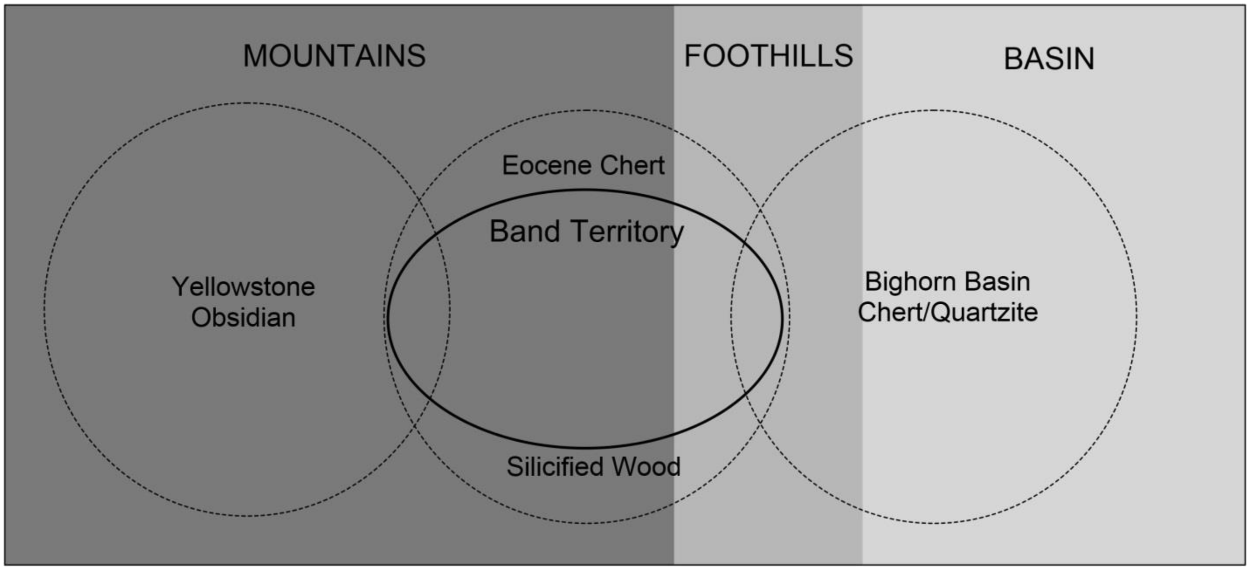


Figure 12-12 Model of stone use and attrition for Cultural Level 2 at Goff Creek.

The low numbers of non-local stone in the Early Archaic-aged Cultural Level 2 assemblage may be due to several factors. One possibility is that there was a reduction in band territory and/or mobility during the Cultural Level 2 occupations (Figure 12-12). It is also possible that the Cultural Level 2 occupations were task-specific winter hunting camps rather than temporary occupations during annual subsistence rounds. Such an interpretation would be in line with Hughes (2003) findings that most of the cultural layers at Mummy Cave were occupied during the winter months with an apparent focus on bighorn sheep procurement. Lastly, a change in the timing of band movements could also explain the low frequency of both obsidian and eastern stone in the Cultural Level 2 assemblage. For instance, if the band spent less time in the Basin/foothills and the Yellowstone Plateau, and more time hunting and gathering in the Absaroka Mountains then there would have been less opportunity to both expend and replenish tool kits with non-local stone.

There was consistently more obsidian in the Late Archaic/Late Prehistoric-aged Cultural Level 4 assemblages than in any of the earlier cultural levels at Goff Creek. A similar increase in the use of obsidian during the Late Archaic is documented at other sites in the area. At Mummy Cave 18% of the chipped stone tools in Layer 32, dated to 2820±135 BP, were obsidian, nearly twice as much as any other layer at the site (Husted and Edgar 2002). Similarly, the upper cultural level of Block E at Moss Creek (PA919), thought to include a Late Archaic component, contained 13.4% obsidian, again nearly twice as high as any other cultural level at the site (Eakin 2012). These data, though limited, suggest a pattern of stone tool use with fairly clear temporal parameters. The reason behind the increased use of obsidian during the Late Archaic period may be tied to an increase in human populations in the Central Rocky Mountains, particularly in the Yellowstone Plateau, that is inferred from frequency distributions of

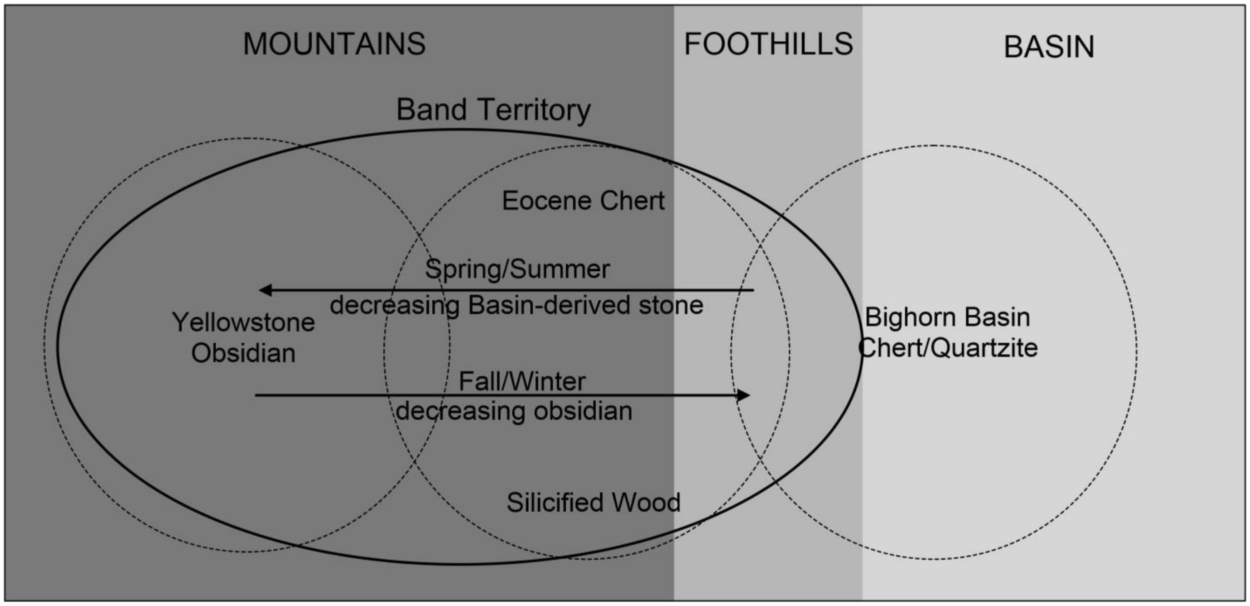


Figure 12-13 Model of stone use and attrition for Late Archaic-aged Cultural Level 4 at Goff Creek.

radiocarbon dates in the region (Kelly et al. 2013; Page 2016a; Surovell et al. 2009). Other portions of western Wyoming, as well as much of North America, witnessed steady population declines during this same period of time (Kelly et al. 2013; Williams 2012). An increase in the use of obsidian would be expected if a band with increasing population had a home territory centered on or near the Yellowstone Plateau (Figure 12-13).

The data from Goff Creek are not well suited to addressing questions of hunter-gatherer mobility because the cultural levels contain multiple, mixed components. Yet, the models presented above provide a foundation for future testing of the hypotheses regarding changes in hunter-gather subsistence and mobility in the Central Rockies. The data, though limited, do suggest that there was a contraction, or perhaps realignment, of hunter-gatherer territories during the Early Archaic period along the North Fork of the Shoshone River. The data also indicate that there was an increase in the human use of resources within the Yellowstone Plateau during the Late Archaic period. Future research could further elucidate these apparent patterns in human use of the Central Rockies and Greater Yellowstone Ecosystem.

Projectile Point Variation

Of the 124 projectile points recovered from Goff Creek 68 could be assigned to a previously defined type (Table 12-9). There were a small number (n=4) of points from Cultural Levels 1 and 2 that, despite being complete or nearly complete, did not closely resemble any named type in the region. Given the poor contextual integrity and the broad temporal duration of each cultural level, the Goff Creek projectile point assemblage is not well suited to detailed diachronic analysis. Be that as it may, the assemblage does provide some insight into the range of stylistic variation in projectile points during the

Figure 12-14 Early Archaic projectile point styles recovered from Goff Creek.

Early Archaic period. Moreover, the assemblage provides useful data that could be used to differentiate Early and Late Archaic corner-notched dart points.

Early Archaic Projectile Point Variation

The Early Archaic-aged cultural levels (1 and 2) at Goff Creek produced examples of each of the three named point types in the region. The Pahaska Side-notch type, also known as Northern and Bitterroot Side-Notched, is the quintessential Early Archaic Point type (Figure 12-14). This was the most common style of projectile point found in Early Archaic layers at Mummy Cave (Husted and Edgar

Table 12-9 Distribution of projectile points by type recovered from Goff Creek.

	Paleoindian		**Early Archaic**				**Middle Archaic**		**Late Archaic**	**Late Prehistoric**			
Cultural Level	**Cody**	**Angostura**	**Blackwater**	**Elko**	**Pahaska**	**Oxbow**	**Hanna**	**Duncan**	**Pelican Lake**	**Rose Spring**	**Desert SN**	**Desert TN**	**CL Total**
1	1	1	5	2	5	1							14
2			7	2	6								15
3						1							1
4							2	2	29	3	1	1	38
Total	1	1	12	4	11	2	2	2	29	3	1	1	68

2002), Helen Lookingbill (Kornfeld et al. 2001), and Trappers Point (Francis and Widman 1999). Yet, only 11 of the 28 (39.3%) identifiable points from the Early Archaic cultural levels at Goff Creek were Pahaska Side-Notched.

The Blackwater “Side-Notched” type was the most frequent style in the Early Archaic assemblage at Goff Creek. This style was defined by Husted and Edgar (2002) based on a small assemblage (n=5) of points from Cultural Layer 16, the oldest Early Archaic layer, at Mummy Cave. Although Husted and Edgar (2002) characterize the type as “side-notched,” two of the five Blackwater point are corner-notched based on the proximal shoulder angle. In the Goff Creek assemblage 10 of the 12 Blackwater points have proximal shoulder angles less than 140° and were therefore classified as corner-notched. Some of the Blackwater points from Goff Creek have concave bases, a characteristic that was not noted for the type by Husted and Edgar (2002:45). However, the “deep wide notches,” short base and “rounded” basal ears of these points closely resemble the Blackwater type and were therefore were assigned to the type. Given the stratigraphic position of the Blackwater points at Mummy Cave, Husted and Edgar (2002) argued that the type predates and was replaced by the Pahaska type. The data from Goff Creek neither substantiate nor disprove Husted and Edgars hypothesized sequence because there are too few reliable radiocarbon dates from the Early Archaic levels and post-depositional mixing has eradicated most evidence of stratified occupations. However, there were many corner and side-notched points recovered from multiple strata at Trappers Point that also conform to the Blackwater type. Since the Early Archaic occupations at Trappers Point spanned at least 1,000 radiocarbon years (ca. 6180-5160 BP) and post-date Cultural Layer 16 (7630 BP) at Mummy Cave by over a thousand years, it would seem that the Blackwater type has a much longer temporal duration than suggested by Husted and Edgar (2002).

A small number of points (n=4) were found that closely resemble the Elko Corner-Notched type. Elko Corner-Notched points are more common west of the Central Rockies in the Snake River Plain Great Basin, where they first appear during the Early Archaic (ca. 7500 BP [Holmer 2009]). Many of the Early Archaic corner-notched darts found at Trappers Point (Francis and Widman 1999) closely resemble Elko points, as do several points from well dated Early Archaic levels at Game Creek (Page 2016b). Three of the points recovered from Cultural Layer 16 at Mummy Cave, the same layer that contained all of the Blackwater type specimens, also closely conform to the Elko type.

Two points in the Goff Creek assemblage bear some resemblance to the Oxbow type. It is possible that these points, one of which is highly fragmentary, are actually Pahaska points with deeper than average concave bases (eg. Figure 12-14, #6,217). Oxbow is a cultural complex from the Northern Plains that spanned the latter part of the Early Archaic and well into the Middle Archaic (Kornfeld et al. 2010). One unmistakable Oxbow point was recovered from the Moss Creek site, about 20 km downstream from Goff Creek, and a few Oxbow, or Oxbow-like, points were also found in Cultural Layers 24 and 28 (Early/Middle Archaic ca. 5390-4390 BP) at Mummy Cave, as well as stratum V at Trappers Point (Francis and Widman 1999).

Table 12-10 Percentages of corner-notched (CN), side-notched and stemmed points in the stratified Early Archaic assemblages from Mummy Cave and Trappers Point.

Mummy Cave (48PA201)							Trappers Point (48SU1006)					
	BP	CN	SN	ST	n=			BP	CN	SN	ST	n=
18-19	7140	18.2%	81.8%	0.0%	11		VI-VII	4690	30.4%	63.0%	6.5%	18
17	6780	0.0%	100.0%	0.0%	6		IV-V	6010-5160	42.1%	55.3%	2.6%	38
16	7630	50.0%	50.0%	0.0%	8		I-III	7880-6180	55.6%	33.3%	11.1%	46

Although most of the points from the Early Archaic cultural levels at Goff Creek can be pigeon-holed into a typological category based largely on proximal shoulder angle, there is some question whether the differences in types are in any way correlated with cultural groups, time or space (Francis and Widman 1999:165). Based on samples of Early Archaic darts recovered from Goff Creek, Mummy Cave and Trappers Point, side and corner-notched darts appear to form opposite ends of a continuum with no clear plane of demarcation based solely on proximal shoulder (notch) angle (Figures 12-15 through 12-17). However there is some stratigraphic evidence from Mummy Cave (Husted and Edgar 2002) and Trappers Point (Francis and Widman 1999) that corner-notched darts were more common during the earlier portion of the Early Archaic (Table 12-10, Figure 12-17). Since 27 (52.9%) of the 51 points and point fragments from Cultural Levels 1 and 2 at Goff Creek are corner-notched it is possible that a

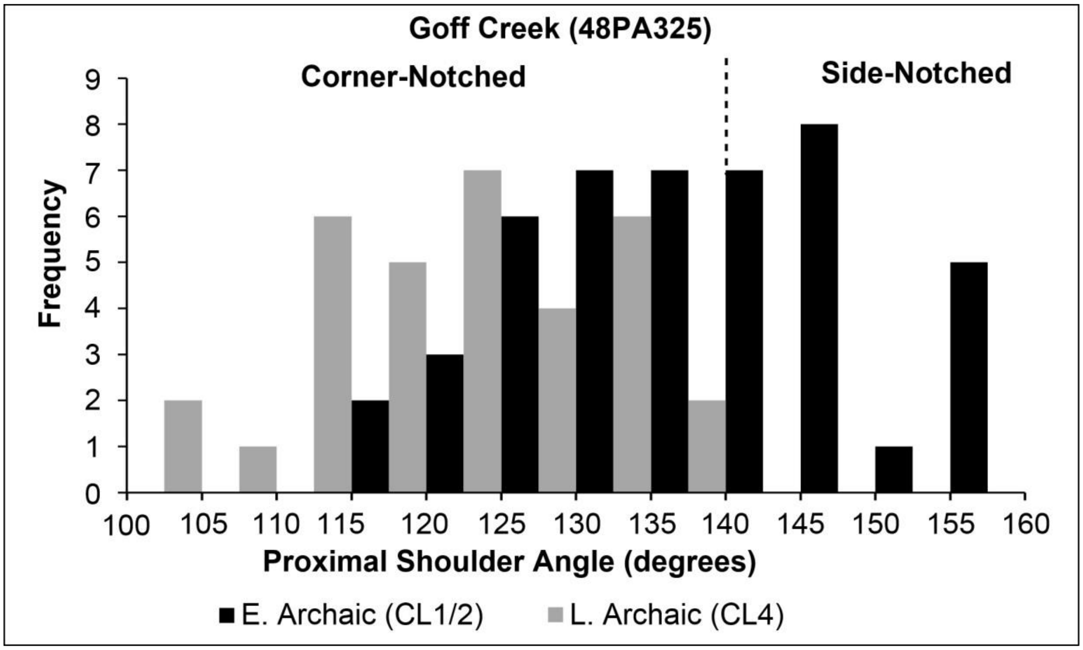


Figure 12-15 Histogram showing the frequency distribution of proximal shoulder angle of dart points from Cultural Levels 1, 2 (Early Archaic) and 4 (Late Archaic) at Goff Creek.

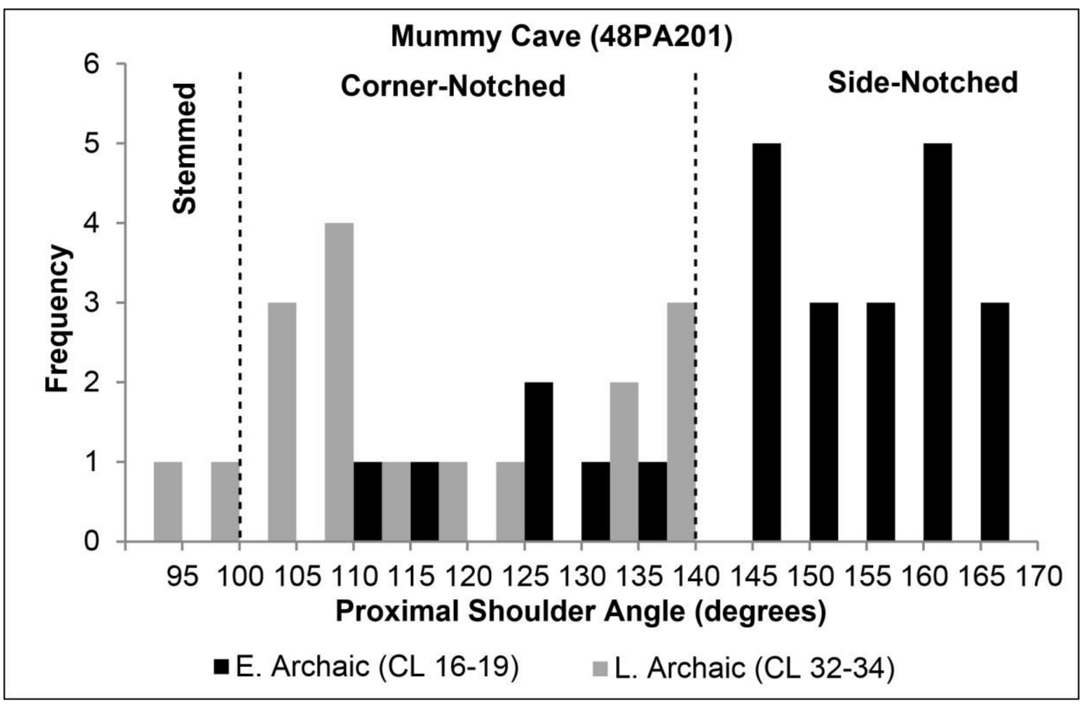


Figure 12-16 Histogram showing the frequency distribution of proximal shoulder angle of dart points from Cultural Layer 16-19 (Early Archaic) and Cultural Layers 32-34 (Late Archaic) at Mummy Cave.

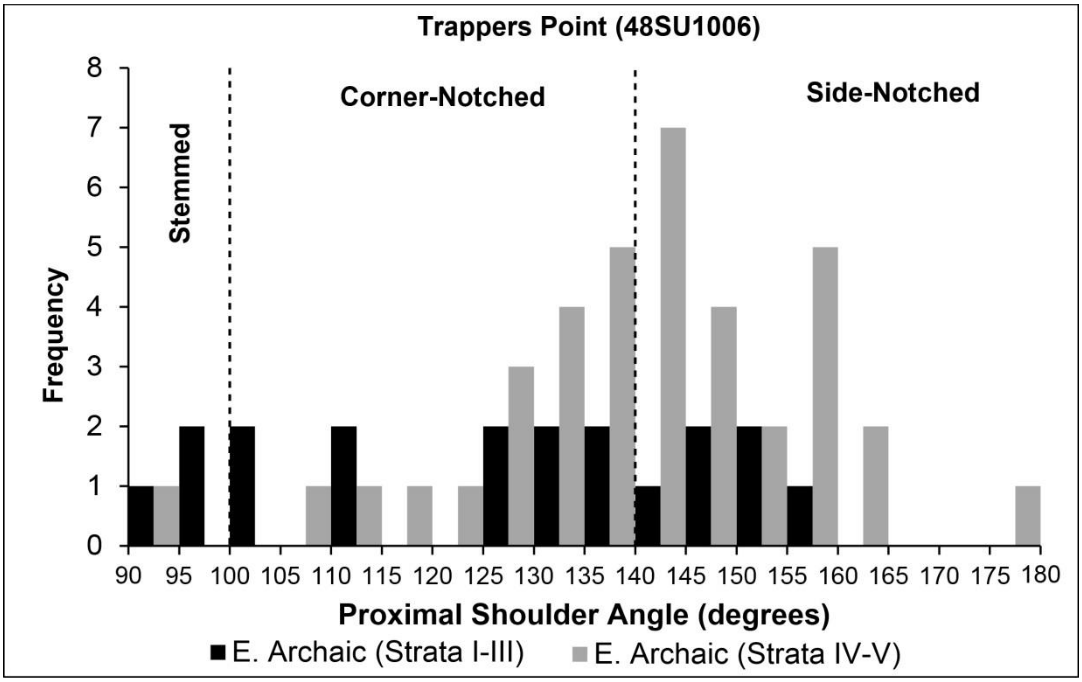


Figure 12-17 Histogram showing the frequency distribution of proximal shoulder angle of dart points from Early Archaic-aged strata at Trappers Point.

majority of the assemblage dates to the earlier portion (ca. 7800-6000 BP) of the Early Archaic, but this is only speculation given the poor context and small size of the sample.

Pronounced stylistic variation of Early Archaic projectile point assemblages has been documented at numerous sites in western Wyoming (Francis and Widman 1999; Larson 2012; Page 2016b). There are some indications that at least some of this variation is patterned in time and/or space. The data from Goff Creek provide little insight into temporal trends, but nevertheless contribute to the growing sample of Early Archaic points found in dated (or dateable) contexts in the Central Rockies.

Distinguishing Early Archaic and Late Archaic Corner-Notched Dart Points

Corner-notched dart points were manufactured predominantly during the Early and Late Archaic periods of the Central Rockies (Francis and Widman 1999; Kornfeld et al. 2010; Larson 2012). Although the range of morphological variation of Early and Late Archaic points overlaps, there are several characteristics that can be used to distinguish the two. The Early and Late Archaic assemblages from Goff Creek were either separated by 10s of centimeters stratigraphically or horizontally by 60 or more meters. Thus, even though the context of each cultural level was poor, the Early and Late Archaic assemblages can be separated with confidence. Therefore, the Goff Creek assemblage provides a useful, albeit small, sample to compare and contrast Early and Late Archaic corner-notched dart assemblages.

Table 12-11 Summary statistics for complete or nearly complete corner-notched dart points recovered from Goff Creek.

Summary Statistics	Blade Width (mm)	Haft Width (mm)	Max. Thickness (mm)	Base Width (mm)	Base Length (mm)	Notch Depth (mm)	Notch Width (mm)	Notch Angle (degrees)
EARLY ARCHAIC CORNER-NOTCHED (n=9)								
median	17.1	12	4.2	17.2	8.1	2.6	5.2	135
mean	17.4	11.8	4.4	16.6	7.8	2.4	5.2	132.3
SD	2.5	1.7	0.6	2.3	1.3	0.5	0.9	6.2
LATE ARCHAIC CORNER-NOTCHED (n=17)								
median	20.5	12.6	4.2	15.2	6.8	3.3	4.4	120
mean	20.9	12.4	4.2	15.1	6.8	3.2	4.4	122.0
SD	2.0	1.7	0.7	1.8	1.4	0.8	1.1	9.5

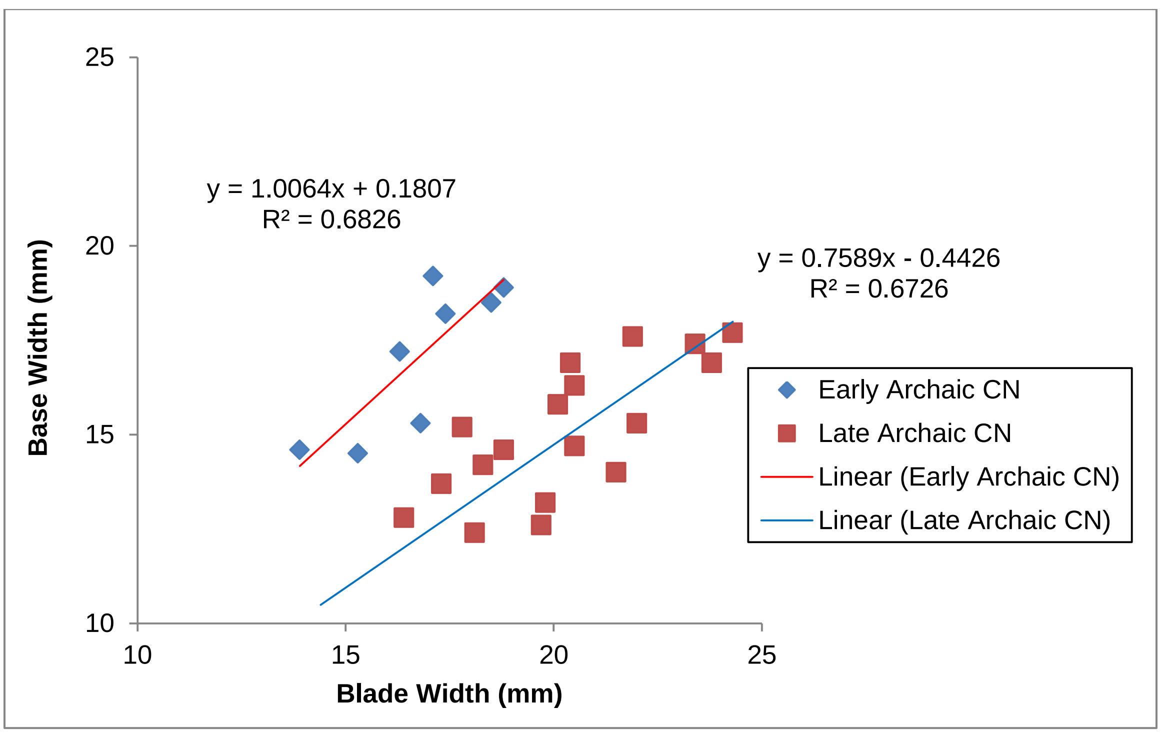


Figure 12-18 Correlation of blade width to base width for Early and Late Archaic corner-notched darts recovered from Goff Creek.

Table 12-12 Percentages of point base shapes in the Early and Late Archaic corner-notched dart assemblages from Goff Creek and Mummy Cave.

Goff Creek (48PA325)							Mummy Cave (48PA201)					
Period	Level	CC	CV	ST	n=		Period	Level	CC	CV	ST	n=
LA	4	0.0%	72.7%	27.3%	22		LA	32-34	5.9%	82.4%	11.8%	17
EA	1-2	31.3%	6.3%	62.5%	16		EA	16-19	50.0%	16.7%	33.3%	6

There were several notable differences between the Early and Late Archaic corner-notched darts at Goff Creek. First, Late Archaic corner-notched darts have a lower proximal shoulder angle than Early Archaic corner-notched darts (Table 12-11, Figure 12-15). Second, the bases of Early Archaic points tend to be as wide, or nearly as wide as the blade, but on Late Archaic points bases tend to be significantly narrower than the blades (Table 12-11). Moreover, base and blade width appear to be strongly correlated within both the Early and Late Archaic sample (Figure 12-18). Third, notches on Late Archaic points tend to be deeper and narrower than Early Archaic specimens (Table 12-11). Fourth, the shape of the proximal margin of Early Archaic point bases are typically either concave or straight, but a significant majority of Late Archaic points have convex proximal base shapes (Table 12-12). A similar pattern is evident in the Early and Late Archaic assemblages from Mummy Cave (Table 12-12). The small sample sizes preclude a rigorous statistical comparison of the corner-notched dart assemblages. Though limited, these data may prove useful in future attempts of cross-dating sites in the area using corner-notched darts.

Conclusion

The Goff Creek data recovery project produced a large assemblage of artifacts and features from which a considerable amount of information can be gleaned. The data recovery plan outlined a number of research questions pertaining to geoacrchaeology and dating, hunter-gatherer subsistence practices, and spatial analysis of artifacts and features. It was hoped that exploration of these topics at Goff Creek could contribute to our current understanding of the prehistory of the Central Rocky Mountains. Eckerle's geoarchaeological research revealed that some of cultural deposits at Goff Creek have poor contextual integrity due to low depositional rates and bioturbation. Those deposits designated Cultural Levels 1 and 4 represent palimpsests spanning perhaps several thousand years. The possibility remains that some of the uncertainty concerning these levels can one day be resolved through more thorough carbon dating, but without those data our interpretations are limited. Yet, Cultural Level 2, which contains at least two Early Archaic occupations, was found to have fairly good contextual integrity and produced numerous diagnostic artifacts, features and activity areas that allow us to infer certain behavior.

The ubiquitous presence of boiled bone dumps in all cultural levels, the highly fragmented nature of the faunal assemblage and distribution of certain skeletal elements strongly indicate that the Goff

Creek Site was used as a hunting camp for small groups of people intensively focused on bighorn sheep procurement and processing. Sheep were certainly hunted with projectiles, but it also likely that other methods were used throughout prehistory such as traps and nets. Although the occupations at Goff Creek remain poorly dated, the dates we do have correspond with Cultural Layers at Mummy Cave. It is likely that Goff Creek served as a secondary camp to a logistical base centered at Mummy Cave. Evidence for this can be found in the diagnostic artifacts since all of the projectile point styles found at Goff Creek are also represented in the Mummy Cave assemblages, though there may be more variation in the Early Archaic points in Cultural Levels 1 and 2 at Goff Creek. There is also the appearance or increase of groundstone tools seen at both sites during the Middle Archaic. Another similarity between the two sites is the marked increase in obsidian artifacts during the Late Archaic period. This pattern may represent a change is seasonal rounds where Goff Creek and Mummy Cave were occupied in the fall by hunter-gatherers traveling east out of the Yellowstone Plateau to winter in foothills of the Absarokas. At least one of the components at Pagoda Creek did contain a relatively high frequency of obsidian artifacts (Eakin 1989). Perhaps in earlier periods local hunter-gatherers camped at Mummy Cave and Goff Creek in the winter and spring, as the data from Mummy Cave suggest, and thus arrived from the east (if they ever left the high country) with toolkits deficient in obsidian. There are patterns in the data all along the North Fork and throughout the Central Rocky Mountains. There can be no debate that the excavations at Goff Creek have further elucidated some of them.

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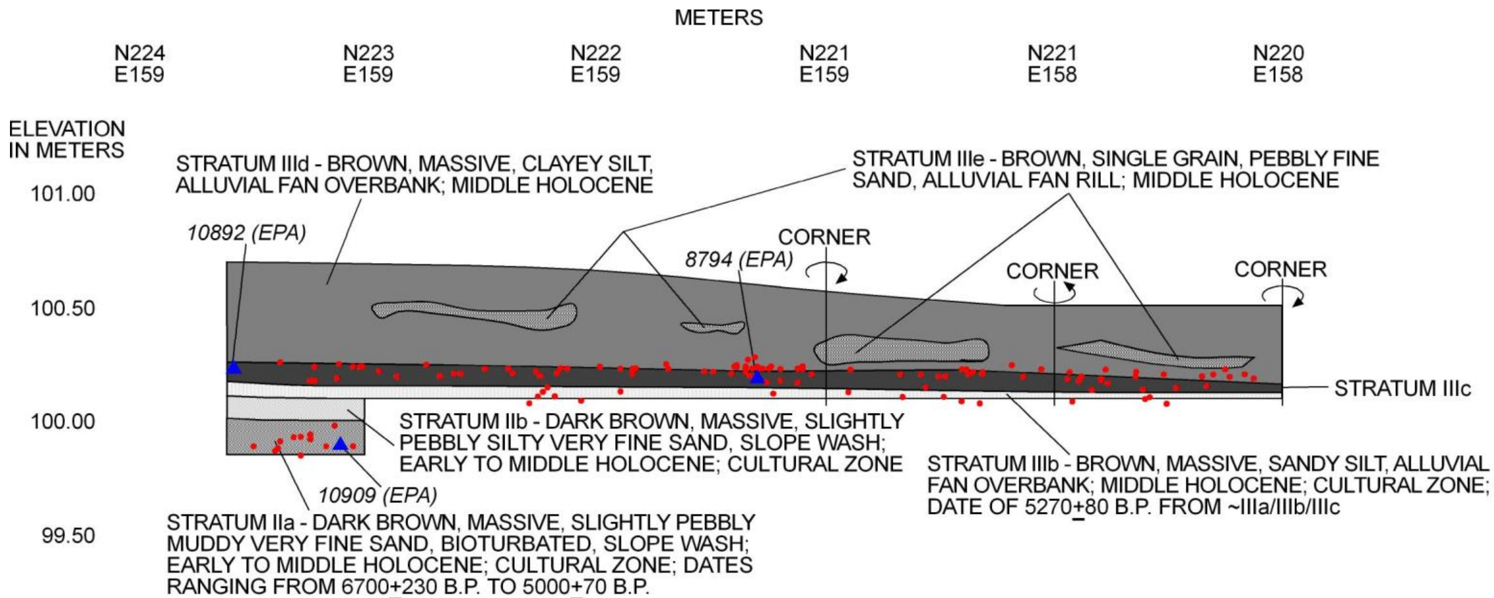
APPENDIX A

SUPPLEMENTAL PROFILES

By, William Eckerle



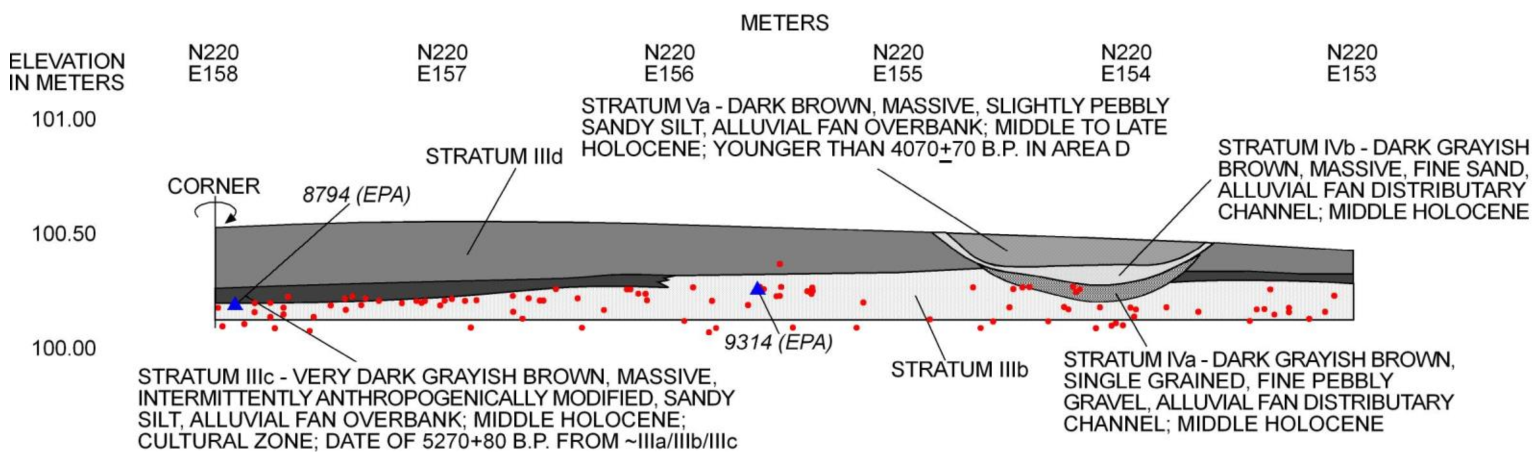


Figure A-1 Illustrated profiles of Area A, Block A.

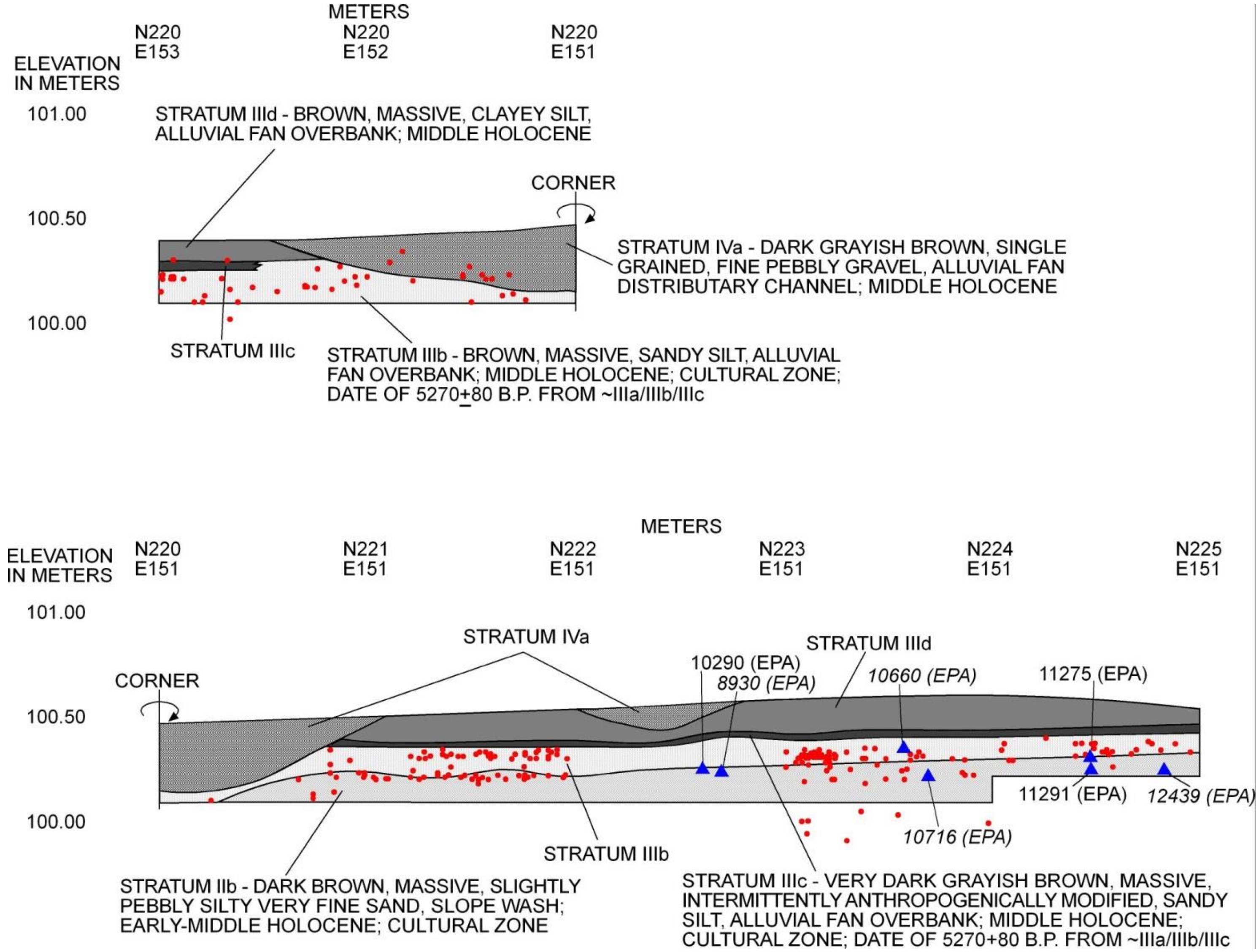


Figure A-2 Illustrated profiles of Area A, Block A.

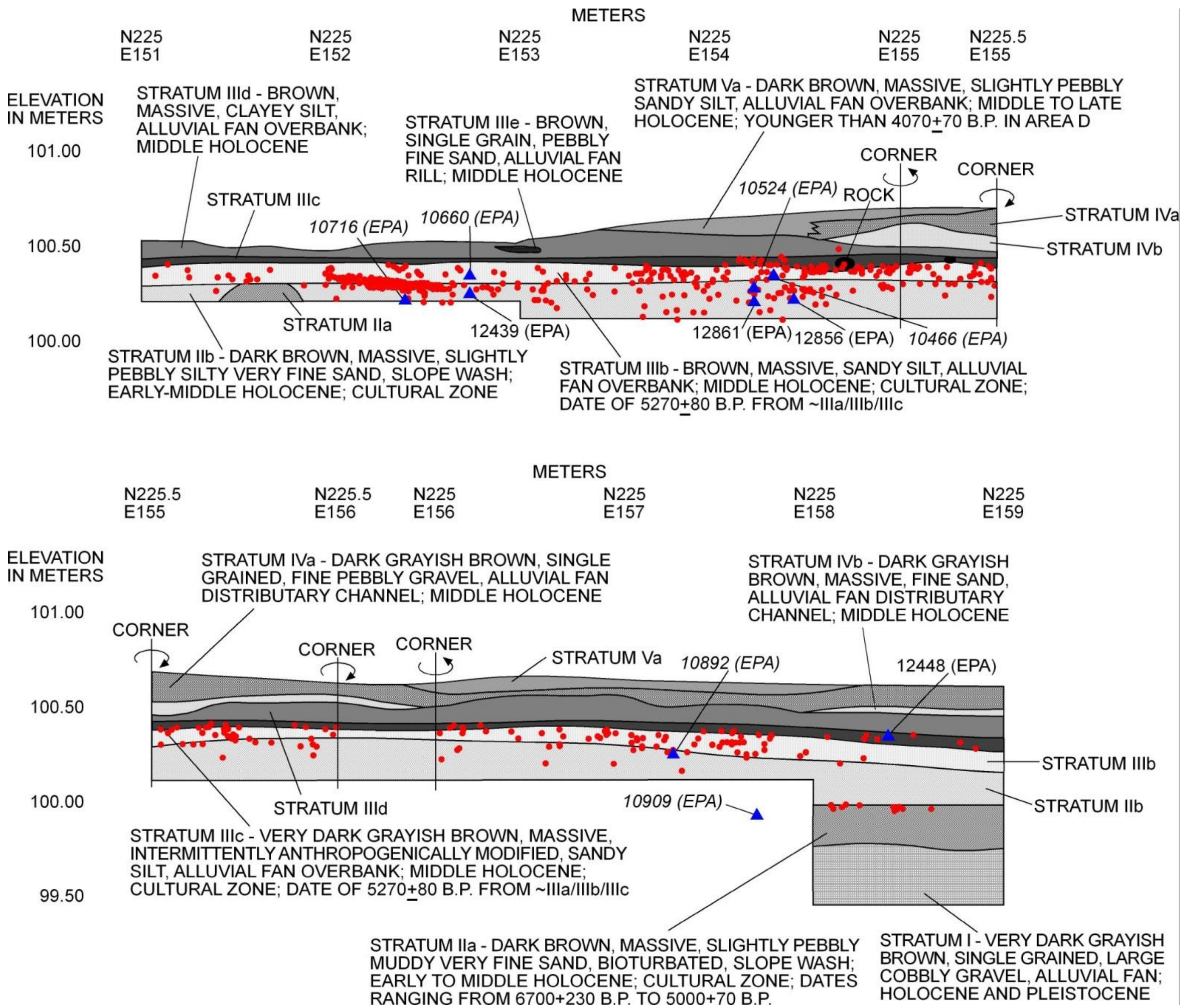


Figure A-3 Illustrated profiles of Area A, Block A

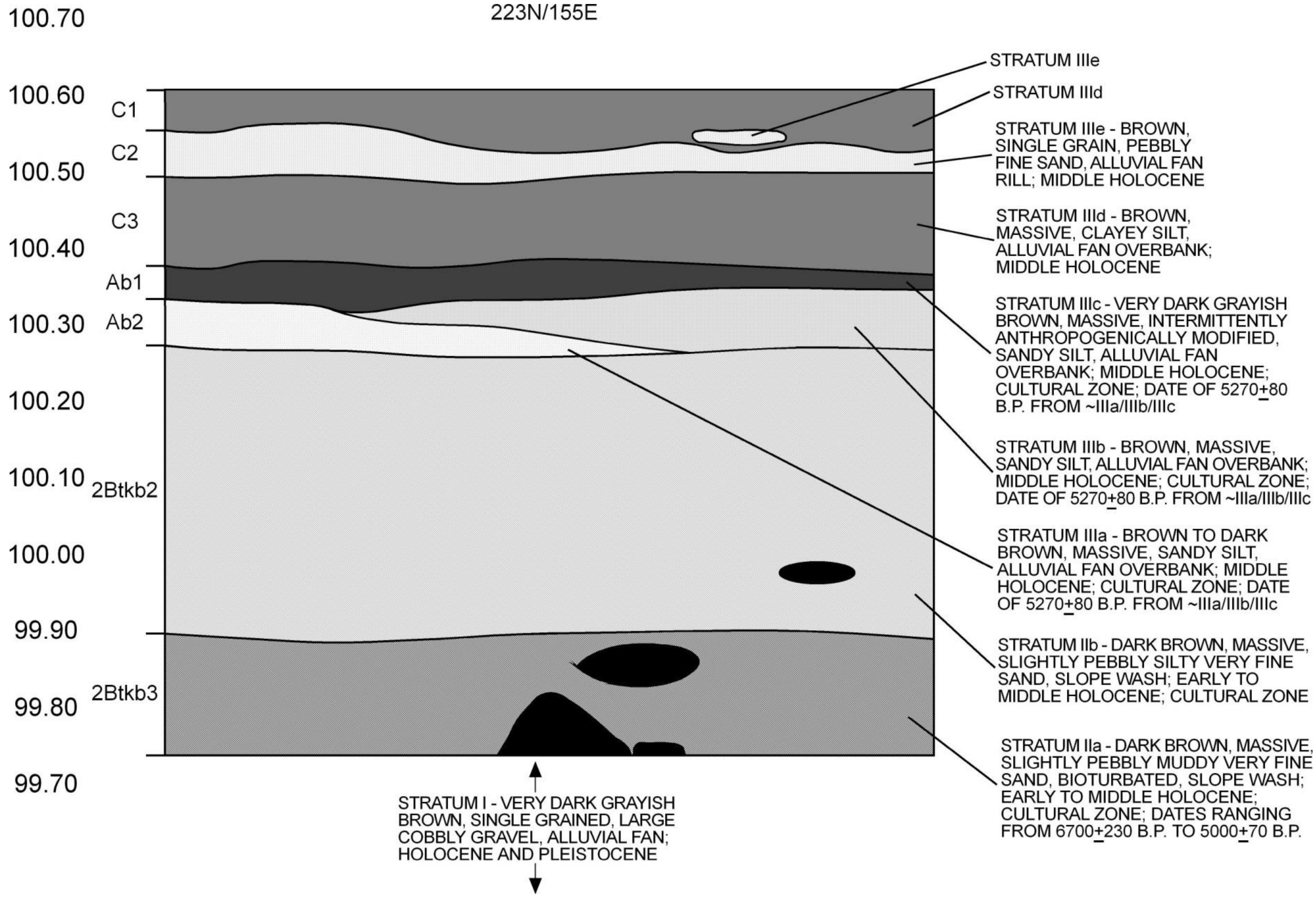
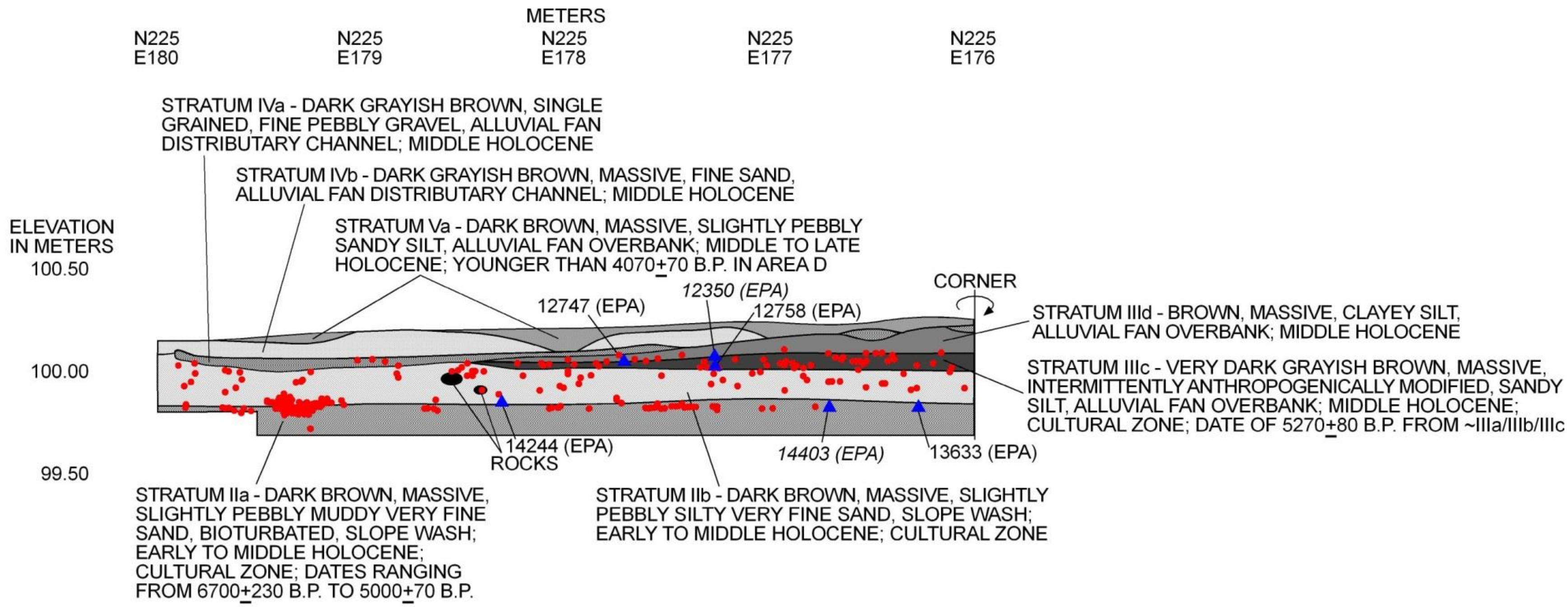


Figure A-4 Detailed soil profile of N223 E155, Area A.



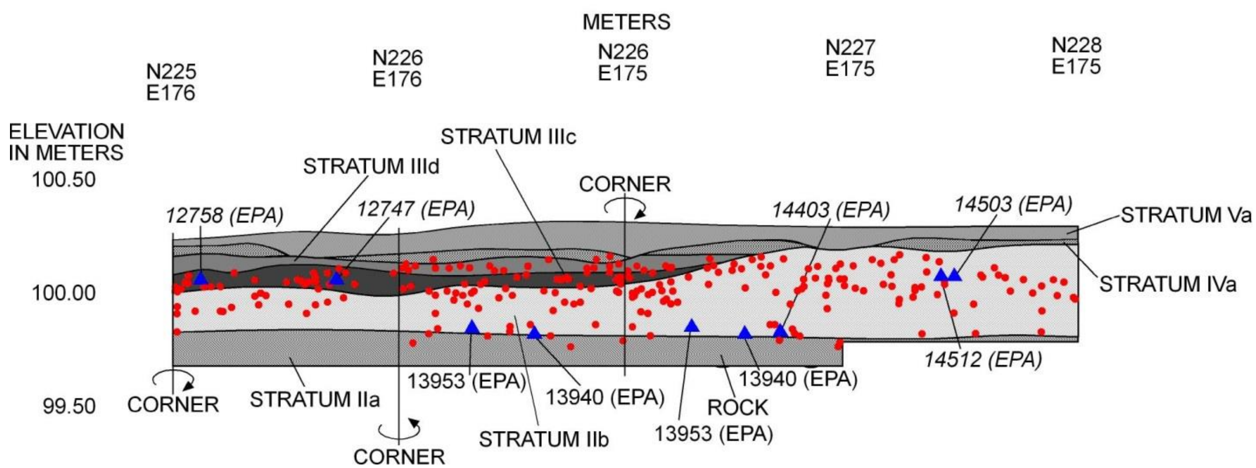


Figure A-5 Area B, Block B illustrated profiles.

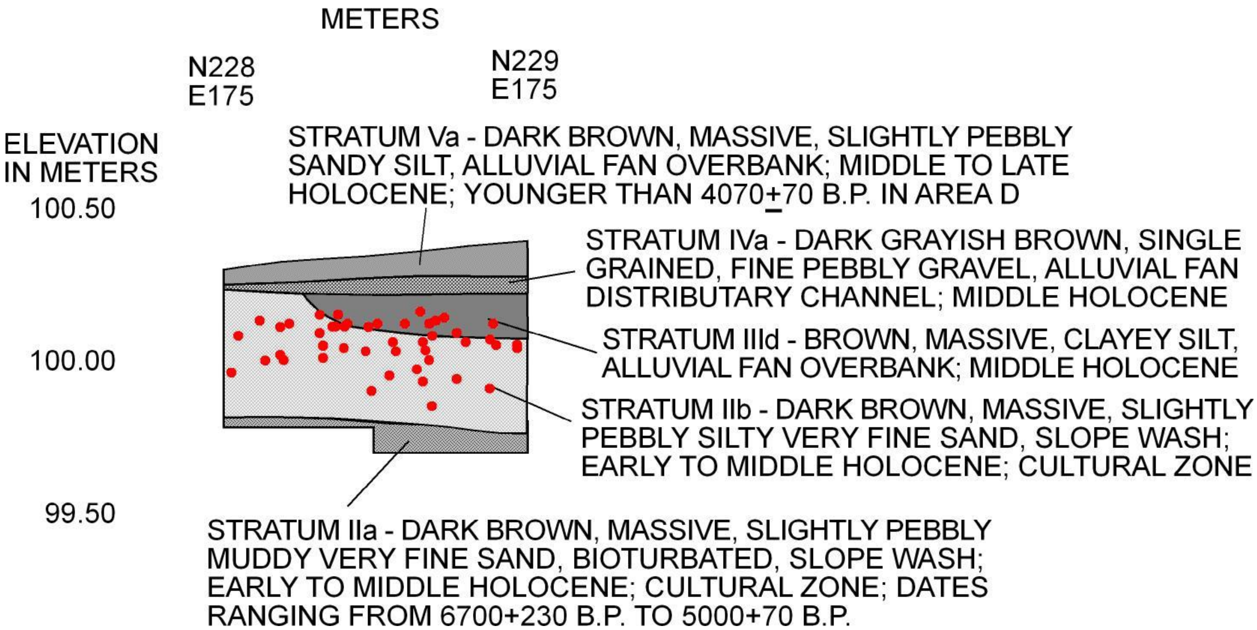


Figure A-6 Illustrated profile of N228 E175, Area B.

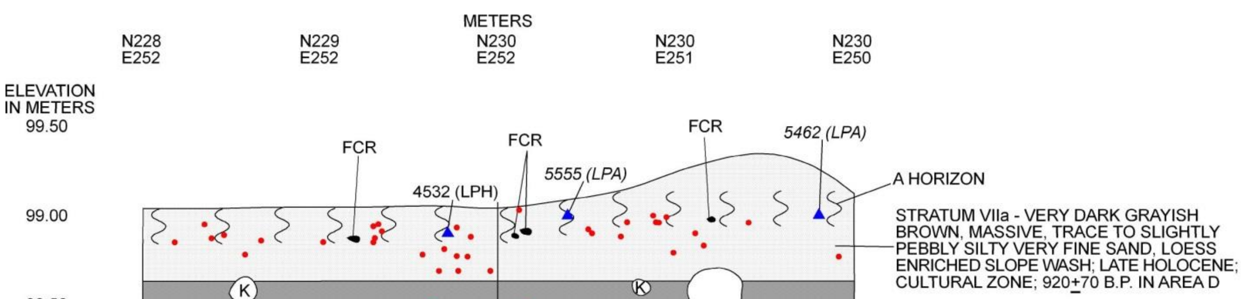
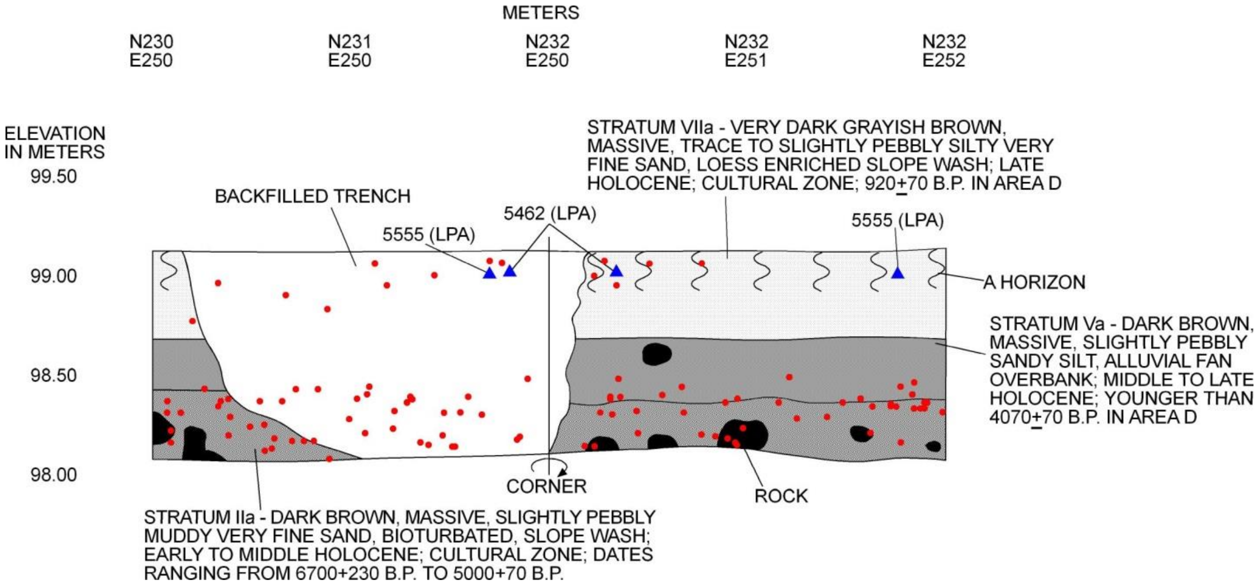


Figure A-7 Illustrated profile of Area D, Block D.



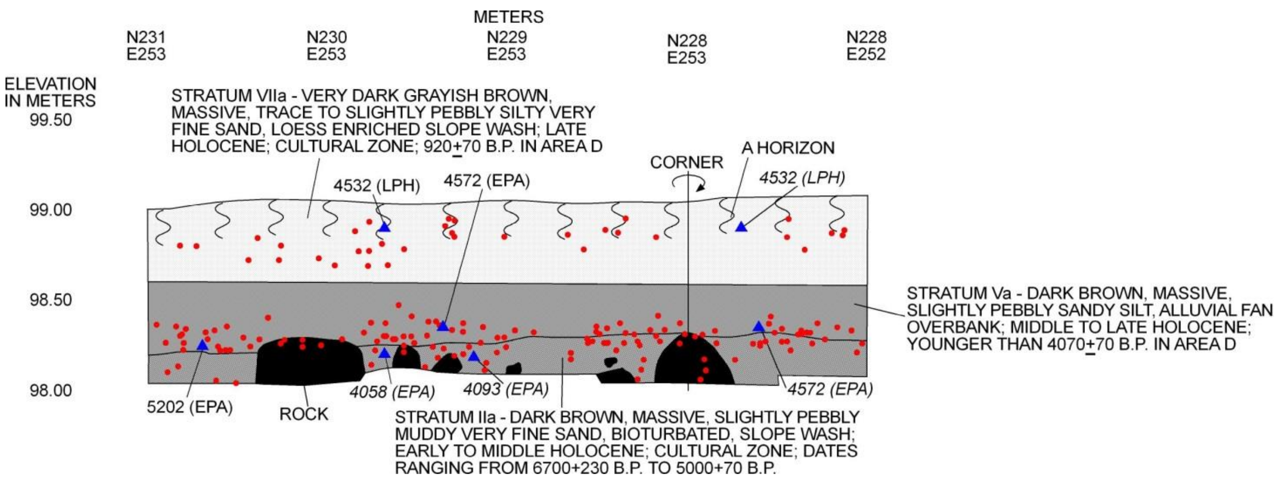


Figure A-8 Illustrated profiles of Area D, Block D.

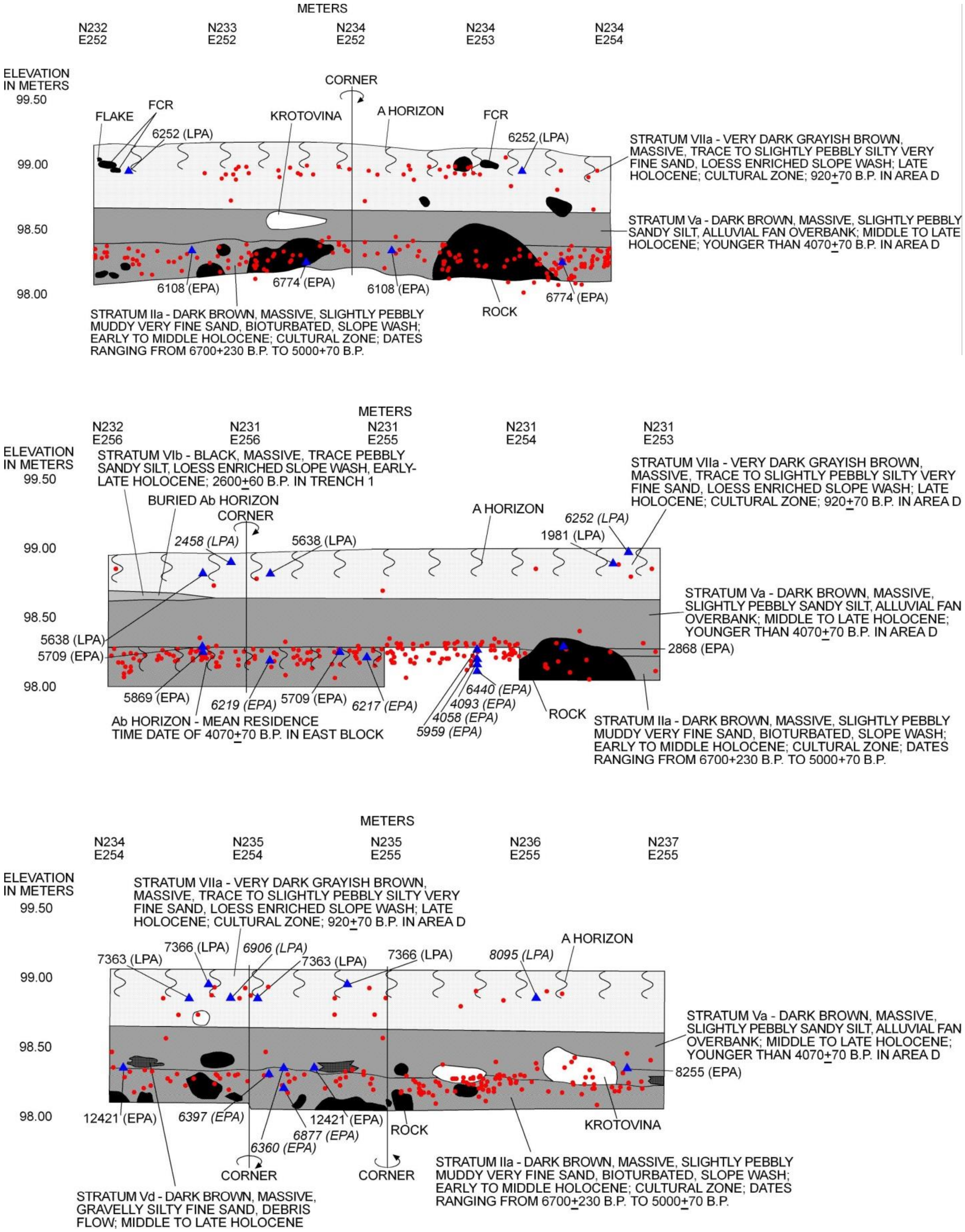


Figure A-9 Illustrated profiles of Area D, Block D.

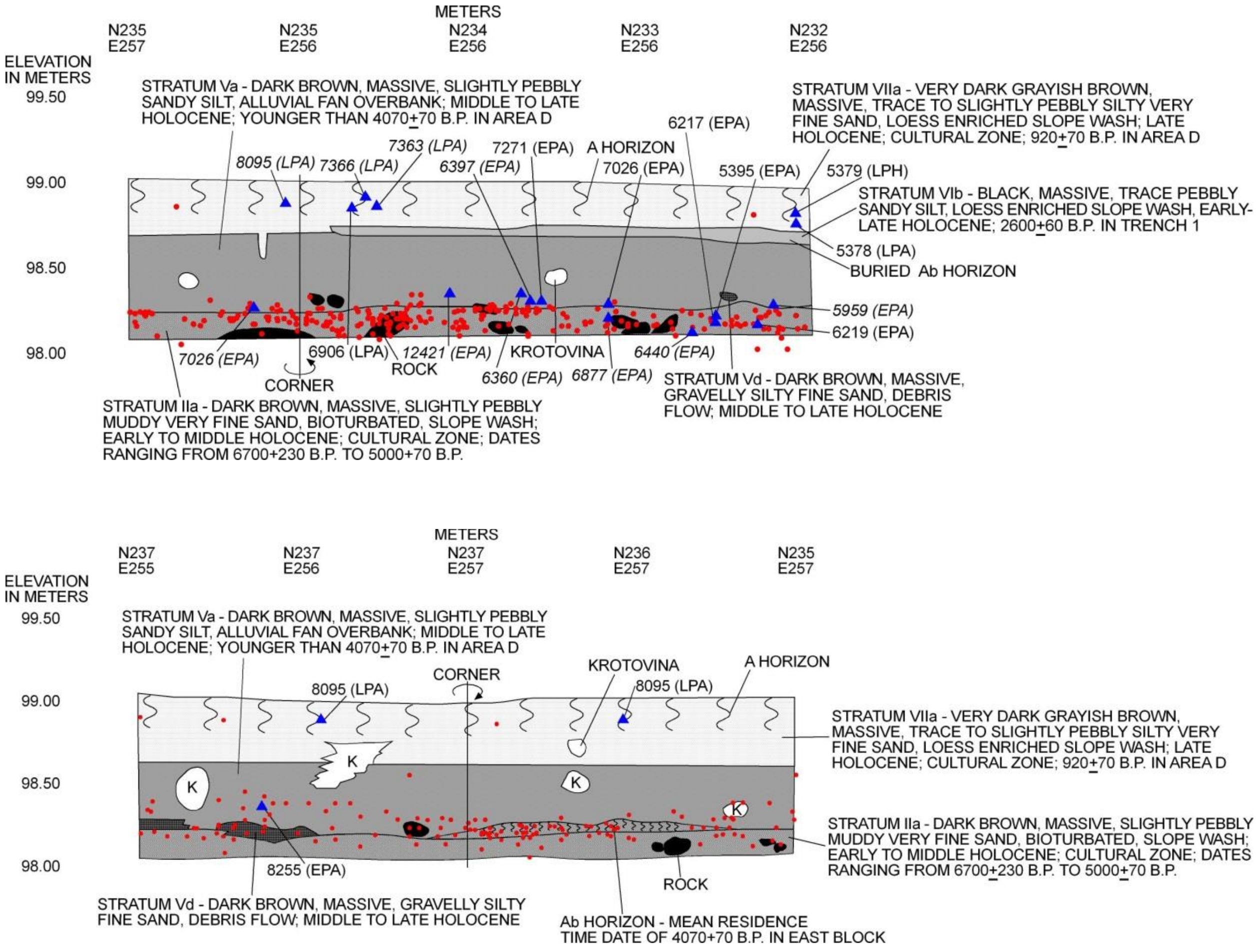


Figure A-10 Illustrated profile of Area D, Block D.

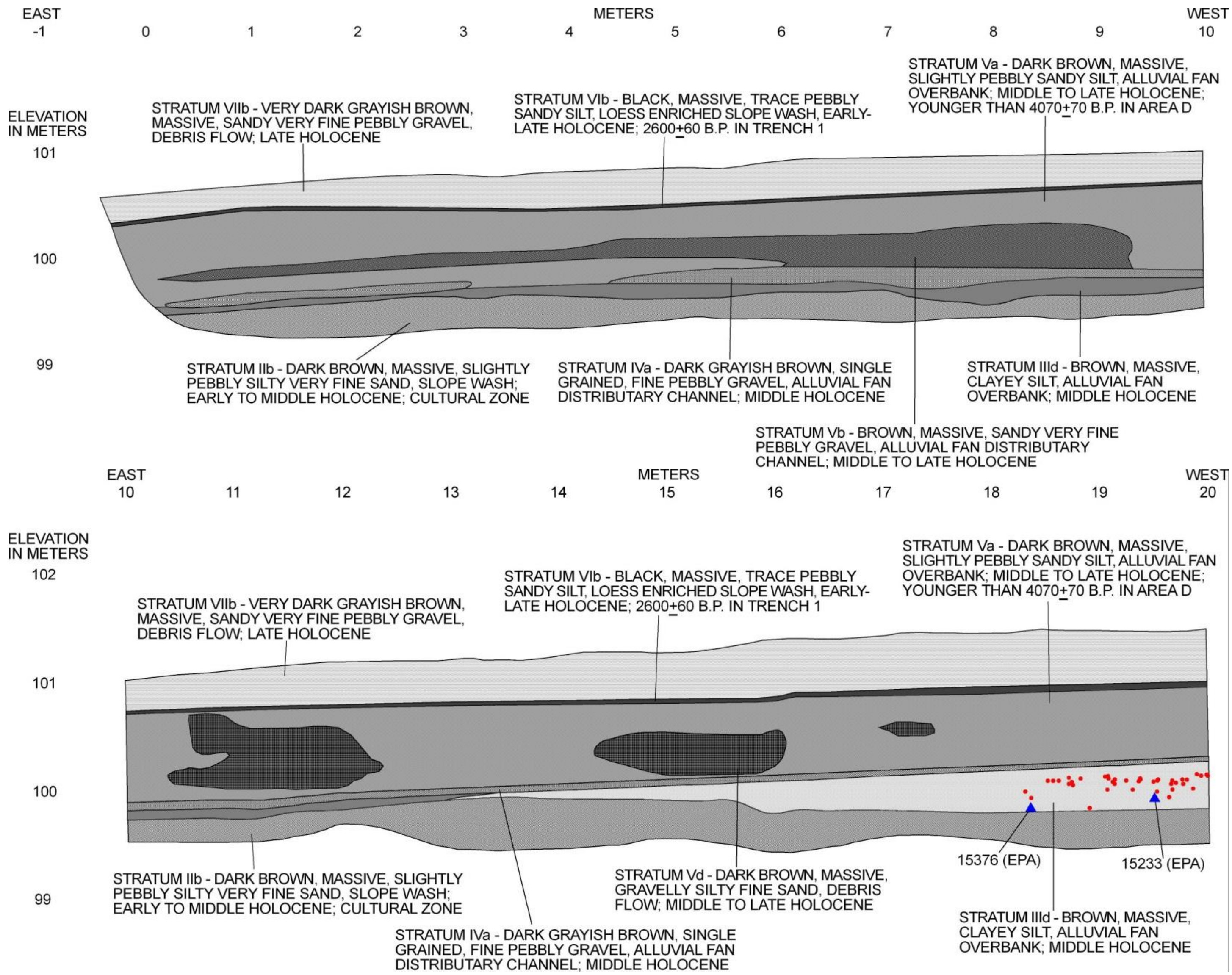


Figure A-11 Illustrated profiles of Trench 2.

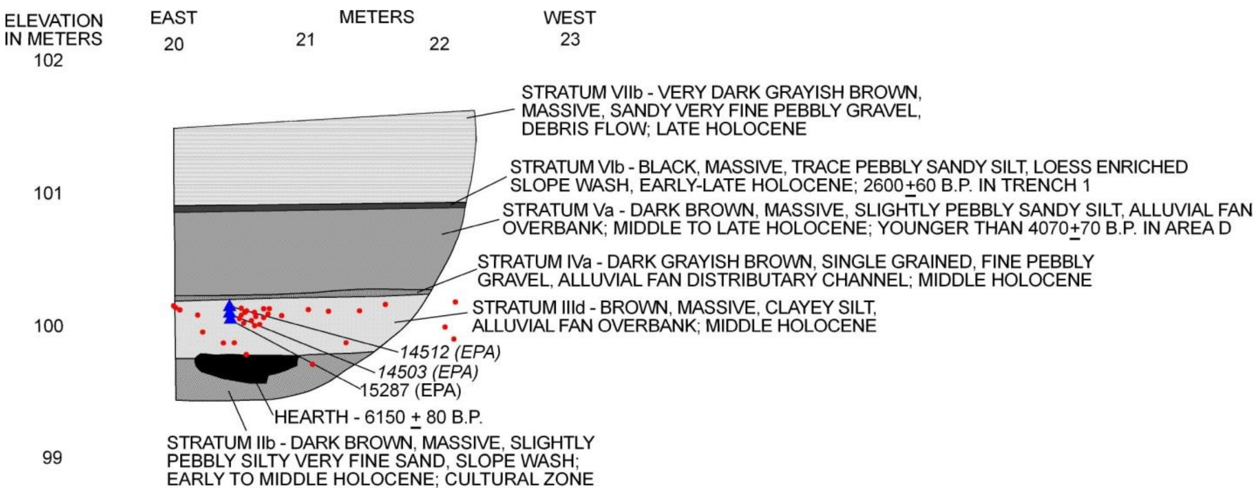
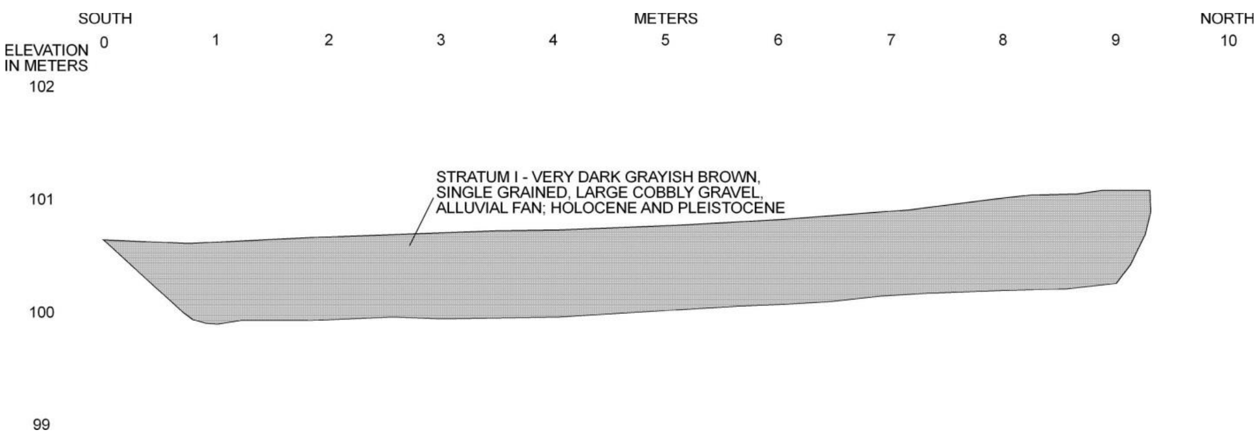


Figure A-12 Illustrated profile of Area D, Block D.



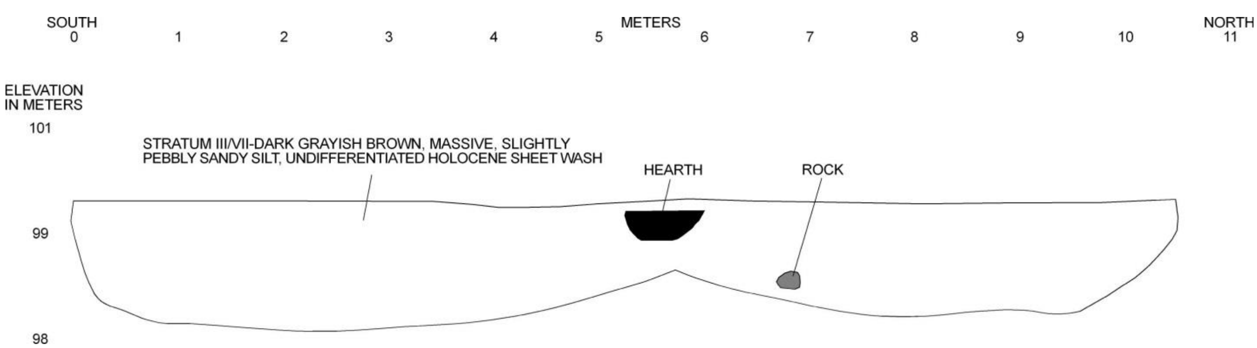


Figure A-13 Illustrated profiles of Trench 4 upper and lower, respectively.

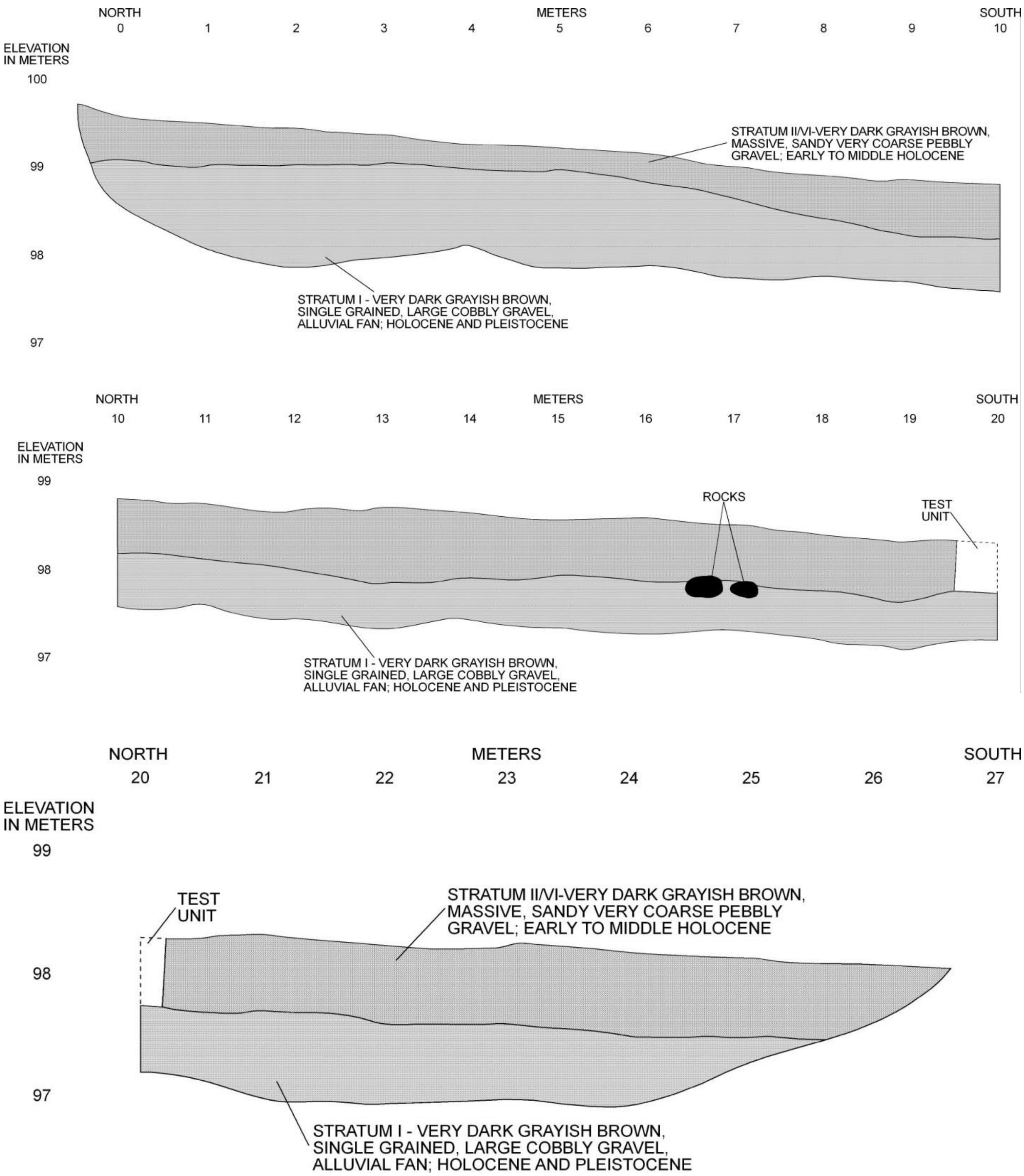


Figure A-14 Illustrated profiles of Trench 5.

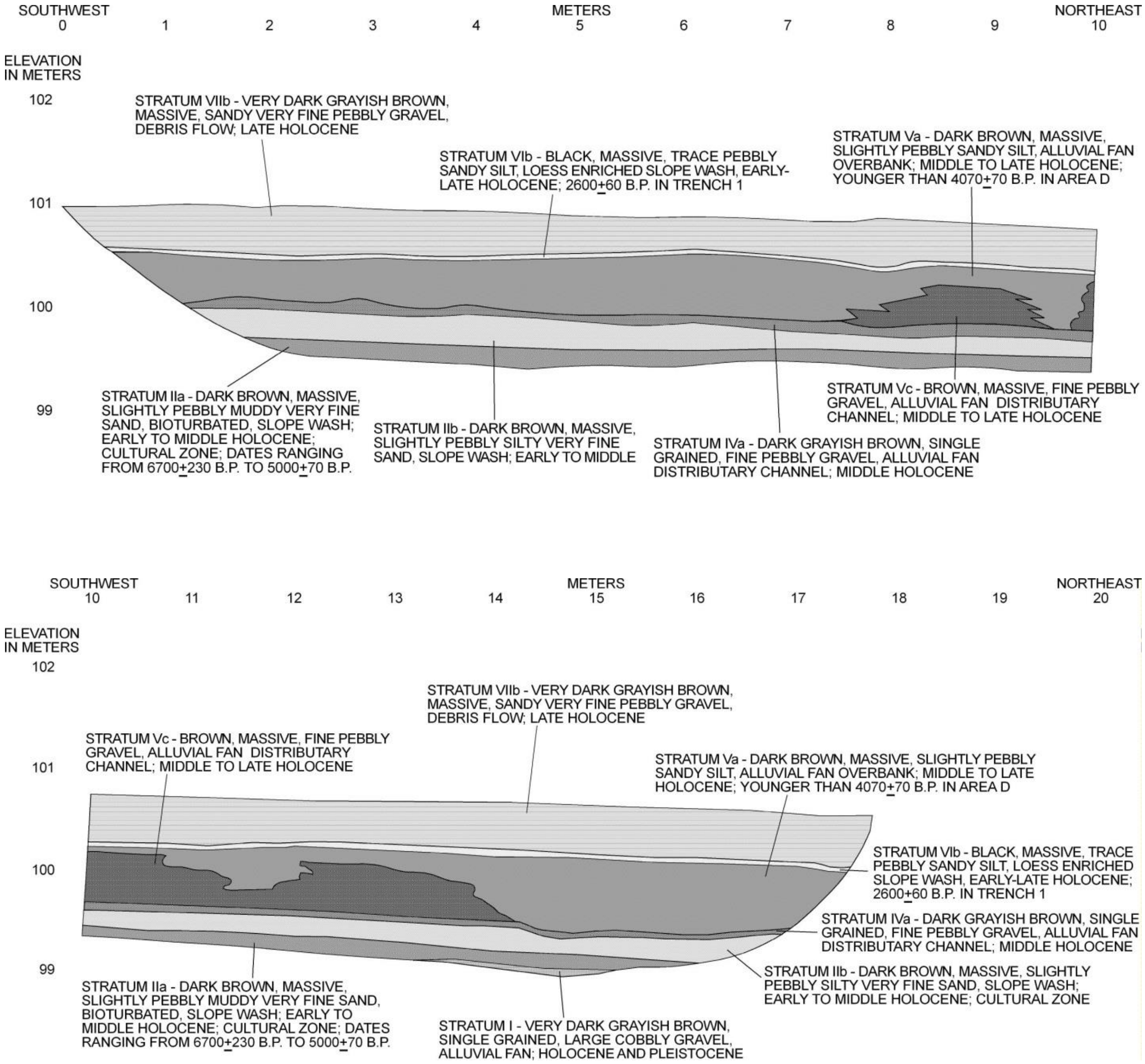


Figure A-15 Illustrated profiles of Trench 6.

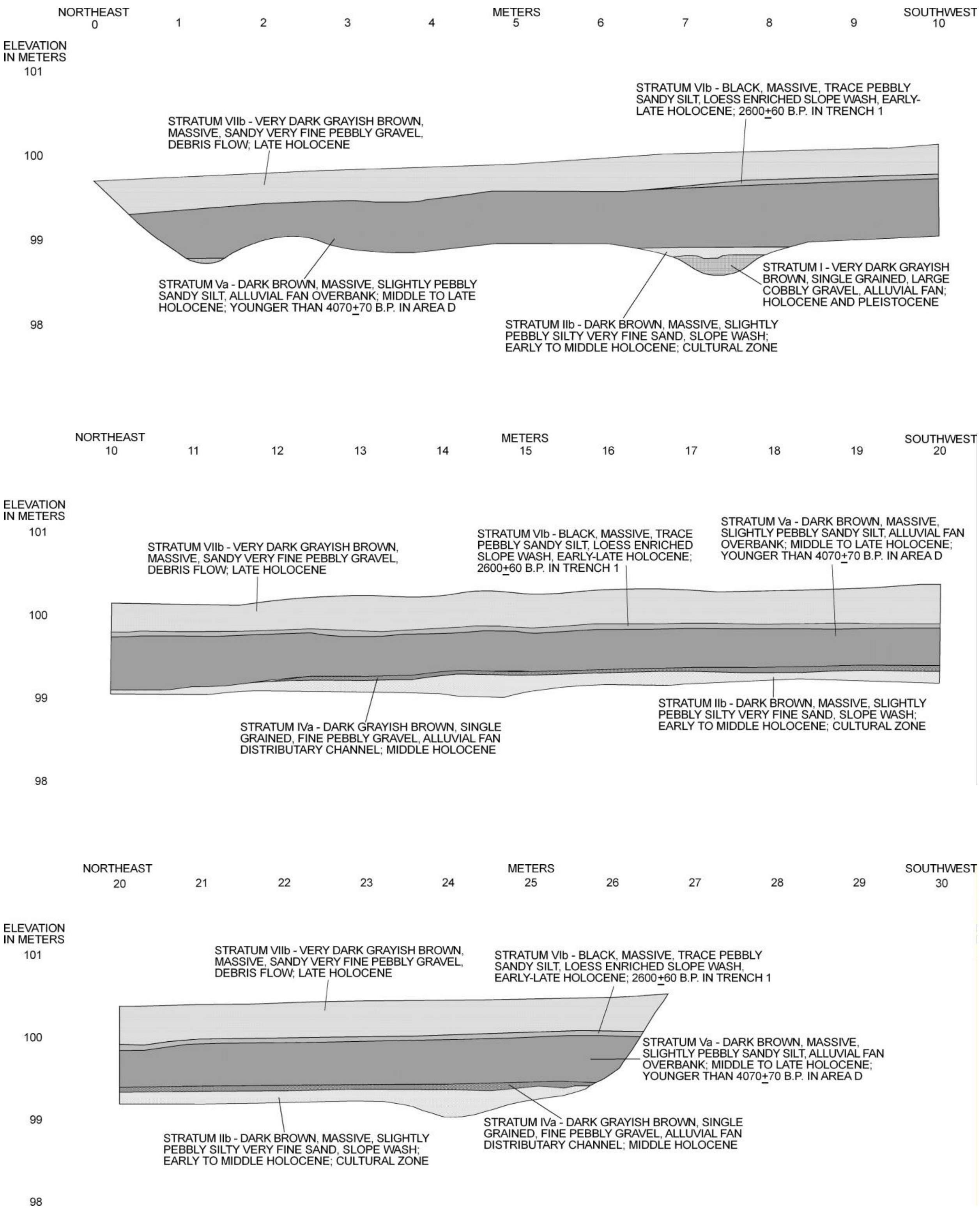


Figure A-16 Illustrated profiles of Trench 7.

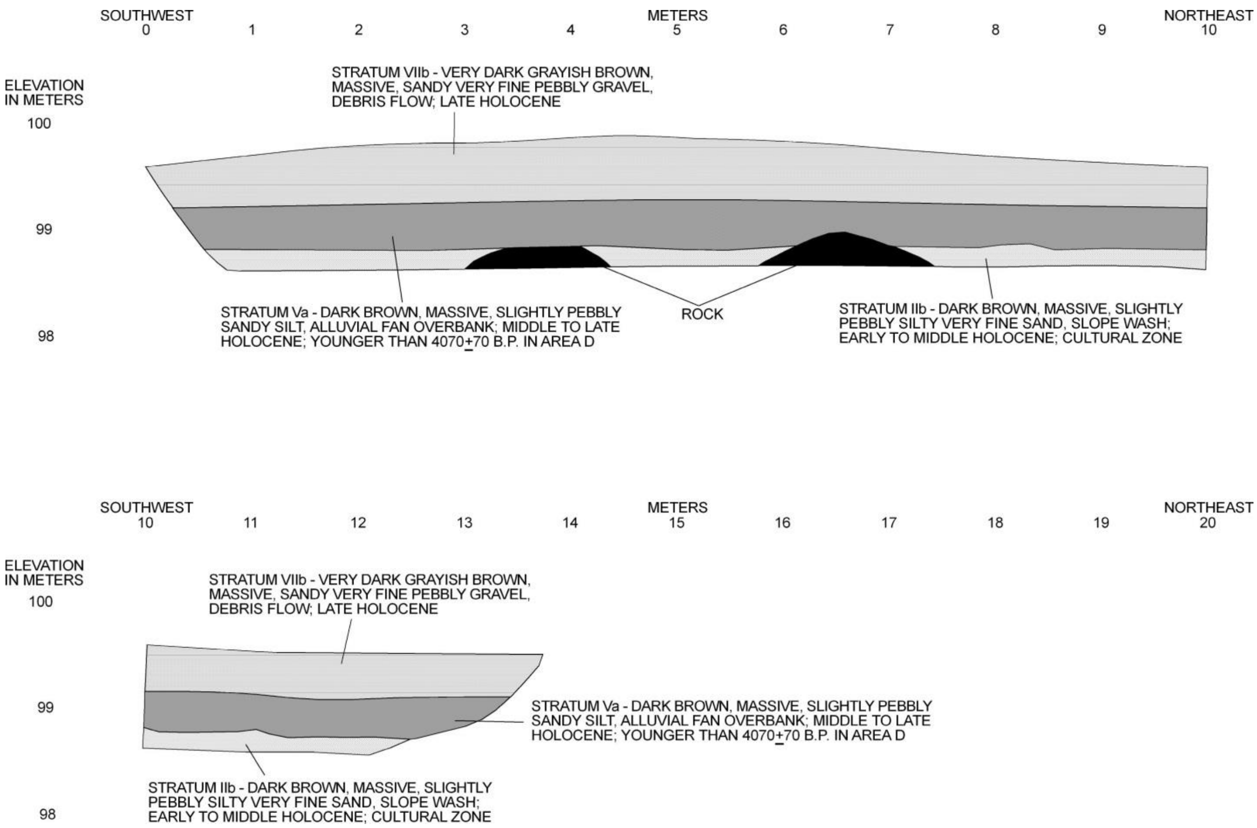


Figure A-17 Illustrated profiles of Trench 8.

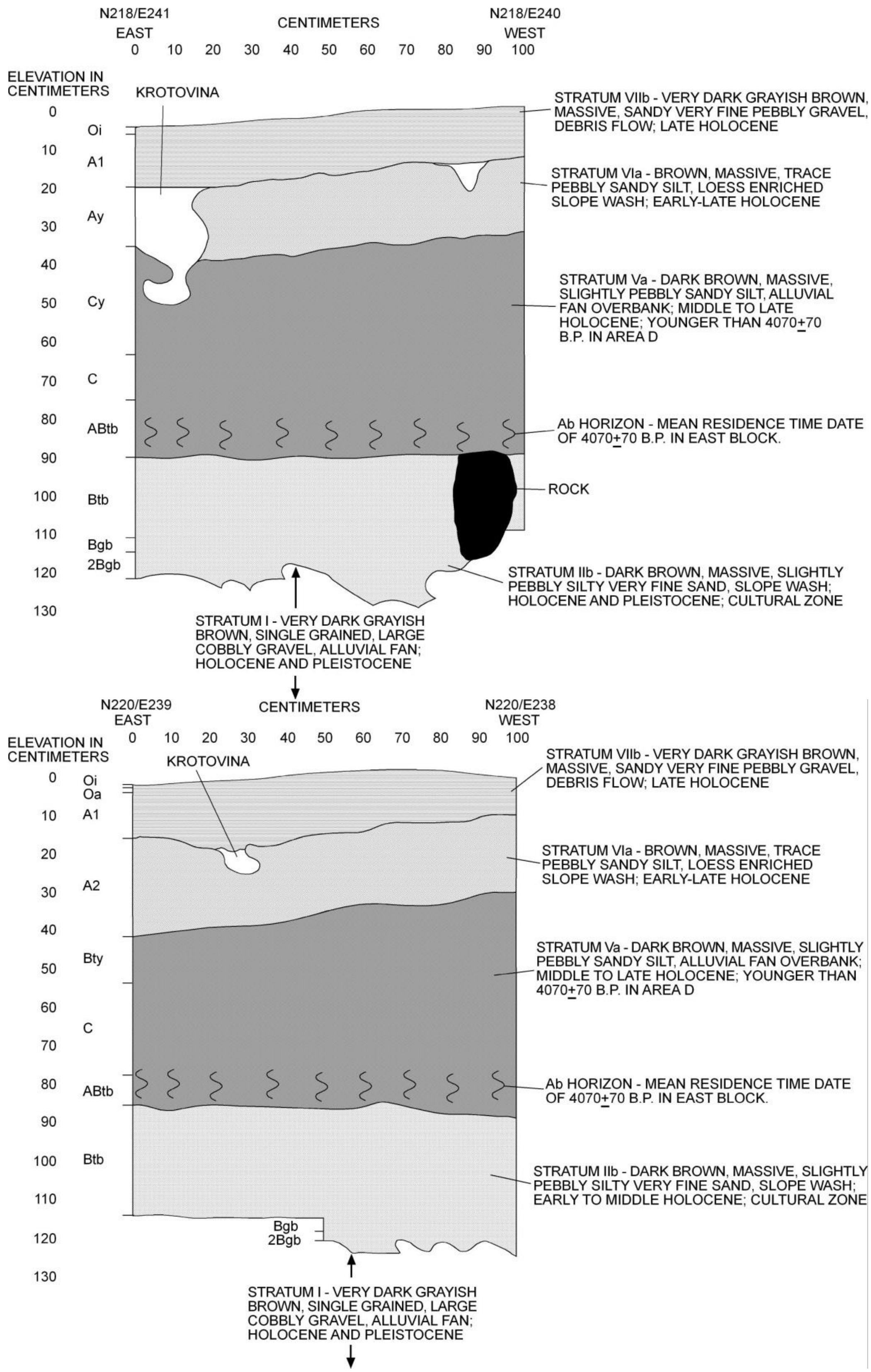


Figure A-18 Illustrated profile of units N218 E240 and N220 E238, Area C.

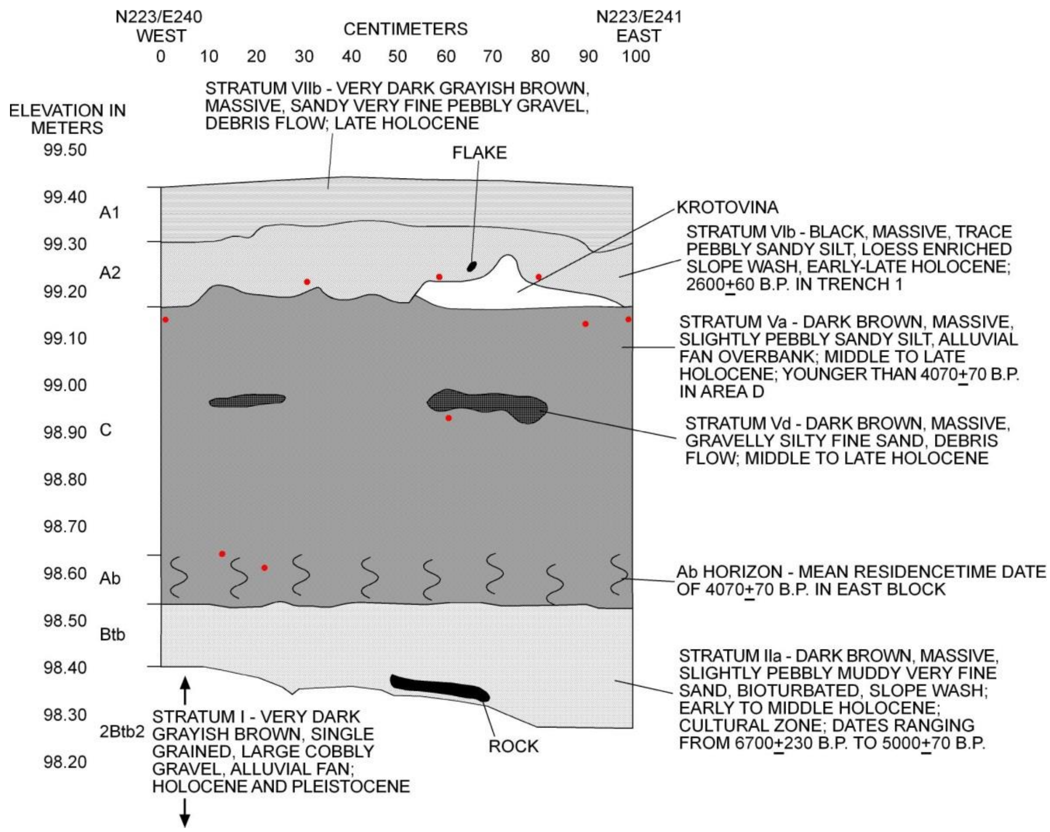


Figure A-19 Illustrated profile from unit N223 E239, Area C.

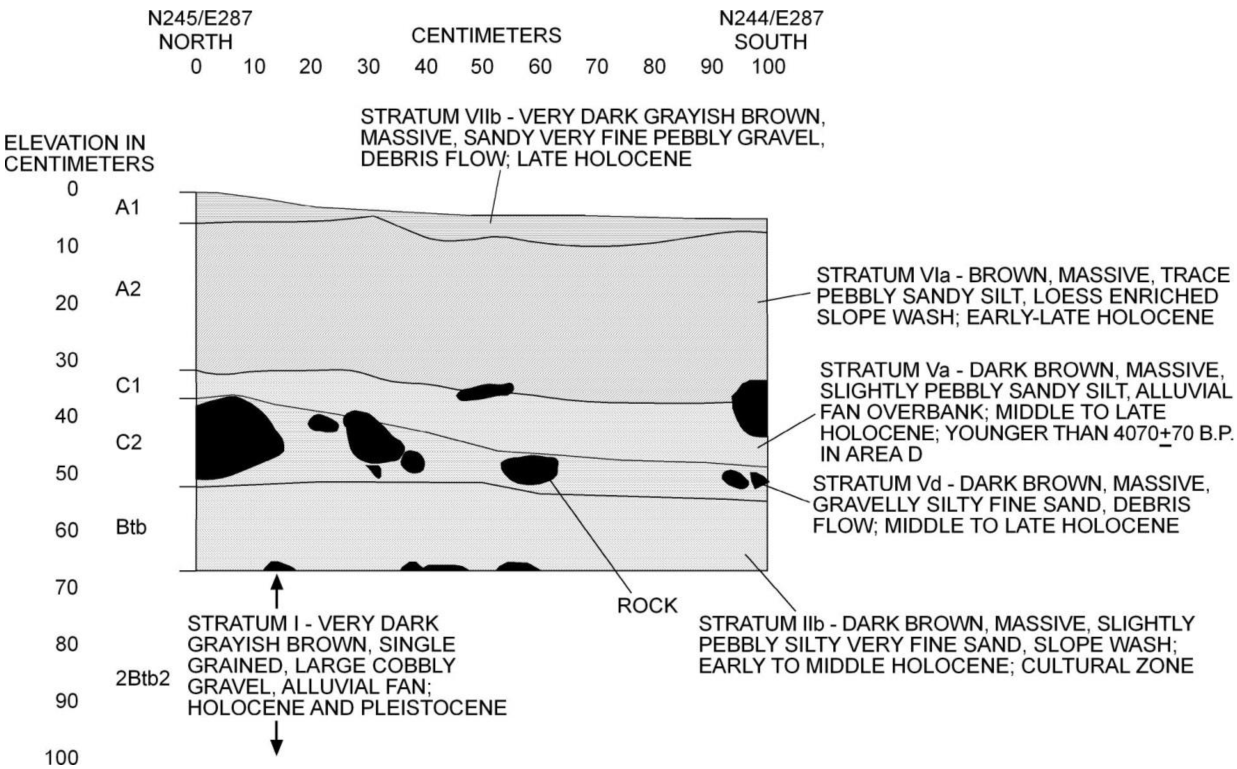


Figure A-20 Illustrated profile for unit N244 E286 in Area F.

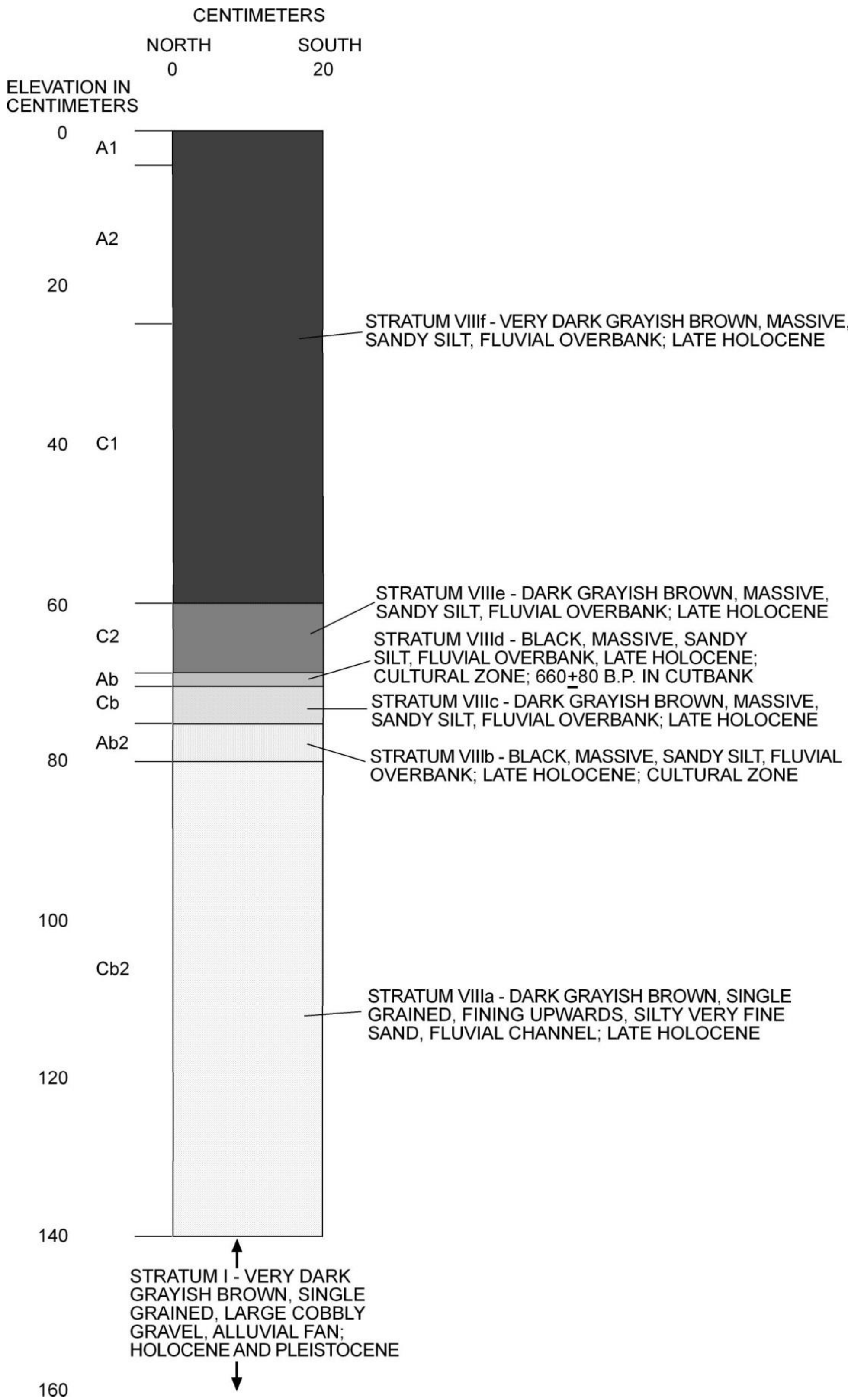


Figure A-21 Illustrated profile of the T1 terrace exposure.

APPENDIX B

ATTRIBUTES OF CHIPPED STONE TOOLS

Description of Lithic Raw Material Type Codes	
BT	Basalt
EC	Eocene Chert
MOC	Morrison Formation Chert
MOQ	Morrison Formation Orthoquartzite
MQ	Misc. Med-Coarse-grained Quartzites
OB	Obsidian/Ignimbrite
PC	Paleozoic Chert - Phosphoria Formation
SW	Silicified Wood
TSQ	Tensleep Quartzite
UIC	Unidentified Chert
WT	Welded Tuff

Description of Use-Wear and Portion Codes

Code	**Description**	**Code**	**Description**
Use Type		**Material Worked**	
C	Cut	H	Hard
S	Scrape	HD	Dry Hide
CH	Chop	S	Soft
GV	Groove	SH	Semi-Hard
P	Plane	UN	Unidentified
W	Wedge	**Portion of Fractured Artifact Present***	
B/D	Bore/Drill	CO	Complete
S/C	Scrape/Cut	PR	Proximal
S/GV	Scrape/Groove	MD	Medial
S/P	Scrape/Plane	DS	Distal
UN	Unidentified	LT	Lateral
		UN	Unidentified

* Does not apply to projectile point tables.

Description of Codes used in Projectile Point Analysis and Tables			
Code	**Description**	**Code**	**Description**
Period		**Portion**	
LPr	Late Prehistoric (ca. 1500-200 BP)	CO	Complete
LA	Late Archaic (ca. 3200-1500 BP)	NC	Nearly Complete
MA	Middle Archaic (ca. 5000-3200 BP)	BMS	Base-Midsection
EA/MA	Early-Middle Archaic (ca. 7600-3200 BP)	BL	Blade
EA	Early Archaic (ca. 7600-5000 BP)	MS	Midsection
FMP	Foothills-Mountain Paleoindian (ca. 9800-7800 BP)	BA	Base
LP	Late Paleoindian (ca. 10,000-8000 BP)	ER	Ear-lateral base fragment
Point Type		TP	Tip
DTN	Desert Tri-Notched	**Haft Type**	
DSN	Desert Side-Notched	SN	Side-Notched
RS	Rose Spring Corner-Notched	CN	Corner-Notched
PL	Pelican Lake Corner Notched	LN	Lanceolate
HA	Hanna	**Fracture Pattern**	
DN	Duncan	IMP	Impact Fracture
OX	Oxbow	BND	Bend Break
PH	Pahaska Side-Notched	BUR	Burin
BW	Blackwater Side-Notched	TA	Thermally Altered
EC	Elko Corner-Notched	UN	Unidentified
ANG	Angostura		
CY	Cody		

Table B-1 Attributes of Projectile Points recovered from Goff Creek (48PA325)

Catalog #	Block	Cultural Level	Unit	Elevation	Period	Point Type	Material Type	Portion	Haft Type	Prox. Shldr. Angle	Max Length	Blade Width	Blade Length	Base Width	Base Length	Haft Width	Max. Thickness	Ear Width	Notch Depth	Notch Width	Haft Grinding	Break Pattern	Blade Shape
771	G	4	N208 E193	100.42	LPr	DSN	OB	BMS	SN	158	12.9	12.5		13.3	7.8	9.6	2.8	4.7	1.7	2.8		IMP	ST
791	G	4	N208 E193	100.42-100.32	LPr	DSN	OB	BA	SN	180	5.6			11.6		7.6	2.4	5.6				BND	
891	G	2	N208 E189	99.74	EA	BW	PC	BMS	CN	121	14.3	16.8		15.3	6.8	12.3	4.4	2.6	2.1	5.2	X	IMP	CV
919	G	2	N208 E189	99.63-99.53	EA	PH	OB	ER	SN	148	7.2						3.2	3.3			X	BND	
957	C	4	N212 E245	99.06	LA	PL	EC	CO	CN	118	25.9	20.5	20	14.7	5.9	10.3	3.7		3.9	4.7			CV
1266	G	2	N208 E193	99.72- 99.62			PC	ER	CN	140	9.8						3.4	3.2			X	BND	
1339	C	4	N217 E242	99.30-99.20			EC	BA	CN	134	10.8				7.7		2.5	4.6	2.3	3.4		UN	
1781	C	4	N221 E239	99.27	LA	PL	EC	BMS	CN	105	19.1	20.1			5.7	12.2	3.9					BND	ST
1795	C	4	N221 E239	99.33-99.23			OB	ER	CN	124	9						2.7					BND	
1823	C	4	N221 E238	99.36-99.26	LA	PL	EC	NC	CN	129	26.7	20.5		16.3	5.5	12.3	3.3		3.4	4.4		IMP	CV
1888	C	4	N223 E239	99.35-99.25			OB	MS			14.2						3.6					IMP	CV
1915	E	4	N229 E264	98.56-98.46			PC	TP			15.4						3.7					BND	ST
1954	E	4	N229 E266	98.42	LA	PL	SW	BMS	CN	117	27.6	18.8	18.9	14.6	8.7	12.7	4.4		2.2	5.1		IMP	ST
1981	D	4	N231 E253	98.88	LA	PL	EC	BMS	CN	135	18.5	24.3		17.7	5.9	13.7	5		4.5	2.5		BND	CV
2032	C	4	N222 E238	99.37-99.27			EC	ER	SN		6						1.2		1.8	3.5		UN	
2143	E	4	N230 E265	98.57-98.47	LA	PL	UIC	MS	CN		18.7	28.4				14.8	4.8					IMP	CV
2270	E	4	N229 E263	98.57-98.47			OB	BA	SN		4					7.8	1.9	3.7				BND	
2374	E	4	N230 E263	98.49	LA	PL	OB	BA	CN	115	12.2			16.1	9.1	11.9	3.6					BND	
2427	E	4	N230 E264	98.50-98.40			OB	BA	CN	123	6						3.7				X	BND	
2458	D	4	N231 E257	98.95-98.85	LA	PL	MOQ	CO	CN	124	27.2	19.7	21.1	12.6	6.8	10	4.4		3.3	4			ST
2534	E	3	N231 E263	97.95-97.85	EA/MA	OX	EC	BA	SN	146	13.1				9.4		4.9	4.4	2.7	4.7	X	IMP	
2600	E	4	N233 E265	98.55	LA	PL	OB	BA	CN	114	12.2			18.4	12.3	14.4	5.9				X	BND	
2603	D	4	N231 E252	99.02-98.92			OB	ER	CN	122	7.3						2.4					BND	
2683	D	1	N231 E252	98.24	FMP	ANG	BT	BA	LN	77	21.9			14.3	21.9	21	7				X	BND	
2741	E	4	N231 E265	98.41			EC	BA	CN	105	9.3						3.2					BND	
2868	D	1	N231 E253	98.31	EA	BW	EC	CO	CN	138	20.7	17.1	11.2	19.2	9.5	12	5	3.9	2.6	6.5	X		CV
2945	E	4	N231 E266	98.34	LA	PL	OB	CO	CN	127	33.3	23.8	14.2	16.9	9.6	12.8	4.1		2.9	5.9			CV
2973	E	4	N231 E263	98.64	LPr	DSN	OB	BA	SN	158	6.1			12.9		6.6	1.9	3.8				BND	
3029	E	4	N232 E265	98.54	LA	PL	MOC	CO	CN	129	24.9	19.8	18.1	13.2	6.8	10	5.3		3	5.6			ST
3059	E	4	N232 E265	98.49			EC	BA	CN	115	10.1			16.6		12.8	5.4					BND	

Table B-1 Attributes of Projectile Points recovered from Goff Creek (48PA325)

Catalog #	Block	Cultural Level	Unit	Elevation	Period	Point Type	Material Type	Portion	Haft Type	Prox. Shldr. Angle	Max Length	Blade Width	Blade Length	Base Width	Base Length	Haft Width	Max. Thickness	Ear Width	Notch Depth	Notch Width	Haft Grinding	Break Pattern	Blade Shape
3114	E	4	N233 E266	98.60-98.50			EC	BA	SN	148	7.1						4	2.6			X	BND	
3485	E	3	N239 E265	97.94-97.84			OB	ER	CN	140	6.7						2	3.4			X	BND	
3542	F	4	N231 E276	98.24-98.14	MA	HA	TSQ	BMS	CN	115	21.2	20.4		16.9	10.3	13.7	5.5					BND	
3612	F	4	N231 E271	98.27	LA	PL	EC	BMS	CN	114	23.6	18.3	23	14.2	4.4	12.4	4.7		3.1	3.5		BND	ST
3676	F	3	N231 E271	97.84-97.74			OB	ER	CN	127	6.4						3.7	3.7			X	BND	
3701	F	4	N231 E277	98.19-98.09	LA	PL	OB	BA	CN	122	15.2			17	17	14.4	5.8				X	BND	
3713	F	4	N231 E277	98.05	LA	PL	EC	MS	CN		26.8	22.7			6.9	14.8	4.4					BND	ST
3778	F	3	N231 E277	97.60-97.50			EC	NC	SN	144	16.8	13.3	8.9	15.6	8.1	11.7	4.7	3.9	2	5.2	X	BND	CV
3839	F	4	N231 E278	97.93-97.80	MA	HA	EC	NC	CN	138	35.2	20.1	27.7	15.8	7.9	13.4	5.5	5.2	2.1	4.5	X	IMP	CV
3840	F	4	N231 E278	97.93-97.80	MA	DN	EC	BMS	CN	113	17	18.1		12.4	6.9	10.7	5.6		2.9	5.9		BND	ST
3855	F	3	N231 E278	97.57			EC	CO	CN	116	35.4	17.3	28.9	13.7	6.5	12.2	5.8		1.7	4.5	X		CV
3889	F	4	N232 E276	98.06	LA	PL	EC	BA	CN	128	7.9			16.7	7.9	12.4	4.6					BND	
3890	F	4	N232 E276	98.03	LA	PL	MOC	BMS	CN	114	26.2	23.4	23.3	17.4	6.4	15.2	4.2		3.6	4.1		IMP	CV
3964	F	4	N233 E275	98.21-98.11			PC	BA	CN	108	7.4						3.3					BND	
4006	F	4	N231 E279	98.06-97.96	LA	PL	EC	BMS	CN		15.8				6.9	11.8	3.5		3.2	3.2	X	IMP	
4022	F	4	N231 E279	98.06-97.96	LA	PL	SW	BMS	CN	135	17.9		13.3	11.6	7.2		2.8		2	2.7		BND	CV
4058	D	1	N229 E254	98.2	EA	PH	PC	NC	CN	135	31.5	17.4	22.7	18.2	9.4	13.2	5.7	4.9	2.1	5.9	X	IMP	ST
4093	D	1	N229 E254	98.19-98.14			EC	ER	SN	150	6						5.2	2.8			X	BND	
4257	F	4	N232 E277	98	LA	PL	OB	BMS	CN	119	20.6	22		15.3	7.7	12.8	5.4		3.8	5.7	X	IMP	ST
4262	C	3	N221 E240	98.60-98.50			EC	CO	ST	90	26.7	16	24.4	7.9	3.6	7.4	3.1			4.5	X		
4288	F	4	N233 E276	98.25-98.15	LA	PL	EC	BMS	CN	111	17			15.7	8.3	13	4					IMP	
4294	F	4	N233 E276	98.1	LPr	RS	EC	NC	CN	116	19	14.4	15.4	7.9	5.4	6.2	2.6		2.7	3.2		IMP	ST
4344	F	4	N233 E279	98.10-98.00			EC	ER	CN	136	8						3.4				X	BND	
4377	F	4	N244 E286	98.04-97.94	LA		OB	MS			13.1						4.3					IMP	CV
4392	F	4	N244 E286	97.94-97.84	MA	DN	EC	CO	CN	109	24.4	16.4	17.5	12.8	8	11	4.7		1.3	6.7			ST
4416	F	4	N233 E278	98.03			OB	MS			17.6	11	17.6				3.3					IMP	ST
4420	F	4	N233 E278	98.02	LPr	RS	EC	NC	CN	110	22.2		18.4	8.3	5.8	6.7	2.6		3.3	4.7		IMP	ST
4463	F	4	N233 E278	98.01-97.91			EC	ER	CN	133	7.5				7		3.5					BND	
4532	D	4	N229 E252	98.95-98.85	LPr	RS	OB	BA	CN	126	6.3			10.3	6.3	7	2.9		1.5			BND	
4572	D	1	N229 E252	98.36	EA	PH	TSQ	BA	SN	144	11.5			19.2		12	4.1	4.9	3.6		X	BND	

Table B-1 Attributes of Projectile Points recovered from Goff Creek (48PA325)

Catalog #	Block	Cultural Level	Unit	Elevation	Period	Point Type	Material Type	Portion	Haft Type	Prox. Shldr. Angle	Max Length	Blade Width	Blade Length	Base Width	Base Length	Haft Width	Max. Thickness	Ear Width	Notch Depth	Notch Width	Haft Grinding	Break Pattern	Blade Shape
4834	F	4	N244 E286	97.74-97.64			OB	BA	CN	123	9.5			18.8		13.4	4.1	3.8			X	BND	
5202	D	1	N230 E252	98.30-98.20			OB	TP			14.2						3.8					IMP	
5378	D	4	N232 E256	98.92-98.62	LA	PL	SW	BA	CN	118	9.8			13.4	9.8	10.3	4					BND	
5379	D	4	N232 E256	98.92-98.62			OB	MS			12.6	8.9					3.1					IMP	ST
5395	D	1	N232 E256	98.22	EA	BW	EC	CO	CN	131	18.2	15.3	12.5	14.5	5.7	11.7	4.1		1.5	4	X		CV
5462	D	4	N231 E250	99.04-98.94	LA	PL	EC	CO	CN	138	27.6	17.8	12.8	15.2	5	15.6	4.2		1.9	3.9			CV
5555	D	4	N231 E251	98.99	LA	PL	MOC	BL	CN		26.3	19	23.4				4.6		3			BUR	CV
5638	D	4	N231 E255	98.87-98.77			EC	BA	CN	132	6.7			23.1			3.5				X	BND	
5709	D	1	N231 E255	98.27-98.22			EC	ER	SN	158	9.6						3.2	4.7			X	BND	
5869	D	1	N231 E256	98.24-98.19			SW	MS			18.3	14.7	18.3				4.7					IMP	ST
5959	D	1	N232 E254	98.30-98.25	EA	BW	EC	BA	SN	142	10.1			15.3		8.8	4.3	3.2	3.6		X	BND	
6108	D	1	N232 E252	98.38-98.28	EA	EC	OB	BA	CN	135	14.8				10.2		3.9	2.8	4.8	6.2	X	BND	
6132	F	4	N233 E277	98.07	LA	PL	OB	BA	CN	132	18.1			15.9	6.4	13.6	5.9		3.6	5.3		BND	CV
6217	D	1	N232 E255	98.19	EA/MA	OX	MOQ	CO	SN	146	28.6	18.1	19.5	17.8	9.1	12.2	5	4.4	2.5	5.6	X		CV
6219	D	1	N232 E255	98.21-98.16	EA	PH	OB	BA	SN	156	7.6						3.4	5.4	5.7		X	IMP	
6252	D	4	N232 E253	99.07-98.90	LA	PL	TSQ	BMS	SN	149	17.3	20.1		20.5	7.1	14.9	5.2		2.3	5		BND	
6360	D	1	N233 E254	98.38-98.33			SW	BA	SN	159	14.3			19.3	10.7	12.1	3.8	6	3.9	4.3	X	BND	
6397	D	1	N233 E254	98.3			OB	BA			11.2				11.2		4.4				X	IMP	
6440	D	1	N232 E254	98.15-98.10	EA	BW	EC	ER	CN	134	11.7					90	3.6	3.2			X	BND	
6774	D	1	N233 E253	98.24	EA	BW	OB	BA	CN	128	8.1			19.2		15.4	3.9	3.9	2.7		X	BND	
6877	D	1	N233 E254	98.23-98.18	EA	BW	OB	BA	CN	139	8.1			17.3			3.9	4.4			X	BND	
6906	D	4	N234 E255	98.90-98.80	LA	PL	EC	BMS	CN	121	23.7	21.9		17.6	7.8	13.5	3.6		3.3	5.6		IMP	ST
7026	D	1	N233 E256	98.30-98.25	EA	BW	EC	ER	CN	137	11.2						4.1					BND	
7271	D	1	N233 E255	98.29			OB	BA	SN	143	12.1			19.5		13.2	4.9	4.4			X	BND	
7363	D	4	N234 E254	98.87	LA	PL	EC	MS	CN		25	18.4	23.2			9.3	3.9					BND	
7366	D	4	N234 E254	98.97-98.87			OB	TP			15.3						2.4					BND	
7979	D	4	N229 E256	98.94-98.84	LPr	DTN	OB	BA	SN	173	13.5			14.2	10.2	7.6	2.7	6.4	2.9			IMP	
7980	D	4	N229 E256	98.84-98.74	LA	PL	EC	NC	CN	116	22.6	21.5		14	7.5	10	5.3		4.2	5.5		BND	ST
8095	D	4	N236 E256	99.08-98.77	LA	PL	EC	MS	CN		18	18.3	16.3			9.7	4.3					IMP	ST
8255	D	1	N236 E255	98.38-98.33			OB	BA	SN	143	6.4			11.2		7.3	3	2.6	1		X	BND	

Table B-1 Attributes of Projectile Points recovered from Goff Creek (48PA325)

Catalog #	Block	Cultural Level	Unit	Elevation	Period	Point Type	Material Type	Portion	Haft Type	Prox. Shldr. Angle	Max Length	Blade Width	Blade Length	Base Width	Base Length	Haft Width	Max. Thickness	Ear Width	Notch Depth	Notch Width	Haft Grinding	Break Pattern	Blade Shape
8794	A	2	N221 E157	100.23	EA	PH	EC	CO	CN	104	36	16.9	28.6		7.4	10.7	4.1		2.1	5.2	X	TA	CV
8930	A	2	N222 E149	100.23	EA	PH	EC	CO	SN	177	39.5	15.2	30.8	15.7	8.7	9.5	3.8	5.3	2.9	3.7	X		ST
9314	A	2	N221 E155	100.29	EA	BW	EC	NC	CN	141	22.4	18.5		18.5	8.8	13.4	4.1	3.5	2.9	5.6	X	IMP	UN
9733	A	2	N222 E153	100.20-100.10	EA	BW	EC	BA	CN	124	6.4			15.8		11.5	4.2	2.4			X	BND	
10290	A	2	N222 E151	100.30-100.20	EA		EC	ER	CN	129	7.6						3.7	3	3		X	BND	
10466	A	2	N223 E154	100.40-100.30	EA	BW	EC	BA	CN	141	8			19.3		13.9	2.7	3.6	2.9		X	BND	
10524	A	2	N223 E154	100.27	EA		SW	NC	SN	148	25.8	20.1		19.1	10.2	14.9	3.9	3.7	2.3	4.7	X	BND	ST
10660	A	2	N223 E152	100.40-100.30	EA	BW	EC	BA	CN	120	19.7	18.9			6.1	11.9	4.4	2.1	2.6	5.1	X	IMP	
10716	A	2	N223 E152	100.21	EA	PH	MOQ	CO	SN	148	26.6	17.7	18.4	17.6	8.2	11.6	5.9	3.5	2.8	4.5	X		CV
10892	A	2	N223 E157	100.30-100.20			OB	ER			9.6	15.5					4.5					IMP	
10909	A	1	N223 E157	99.92			OB	ER	CN	137	11.5						3.1	4.6			X	BND	
11275	A	2	N224 E150	100.3	EA	BW	EC	CO	CN	129	34.1	18.8	25.9	18.9	8.2	12.4	4.2	3.6	3.2	5.2	X		CV
11291	A	2	N224 E150	100.30-100.20	EA		EC	ER	CN	137	10.9						4	2.7			X	BUR	
12350	B	2	N223 E177	100.10-100.00	EA		OB	BA	CN	126	7.2			17.1	5.7	14.8	3.7	3.1	1.5	3.4	X	BND	
12421	D	1	N234 E254	98.35	EA	EC	OB	BA	CN	130	13.8	19.7		19.9	9.4	13.3	4.3	3.7	3.9	5.9	1	BND	
12439	A	2	N224 E152	100.30-100.20	EA	BW	MOQ	BA	SN	146	17.6			17.6		11.7	3.6	2.7	3		X	BND	
12448	A	2	N224 E158	100.40-100.30			OB	ER	CN	120	8.1						3.6	4.5			X	BND	
12585	A	1	N226 E162	100.10-100.00			EC	MS			21.9	16.2					4.5					IMP	
12747	B	2	N225 E177	100.10-100.00			OB	ER	SN	150	14.7						3.1	3.8			X	BND	
12758	B	2	N225 E177	100.10-100.00			OB	ER	SN		6.4						2.7				X	BND	
12856	A	2	N225 E154	100.22	EA	PH	EC	CO	SN	146	24.6	15.9	16.4	14.7	8.2	10.7	4.7	3.3	2.2	4.5	X		CV
12861	A	2	N225 E154	100.2	EA	BW	EC	NC	CN	135	22.4	22.6	14.5	12.9	8.1	7.7	3.8	2.9	2.7	5.9	X	BND	CV
13216	B	2	N222 E178	100.00-99.90			EC	ER	CN	135	9.5						3.9	4.2			X	BND	
13633	B	1	N224 E176	99.85-99.80	EA	PH	TSQ	BA	SN	152	7.7			18.7		11.5	4.8	4.2	4.1		X	BND	
13940	B	1	N226 E175	99.83	LP	CY	UIC	TP			27.9	17.2	27.9				5.8					BND	
13953	B	1	N226 E175	99.90-99.80			EC	ER	CN	122	12.3						3.7	4.2			X	BND	
14244	B	1	N225 E178	99.90-99.80			TSQ	ER	SN		9.7						3				X	BND	
14403	B	1	N226 E176	99.85-99.80			MOQ	ER	SN		7						1.8	3.1			X	BND	
14503	B	2	N227 E176	100.07	EA		EC	CO	CN	126	23.5	13.9	17.1	14.6	6.4	11.7	4.2	4.2	2.1	3.8	X		CV
14512	B	2	N227 E176	100.10-100.00			EC	ER	CN	140	8.6						3	2.7	3.1		X	BND	

Table B-1 Attributes of Projectile Points recovered from Goff Creek (48PA325)

Catalog #	Block	Cultural Level	Unit	Elevation	Period	Point Type	Material Type	Portion	Haft Type	Prox. Shldr. Angle	Max Length	Blade Width	Blade Length	Base Width	Base Length	Haft Width	Max. Thickness	Ear Width	Notch Depth	Notch Width	Haft Grinding	Break Pattern	Blade Shape
15233	B	2	N229 E177	99.95	EA	EC	MOQ	CO	CN	135	28.6	16.3	21.2	17.2	7.4	11.6	3.7	3.2	2.8	4.7	X		ST
15287	B	2	N229 E176	100.05	EA	PH	EC	CO	SN	157	29.9	16.2	22.3	19	7.6	13.6	4.9	3.7	2.2	3.4	X		ST
15376	B	1	N229 E178	99.90-99.80	EA	PH	EC	BA	SN	143	9			19		12.8	4.1	3.1	2.9		X	BND	
15417	B	2	N222 E176	100.00-99.90			SW	ER	SN		10.1						2.6	4.6			X	BND	

Table B-2 Attributes of bifaces recovered from Goff Creek (48PA325).

Catalog #	Area	Unit	Elevation (m)	Cultural Level	Portion	Material Type	Stage	Length	Width	Thickness	Use 1	Mat. Worked 1	Use 2	Mat. Worked 2	Use 3	Mat. Worked 3
485	G	N205 E199	100.32-100.22		UN	PC	V	4.7	4.4	2.6						
556	G	N206 E191	100.53-100.43		UN	UIC	V	5.1	3.3	1.5						
559	G	N206 E191	100.53-100.43		UN	OB	V	7.2	5.5	2.1						
568	G	N206 E191	100.4		UN	SW	III	39.1	42.3	9.3	S	SH	C	S		
577	G	N206 E191	100.43-100.33		UN	EC		6.2		4.4						
586	G	N206 E191	100.33-100.23		UN	OB	IV	7.9	7.9	3.9						
679	G	N206 E193	100.41		CO	EC	V	41.3	13.9	4.8	S	SH	S	SH		
776	G	N208 E193	100.42-100.32		UN	OB	V	12.3	4.7	2.1						
777	G	N208 E193	100.42-100.32		UN	OB	IV	9.2	2.7	2.3						
787	G	N208 E193	100.42-100.32		DS	EC	V	5.1	3.3	2.1						
809	G	N208 E189	100.51		LT	SW	III	44.1	46.1	12.5	S	HD				
933	G	N233 E201	100.51		LT	EC	IV	44	17.2	7.3	c	S				
940	C	N212 E245	99.20-99.10	4	MD	EC	III	22.3	23.1	5.5						
950	C	N212 E245	99.10-99.00	4	LT	EC	V	5	3.3	2.3						
970	C	N212 E245			DS	SW	V	17.3	10.3	2.4	c	S	C	S		
972	C	N212 E245	98.88	4	CO	SW	III	39.8	32.1	10.4						
993	C	N212 E245	98.45	1	DS	EC	IV	35	27	8.6	c	S	C	S		
998	C	N212 E245	98.46	1	PR	OB	III	31.6	37.7	8.3						
1046	G	N206 E191	99.73- 99.63		UN	OB	V	6.4	10.7	3.1						
1077	G	N210 E191	100.54-100.44		UN	EC	III	9.6	15.4	7.4	c	S				
1129	G	N210 E191	99.64- 99.54		UN	EC	V	7.6	3.1	1.8						
1150	G	N212 E191	100.50-100.40		UN	PC	V	7	5.5	2.2						
1185	G	N212 E191	99.80- 99.70		DS	EC	V	9	8.5	2.2						
1249	G	N208 E193	99.92- 99.82		MD	OB	III	17.6	11.3	5.4						
1367	C	N217 E242	99.10-99.00	4	CO	SW	III	66.8	42.6	16.8	S	H				
1397	C	N217 E242	98.50-98.40	1	UN	OB	V	22.8	15	5.5						
1406	G	N231 E199	100.62-100.52		UN	OB	III	6.9	9	2.5	S	SH				
1480	C	N218 E240	99.30-99.20	4	UN	EC	IV	29.5	30	6.9	c	S	C	S		
1481	C	N218 E240	99.30-99.20	4	DS	PC	V	15.8	12.3	3.8						
1497	C	N218 E240	99.20-99.10	4	LT	PC	V	7.6	3.1	2.1						
1499	C	N218 E240	99.18	4	UN	EC	III	22.2	9.2	6.6	c	SH				
1503	C	N218 E240	99.15	4	UN	SW	III	21.9	34.7	8.5						
1509	C	N218 E240	99.20-99.10	4	UN	OB	V	5.6	2.9	1.6						
1542	C	N218 E240	98.80-98.70	1	DS	SW	IV	27.2	19.5	6.5	c	S	C	S		
1556	C	N218 E240	98.61	1	UN	SW	III	37.4	29.4	9.7	S	SH	S	SH		

Table B-2 Attributes of bifaces recovered from Goff Creek (48PA325).

Catalog #	Area	Unit	Elevation (m)	Cultural Level	Portion	Material Type	Stage	Length	Width	Thickness	Use 1	Mat. Worked 1	Use 2	Mat. Worked 2	Use 3	Mat. Worked 3
1575	C	N218 E240	98.60-98.50	1	UN	OB	V	4.9	3.4	1.6						
1636	C	N220 E238	99.29	4	MD	EC	III	29	39	10.3	P	H				
1657	C	N220 E238	99.26-99.16	4	UN	OB	V	5.1	5.7	2.4						
1669	C	N220 E238	99.11	4	PR	OB	V	23.6	24.2	4.3						
1794	C	N221 E239	99.33-99.23	4	UN	OB	V	10.8	7.8	3.4						
1846	C	N221 E240	98.60-98.50	1	DS	OB	IV	11	12.6	3.7						
1847	C	N221 E240	98.60-98.50	1	DS	SW	IV	47.4	20.3	5.8	c	S	C	S		
1860	C	N222 E239	99.41-99.31	4	UN	OB	II	34.5	16.5	8.4						
1884	C	N223 E239	99.35-99.25	4	UN	OB	IV	11.5	3.9	2.8						
1935	E	N229 E266	98.54	4	CO	PC	II	49.4	37.2	18.9						
1961	E	N229 E266	98.44-98.34	4	DS	EC	V	7	6.5	2.1						
2026	C	N222 E238	99.47-99.37	4	DS	EC	IV	7.8	11.8	5.4						
2065	C	N222 E240	99.31-99.21	4	LT	OB	V	7	11	3.3						
2206	C	N223 E238	99.37-99.27	4	LT	OB	III	23.3	32.2	6.4	c	S	C	S		
2237	C	N223 E238	99.17-99.07	4	UN	OB	V	9	5.4	3.8						
2252	C	N230 E238	99.65-99.55	4	LT	OB	III	51.9	14.3	7.8	c	SH				
2305	E	N229 E265	98.64-98.54	4	DS	EC	V	20	17.1	4.1						
2310	E	N229 E265	98.54-98.44	4	LT	OB	V	13.8	6	3.4						
2316	E	N229 E265	98.48	4	UN	SW	III	27.7	23.2	3.9						
2339	E	N229 E265	98.41	4	CO	SW	II	50.9	34	13.3						
2408	E	N230 E264	98.5	4	DS	EC	V	20.9	16.3	4.3						
2451	E	N230 E266	98.43-98.33	4	UN	PC	II	34.5	14.8	8.9						
2459	D	N231 E257	98.74	4	UN	EC	II	29.8	23.9	10.5	S	H				
2466	D	N231 E257	98.76	4	UN	EC	IV	14.7	24.9	5.8						
2476	D	N231 E257	98.71	4	CO	SW	I	74.5	57.2	17	S	H				
2497	D	N231 E257	98.35-98.25	1	UN	EC	V	15.8	13.2	6.1						
2504	D	N231 E257	98.15-98.05	1	UN	TSQ	III	24.8	20.3	5.2						
2505	D	N231 E257	98.15-98.05	1	LT	EC	V	14.4	7.8	3.2						
2531	E	N231 E263	98.05-97.95	3	DS	OB	V	11.6	8.5	3.3						
2732	E	N231 E265	98.39	4	LT	BT	III	37.9	23.1	6.9	c	S				
2739	E	N231 E265	98.46	4	PR	EC	III	17.8	30.6	7.8						
2864	D	N231 E253	98.31	1	DS	SW	III	31.2	33.3	6.6	c	S				
2940	E	N231 E266	98.45	4	DS	EC	IV	34.3	30.9	7.3	c	SH	C	SH		
3047	E	N232 E265	98.50-98.40	4	UN	EC	V	5.9	4.6	2.5						
3062	E	N232 E266	98.68-98.58	4	UN	PC	III	25.1	15	5.2	S	SH				
3092	E	N232 E266	98.41	4	CO	SW	II	60.7	32.6	16.8						

Table B-2 Attributes of bifaces recovered from Goff Creek (48PA325).

Catalog #	Area	Unit	Elevation (m)	Cultural Level	Portion	Material Type	Stage	Length	Width	Thickness	Use 1	Mat. Worked 1	Use 2	Mat. Worked 2	Use 3	Mat. Worked 3
3095	E	N232 E266	98.45	4	LT	SW	II	41.1	11.3	11.3						
3109	E	N233 E266	98.60-98.50	4	UN	EC	V	8	5.7	3.7						
3111	E	N233 E266	98.57	4	UN	MOQ	V	20.9	16.4	4.3						
3126	E	N233 E266	98.50-98.40	4	DS	OB	V	9.3	10.9	2.5						
3262	E	N234 E265	98.5	4	UN	OB	V	12.9	11.2	4.3						
3291	E	N236 E265	98.32	4	PR	EC	III	21.9	27.9	6.7						
3321	E	N236 E265	97.85	3	DS	SW	II	40.7	28.9	14						
3379	F	N233 E277	98.15-98.05	4	UN	OB	V	4.7	2.1	1.3						
3405	E	N239 E265	98.54	4	LT	OB	IV	17.7	23.2	6.5	c	S				
3410	E	N239 E265	98.61	4	CO	OB	V	20.3	9.8	4.2						
3415	E	N239 E265	98.64-98.54	4	UN	OB	V	11.3	5.4	3.2						
3421	E	N239 E265	98.51	4	LT	EC	IV	12.4	24.9	5.9						
3422	E	N239 E265	98.54-98.44	4	PR	OB	IV	10.1	6.4	3.7						
3433	E	N239 E265	98.44-98.34	4	LT	EC	IV	16.2	12.6	5.2						
3439	E	N239 E265	98.29	4	CO	EC	III	60.2	38.5	13.7	c	S				
3482	E	N239 E265	97.94-97.84	3	PR	SW	III	20.8	34.6	6.8						
3489	E	N239 E265	97.84-97.74	3	PR	EC	V	25.7	6.1	2.9	c	S				
3515	F	N231 E275	98.14-98.04	4	UN	OB	V	6.5	5.5	2.7						
3597	F	N232 E275	98.23	4	PR	EC	III	42.1	32	9.6	c	SH	C	SH		
3598	F	N232 E275	98.21	4	UN	EC	III	47.3	34.9	8.7	S	H				
3603	F	N231 E271	98.44-98.34	4	DS	EC	V	13.5	12.1	4.5						
3643	F	N231 E271	98.15	4	UN	EC	IV	63.6	22.7	8.3	c	H				
3677	F	N231 E271	97.84-97.74	3	DS	EC	V	7.9	6.4	1.8	c	S	C	S		
3685	F	N231 E271	97.84-97.74	3	UN	OB	V	4.7	8.9	3.4						
3690	F	N231 E271	97.84-97.74	3	UN	OB	V	4	4.1	1.9						
3700	F	N231 E277	98.19-98.09	4	UN	EC	III	30.8	21.2	14.2						
3705	F	N231 E277	98.06	4	UN	EC	II	30.3	44.8	27.3						
3711	F	N231 E277	97.98	4	UN	SW	IV	45.7	32.5	8.3	c	S				
3716	F	N231 E277	98.02	4	UN	SW	III	24.5	31.9	13.5						
3758	F	N231 E277	97.63	3	UN	OB	III	18.5	28.4	5.5	S	SH	S	SH	S	SH
3796	F	N231 E279	98.07	4	DS	EC	IV	29	16.5	5.4	c	S				
3800	F	N231 E279	98.01	4	UN	EC	III	20.5	16.7	6.3	S	H				
3802	F	N231 E278	98.20-98.10	4	UN	EC	IV	15	38.8	6.9	S	SH				
3810	F	N231 E278	98.10-98.00	4	UN	OB	V	5.2	4.9	2.7						
3837	F	N231 E278	97.93-97.80	4	UN	EC	III	14.2	16.2	7.2	c	SH				
3857	F	N231 E278	97.60-97.50	3	LT	EC	V	9.5	1.4	1.8	c	SH				

Table B-2 Attributes of bifaces recovered from Goff Creek (48PA325).

Catalog #	Area	Unit	Elevation (m)	Cultural Level	Portion	Material Type	Stage	Length	Width	Thickness	Use 1	Mat. Worked 1	Use 2	Mat. Worked 2	Use 3	Mat. Worked 3
3882	F	N232 E276	98.15-98.05	4	LT	EC	V	12.9	6.5	3.5	c	S				
3900	F	N232 E276	98.05-98.00	4	UN	EC	III	25.8	12.4	8.3						
3913	F	N232 E279	98.10-98.00	4	LT	OB	V	13.2	5.6	4						
3917	F	N232 E279	98.10-98.00	4	UN	EC	V	6.3	7.2	2.8						
3930	F	N232 E279	98.10-98.00	4	DS	EC	V	20.1	19.2	3.8	c	S	C	S		
3939	F	N232 E279	98.00-97.90	4	LT	OB	V	13.6	7.5	3.5	c	SH				
3944	F	N232 E279	97.94	4	UN	EC	III	46.8	32.9	9.3	c	SH	C	SH		
3974	F	N233 E275	98.21-98.11	4	PR	OB	V	9.1	7.1	4						
3981	F	N233 E275	98.11-98.01	4	DS	EC	IV	16.6	7.1	3.1						
3987	F	N233 E275	98.11-98.01	4	UN	OB	V	10.7	4.4	2.9						
4000	F	N233 E277	98.25-98.15	4	UN	OB	III	15.2	23.5	5.7	c	SH	C	SH		
4049	F	N231 E279	97.66-97.56	3	LT	EC	V	11.2	3.9	2.9						
4127	D	N230 E251	98.96	4	UN	EC	III	37.3	46.7	7.3						
4212	F	N232 E275	98.20-98.10	4	PR	EC	V	10.9	8.9	4						
4216	F	N232 E275	98.10-98.00	4	UN	SW	V	7.8	4	2.6						
4218	F	N232 E275	98.06	4	CO	EC	III	42.4	34.5	8.9	c	SH	C	S		
4225	F	N232 E275	98.10-98.00	4	UN	OB	IV	9.5	6.6	3.6						
4253	F	N232 E277	98.07-97.97	4	UN	EC	II	24.9	21	9.3						
4285	F	N232 E278	98.08-97.98	4	UN	EC	III	20.2	15.7	4.7						
4289	F	N233 E276	98.25-98.15	4	PR	EC	III	41.2	27.7	7.9	c	SH	C	SH		
4310	F	N233 E276	98.15-98.05	4	LT	OB	IV	18.8	11	5.2	c	SH				
4315	F	N233 E276	98.15-98.05	4	UN	UIC	V	5.6	3.9	1.6						
4331	F	N233 E279	98.10-98.00	4	UN	OB	V	7.2	4.9	1.8						
4343	F	N233 E279	98.10-98.00	4	LT	EC	IV	19.8	10.2	2.9	c	S				
4354	F	N233 E279	98.00-97.95	4	DS	EC	V	8.8	12.7	2.8	c	S	C	S		
4384	F	N244 E286	97.94-97.84	4	UN	EC	V	7	8.4	3.4						
4390	F	N244 E286	97.94-97.84	4	LT	EC	V	12.4	4.8	3.2						
4396	F	N244 E286	97.8	4	PR	EC	III	47.9	27.1	7.9						
4467	F	N239 E283	97.93-97.83	4	LT	EC	III	17	11.6	6.5						
4486	F	N239 E283	97.81	4	CO	EC	II	42.3	26.1	9.9	S	H				
4497	F	N239 E283	97.73-97.63	4	UN	OB	V	6.4	6.7	2.2						
4553	D	N229 E252	98.69	4	CO	SW	III	61.8	44.1	11.9						
4611	D	N228 E252	98.96-98.86	4	DS	EC	IV	14.8	20.4	4.8						
4694	D	N228 E252	98.26-98.21	1		SW	IV	18.8	27.8	5.5						
4796	D	N229 E254	98.23	1	UN	EC	II	48	18.2	12.1						
4839	F	N244 E286	97.54	4	LT	UIC	III	27.8	27.5	10	S	SH				

Table B-2 Attributes of bifaces recovered from Goff Creek (48PA325).

Catalog #	Area	Unit	Elevation (m)	Cultural Level	Portion	Material Type	Stage	Length	Width	Thickness	Use 1	Mat. Worked 1	Use 2	Mat. Worked 2	Use 3	Mat. Worked 3
4856	D	N231 E254	99.00-98.70	4	PR	EC	III	33.3	31.9	7.4	c	S				
4917	D	N231 E254	98.25-98.20	1	LT	EC	IV	16.7	7.8	4.8	c	S				
4937	D	N231 E254	98.23	1	PR	EC	III	22.8	37.3	8.3						
4994	D	N231 E256	98.84-98.74	4	PR	SW	III	28.3	20	5.6	c	S	C	S		
5019	D	N229 E252	98.25-98.15	1	LT	EC	III	19.1	7.6	5.1						
5138	D	N230 E252	99.00-98.90	4	UN	EC	IV	20.7	23	5.2						
5172	D	N230 E252	98.35	1	DS	SW	II	21.6	30.8	10.2						
5237	D	N230 E255	98.76	4	UN	EC	II	24.4	36.2	8.9						
5239	D	N230 E255	98.84-98.74	4	LT	OB	V	11.7	7.2	3.5						
5248	D	N230 E255	98.74-98.64	4	MD	TSQ	III	30.3	58.3	10.2						
5336	D	N230 E255	98.24-98.14	1	UN	EC	V	8	6	2.4						
5342	D	N230 E255	98.24-98.14	1	LT	OB	III	22.3	8.8	7.5						
5374	D	N232 E256	98.92-98.62	4	LT	EC	IV	17.5	8.3	3.6	c	S				
5375	D	N232 E256	98.92-98.62	4	UN	EC	III	33	16.7	8.8						
5399	D	N232 E256	98.27-98.22	1	LT	PC	IV	17.6	12.7	5.5	S	H				
5417	D	N230 E251	98.26	1	UN	SW	III	19.3	39.4	10.5						
5527	D	N231 E250	98.2	1	UN	OB	V	17	9.2	5.7						
5592	D	N231 E251	98.43	1	UN	EC	III	16.7	14.9	5.3						
5611	D	N231 E251	98.34-98.24	1	DS	MOQ	IV	32.7	20	7.5	c	SH	C	SH		
5637	D	N231 E255	98.87-98.77	4	UN	EC	IV	17.9	12.8	3.8						
5664	D	N231 E255	98.37-98.32	1	UN	EC	IV	15.2	7.7	5.4						
5764	D	N232 E251	99.14-98.84	4	UN	EC	IV	17.1	11.7	3.9						
5767	D	N232 E251	99.14-98.84	4	CO	EC	II	47.1	34.3	10.5	S	SH	S	SH		
5923	D	N232 E254	99.00-98.70	4	MD	OB	V	14.6	20.9	5.4						
5940	D	N232 E254	98.32	1	DS	OB	IV	18.5	21.3	5.9	S	SH	S	SH		
6000	D	N232 E254	98.25-98.20	1	LT	EC	V	9	7.5	2.7						
6054	D	N232 E252	98.89	4	MD	EC	IV	30.6	22	6.9	c	S				
6147	D	N232 E255	98.8	4	LT	EC	IV	26.5	15	5.2						
6149	D	N232 E255	98.86-98.76	4	DS	EC	V	12.7	10.4	2.9						
6318	D	N232 E253	98.27-98.17	1	LT	OB	V	19.1	6.6	3.4	c	S				
6337	D	N233 E254	99.03	4	UN	OB	IV	14.6	6.8	3.5	c	S				
6349	D	N233 E254	98.42	1	UN	SW	III	51.7	30.3	17.9	S	H				
6439	D	N232 E254	98.15-98.10	1	UN	EC	V	7.6	5.5	2.3						
6456	D	N233 E252	99.10-99.00	4	CO	EC	III	41.4	26.9	6.5	c	SH	C	SH		
6491	D	N233 E252	98.90-98.80	4	LT	EC	IV	21.1	10	4.8	c	SH				
6524	D	N233 E252	98.38	1	LT	SW	III	31.8	12.4	7	S	H				

Table B-2 Attributes of bifaces recovered from Goff Creek (48PA325).

Catalog #	Area	Unit	Elevation (m)	Cultural Level	Portion	Material Type	Stage	Length	Width	Thickness	Use 1	Mat. Worked 1	Use 2	Mat. Worked 2	Use 3	Mat. Worked 3
6618	D	N232 E256	98.17	1	PR	SW	III	31.7	28.7	8.9						
6632	D	N232 E256	98.17-98.12	1	LT	EC	V	12.8	6.9	9.3	c	SH				
6671	D	N233 E253	98.96-98.86	4	DS	EC	IV	20	14.5	4.8	c	SH	C	SH		
6677	D	N233 E253	98.96-98.86	4	DS	EC	III	22.1	17	5.5	S/P	H	S	H		
6789	D	N233 E253	98.21-98.16	1	UN	OB	V	9.6	4.7	3						
6832	D	N233 E254	98.28-98.23	1	UN	OB	IV	8.6	5.2	3.1						
6854	D	N233 E254	98.23	1	UN	EC	III	36.3	28.6	8.8						
6965	D	N234 E255	98.26	1	LT	OB	III	33.2	14.8	12	c	SH				
7038	D	N233 E256	98.25-98.20	1	UN	EC	V	5.5	3.2	2.2						
7054	D	N233 E256	98.20-98.15	1	UN	EC	IV	14.8	8.5	3.1	c	S				
7071	D	N233 E256	98.20-98.15	1	UN	SW	IV	8.5	11.3	4.9	S/C	SH	S/C	SH		
7235	D	N233 E255	98.80-98.70	4	DS	EC	II	51.7	32.2	15.1						
7284	D	N233 E255	98.23	1	LT	EC	III	23.2	16.4	7.3	c	SH				
7552	D	N235 E255	98.92-98.82	4	PR	EC	IV	27	19.7	5	S	S	S	S		
7566	D	N235 E255	98.72-98.62	4	UN	EC	V	16.3	21.2	3.4						
7621	D	N234 E254	98.27	1	DS	TSQ	IV	30.2	28.9	5.9	c	S	C	S		
7755	D	N234 E256	99.00-98.54	4	DS	EC	V	15	14.8	3.2	c	S				
7854	D	N235 E255	98.22-98.17	1	UN	EC	V	6.7	4.6	2.7						
7856	D	N235 E255	98.18	1	PR	SW	III	42.6	40	9.4	c	SH	C	SH		
7911	A	N220 E151	100.2	2	CO	EC	III	44.5	31.6	9.5						
8022	D	N234 E256	98.19	1	CO	OB	IV	26.5	13.9	4.1	c	S	C	S		
8043	D	N234 E256	98.15	1	UN	SW	III	85.9	47.4	24.3	S	H	S	H		
8168	D	N236 E256	98.13-98.08	1	UN	EC	III	16.1	29.3	6.8						
8226	D	N236 E255	98.58-98.48	1	MD	EC	IV	18.8	47.6	8.9	c	SH	C	SH		
8254	D	N236 E255	98.38-98.33	1	PR	OB	V	6	14.1	4.1						
8286	D	N236 E255	98.23	1	UN	EC	IV	11.5	21.7	6.1	c	SH	C	S		
8288	D	N236 E255	98.18	1	UN	SW	III	10.3	29	8.6	S	H				
8310	D	N236 E255	98.18-98.13	1	UN	EC	III	24	11.6	7.3						
8332	A	N221 E154	100.33	2	DS	EC	IV	47.2	37	7.8	c	SH	C	SH		
8403	D	N229 E256	98.44-98.34	1	CO	EC	III	73	41.8	15.7						
8425	A	N220 E153	100.18	2	UN	EC	IV	35.8	25.4	6	c	S	C	S		
8467	A	N220 E154	100.12	2	CO	EC	III	52.3	32.8	10.6	S	SH				
8502	A	N220 E157	100.24	2	UN	EC	IV	35	21.1	5.2	c	SH	C	SH		
8616	A	N220 E156	100.29	2	CO	EC	IV	42.2	22.5	6.8	c	SH	C	SH		
8673	A	N221 E153	100.26	2	UN	OB	III	22.2	41.2	8.4	c	SH				
8680	A	N221 E153	100.30-100.20	2	UN	EC	V	5.3	4.5	2.2						

Table B-2 Attributes of bifaces recovered from Goff Creek (48PA325).

Catalog #	Area	Unit	Elevation (m)	Cultural Level	Portion	Material Type	Stage	Length	Width	Thickness	Use 1	Mat. Worked 1	Use 2	Mat. Worked 2	Use 3	Mat. Worked 3
8706	A	N221 E156	100.40-100.30	2	LT	EC	V	20.1	4.9	2.9						
8729	A	N221 E156	100.30-100.20	2	DS	EC	V	4.6	6.7	1.3						
8788	A	N221 E157	100.26	2	UN	EC	III	42.9	23.5	9.1	S	H				
8838	A	N221 E158	100.22	2	CO	EC	IV	37.2	15.2	4.7	c	SH	C	SH		
8890	A	N221 E158	100.20-100.10	2	DS	EC	IV	11	8.5	2.5	c	SH	C	SH		
8912	A	N222 E147	100.19	2	PR	SW	III	27.2	22.5	5.7	c	S				
8984	A	N222 E150	100.24	2	LT	EC	II	77	33	21.5						
9069	A	N221 E154	100.23	2	UN	EC	III	47.9	23.6	12.2	S	H				
9092	A	N221 E154	100.20-100.10	2	UN	OB	IV	15.9	8.1	4.1	c	S				
9118	A	N222 E155	100.31	2	UN	EC	III	54.9	14	10.5	c	SH				
9163	A	N222 E158	100.30-100.20	2	UN	EC	V	8.7	5.8	2.8						
9268	A	N221 E155	100.28	2	UN	PC	III	34.8	15	9						
9390	A	N222 E152	100.31	2	UN	EC	III	20.2	38.2	9.1						
9584	A	N222 E151	100.30-100.20	2	UN	EC	V	16	8.6	4.9						
9586	A	N222 E151	100.27	2	UN	EC	III	24.7	40.6	8.9	c	H	C	H		
9647	A	N222 E150	100.18	2	DS	OB	IV	25.6	24.3	5.5	c	S	C	S		
9661	A	N222 E153	100.40-100.30	2	LT	EC	IV	14.1	19	2.8	c	SH				
9730	A	N222 E153	100.20-100.10	2	LT	EC	IV	8.7	7.1	2.9	c	SH				
9891	A	N222 E156	100.3	2	UN	EC	III	30.5	26.2	11.1	S	H				
10049	A	N222 E154	100.19	2	UN	EC	IV	29.5	45	9.9	S	H				
10097	A	N222 E157	100.37	2	UN	EC	III	28.6	30.4	11.5	S	H				
10314	A	N222 E151	100.25	2	PR	EC	III	27.7	38.4	10.8	c	SH	C	SH		
10442	A	N223 E151	100.00-99.90	1	UN	EC	V	10.7	8.1	3.1						
10472	A	N223 E154	100.33	2	DS	EC	III	20.3	18.7	4.5	c	SH	C	SH		
10535	A	N223 E154	100.30-100.25	2	DS	EC	IV	12.3	11.5	3.1	c	SH				
10542	A	N223 E154	100.27	2	CO	EC	III	42.5	25.5	10.1	S	SH				
10627	A	N223 E150	100.20-100.10	2	UN	SW	III	7.4	9.8	2.8	S	H	S	H		
10648	A	N223 E152	100.39	2	UN	SW	III	44.4	23.5	10.2	S	H				
10662	A	N223 E152	100.40-100.30	2	LT	SW	III	25.3	11	7	S	SH				
10663	A	N223 E152	100.40-100.30	2	LT	EC	V	16.8	3.8	1.8						
10665	A	N223 E152	100.39	2	UN	SW	II	35	46.3	11.7	S	H				
10718	A	N223 E152	100.30-100.20	2	UN	SW	III	14.5	30.8	9.1						
10762	A	N223 E152	100.30-100.20	2	UN	EC	V	10.3	5.3	3.1						
10859	A	N223 E153	100.30-100.20	2	UN	SW	IV	26.2	8.5	5.1	c	SH				
10984	A	N224 E153	100.40-100.30	2	LT	EC	III	19	9.5	5.1	S	SH				
11026	A	N223 E155	100.34	2	UN	EC	II	20.8	14.4	8						

Table B-2 Attributes of bifaces recovered from Goff Creek (48PA325).

Catalog #	Area	Unit	Elevation (m)	Cultural Level	Portion	Material Type	Stage	Length	Width	Thickness	Use 1	Mat. Worked 1	Use 2	Mat. Worked 2	Use 3	Mat. Worked 3
11072	A	N223 E155	100.35	2	PR	EC	III	28.6	38.6	12	S	SH				
11087	A	N223 E155	100.40-100.30	2	DS	EC	V	10.8	10.3	4.4	S	SH				
11136	A	N223 E155	100.30-100.20	2	UN	EC	III	13	7.7	3.1	c	S				
11234	A	N223 E154	100.19	2	LT	EC	II	28.8	21.1	10.1	c	S				
11252	A	N223 E154	100.20-100.10	2	LT	OB	V	13.4	5.4	2.8	c	S				
11423	A	N223 E158	100.27	2	UN	SW	IV	29.3	28.1	4.9	c	S	C	S		
11444	A	N223 E158	99.91	1	UN	SW	II	56.1	41.1	15.2	S	SH				
11486	A	N224 E151	100.40-100.30	2	DS	TSQ	IV	7.2	9	2.1						
11791	A	N224 E155	100.29	2	DS	EC	III	38.1	38	12.3	S	SH	S	SH		
11818	A	N224 E152	100.31	2	LT	EC	III	41.1	10.1	8	c	H				
12006	A	N224 E154	100.29	2	UN	EC	III	24.4	33.7	8.8						
12043	A	N224 E154	100.20-100.10	2	UN	EC	III	12.4	12.5	4.9						
12065	A	N224 E154	99.90-99.80	1	UN	TSQ	III	30.7	22.1	6.7	c	SH				
12242	A	N224 E153	100.20-100.10	2	LT	EC	III	17.4	7.4	5.4	c	SH				
12248	A	N224 E153	100.20-100.10	2	LT	EC	III	14.9	12.4	3.6	c	SH				
12249	A	N224 E153	100.20-100.10	2	DS	EC	IV	4.7	6.2	2.3						
12342	A	N226 E163	99.97	1	UN	SW	III	32.8	44	10.5	S	SH	S	SH		
12447	A	N224 E158	100.40-100.30	2	LT	OB	V	12.1	4	1.9						
12473	A	N224 E158	100.20-100.10	2	UN	SW	V	10	5.8	3.5	S	SH				
12538	A	N226 E162	100.40-100.30	2	DS	EC	V	17.8	15.5	3.3						
12609	A	N224 E155	100.28	2	DS	EC	II	44.3	42.4	14.7						
12647	A	N224 E155	100.23	2	MD	EC	III	43.8	35	12.6	S	H				
12648	A	N224 E155	100.23	2	PR	EC	III	44.4	28.6	8.8	S	SH				
12684	A	N224 E156	100.34	2	UN	EC	III	32.1	21.2	9.9						
12685	A	N224 E156	100.33	2	PR	EC	II	42.5	39.9	9.3	S	SH				
12766	B	N225 E177	99.99	2	DS	EC	IV	28.1	23.9	7.5	S	SH	S	SH		
12786	B	N225 E177	99.82	1	UN	EC	III	39.2	25.8	9.2	S	SH	S	SH	S	SH
12794	B	N225 E177	99.82	1	UN	UIC	III	46.7	27.2	9.8	c	SH				
12845	A	N225 E154	100.40-100.30	2	LT	PC	V	9.3	4.3	1.2						
13128	B	N223 E176	100.00-99.90	2	UN	OB	V	9.6	4.3	1.7						
13158	B	N223 E176	99.89	1	CO	SW	III	63.8	40.7	18.2	S	SH	S	SH		
13282	B	N223 E178	99.94	2	LT	EC	II	25.6	17.6	11.9						
13516	B	N224 E177	100.00-99.90	2	UN	EC	III	19.9	15.3	8.3	S	SH				
13632	B	N224 E176	99.84	1	DS	SW	III	47.5	33.1	10	S	H				
13677	B	N224 E178	100	2	UN	EC	III	43.5	27.7	10.9						
13759	B	N225 E175	100.00-99.90	2	UN	EC	III	23.8	13.6	10.4						

Table B-2 Attributes of bifaces recovered from Goff Creek (48PA325).

Catalog #	Area	Unit	Elevation (m)	Cultural Level	Portion	Material Type	Stage	Length	Width	Thickness	Use 1	Mat. Worked 1	Use 2	Mat. Worked 2	Use 3	Mat. Worked 3
13810	B	N225 E176	99.99	2	UN	SW	III	42.7	31.5	7.8						
13913	B	N226 E175	100.10-100.00	2	UN	SW	III	15.2	11.4	5.5						
13954	B	N226 E175	99.79	1	UN	OB	V	15	11.9	5.1						
13973	B	N226 E177	100.08	2	UN	SW	III	48.1	17.4	9.1	S	H				
14218	B	N225 E178	99.98	2	LT	EC	IV	26.5	11.2	5.5						
14229	B	N225 E178	99.83	1	CO	SW	III	44.9	32.8	8.2						
14285	B	N226 E176	100.07	2	PR	EC	III	31.7	15.1	10.2						
14317	B	N226 E176	100	2	CO	SW	III	52	30.7	17	S	SH	S	SH		
14319	B	N226 E176	100.03	2	UN	OB	III	28	16.9	9.1	c	SH				
14428	B	N227 E175	100.10-100.00	2	UN	EC	II	19.8	17.1	6.3						
14451	B	N227 E175	100.10-100.00	2	LT	EC	IV	16.8	5.9	2.3						
14782	B	N228 E176	99.96	2	CO	SW	III	89.5	60.1	22.4						
14806	B	N225 E179	99.82	1	LT	SW	III	30.7	7.9	5						
14994	B	N228 E175	99.95	2	CO	SW	IV	38.3	21	6.2						
15203	B	N229 E177	100.20-100.10	2	UN	OB	V	5.3	3.4	2.3						
15282	B	N229 E176	100.20-100.10	2	LT	EC	IV	14.8	6.9	3.6						

Table B-3 Attributes of drills recovered from Goff Creek (48PA325). All measurements in millimeters.

Catalog #	Area	Cultural Level	Unit	Elevation	Material Type	Portion	Length	Width	Thickness	Bit Length	Bit Width	Material Worked	X-Section
793	G	4	N208 E193	100.42-100.32	UIC	TP	11.5	7.7	2.5	11.5	5.2	SH	OV
834	G	4	N208 E189	100.43-100.33	EC	TP	21.5	13.1	5.2	21.5	9.4	SH	DM
853	G	4	N208 E189	100.33-100.23	OB	TP	8.4	3.2	2.1	8.4	3.2	S	DM
1517	C	4	N218 E240	99.10-99.00	MOC	TP	10.9	9.2	3.3	10.9	9.2	SH	DM
1584	C	3	N218 E240	98.60-98.50	EC	TP	18.2	10.2	4.9	14.5	9.6	SH	DM
1744	C	4	N220 E239	99.44-99.34	OB	TP	15.8	5.5	2	15.8	5.5	S	OV
2205	C	4	N223 E238	99.37-99.27	OB	TP	5.9	4.7	1.6	5.9	4.7	S	OV
2228	C	4	N223 E238	99.17-99.07	EC	TP	11.9	7.6	4.4	11.9	7.6	SH	DM
2946	E	4	N231 E264	98.60-98.50	OB	MS	7.5	5.8	2.3		5.8	SH	OV
3546	F	4	N231 E276	98.14-98.04	OB	TP	8.8	4.9	1.4	8.8	4.9	S	OV
3654	F	4	N231 E271	98.14-98.04	OB	MS	16.4	9.8	3.3	7.9	6.4	S	OV
6475	D	4	N233 E252	98.96	EC	CO	23.1	22.8	4.7	3.9	4.6	SH	OV
8315	D	1	N236 E255	98.13-98.08	EC	CO	26.2	15.4	1.6	3.4	3	S	OV
9956	A	2	N223 E151	100.31	EC	CO	35.5	19.1	6.1	10.2	6.6	H	TR
12378	B	2	N223 E177	99.91	SW	CO	40.2	26.7	2.6	10.2	8.6	SH	TR
13197	B	2	N223 E177	100.10-100.00	SW	TP	8.7	5.5	3.3	8.7	5.5	H	DM
13200	B	2	N223 E177	100.10-100.00	SW	TP	8.5	4.1	2.9	8.5	4.1		DM

Table B-4 Attributes of scrapers recovered from Goff Creek (48PA325). All measurements in mm.

Catalog #	Scraper Type	Area	Cultural Lvl	Unit	Elev. (m)	Mat. Type	Length	Width	Thickness	Bit Width	Bit Angle	Mat. Worked
1696	End	C	3	N220 E238	98.76	EC	29.3	27.1	7.7	26.9	76	H
2001	End	C	4	N221 E239	99.22	SW	54.6	40.4	20.2	35.0	75	H
2315	End	E	4	N229 E265	98.49	EC	31.7	26.0	6.4	20.0	64	H
2616	End	D	4	N231 E252	98.89	EC	36.1	34.6	11.6	11.6	63	HD
2730	End	E	4	N231 E265	98.48-98.38	EC	26.2	21.0	7.3	21.0	87	H
2824	End	C	4	N221 E240	99.16	SW	46.8	33.2	12.6	30.7	64	H
3000	End	E	4	N231 E263	98.35	PC	21.0	15.8	4.6	13.1	56	SH
3031	End	E	4	N232 E265	98.51	SW	38.2	25.5	7.1	25.5	62	SH
3256	End	E	4	N234 E265	98.53	EC	31.0	20.3	8.7	14.3	63	SH
3357	End	E	4	N230 E264	98.60-98.50	EC	41.9	40.1	15.1	40.1	65	H
3370	End	F	4	N233 E277	98.05	EC	45.5	31.0	15.8	32.9	53	H
3619	End	F	4	N231 E271	98.27	EC	18.8	30.7	7.0	26.6	63	SH
3756	Side	F	3	N231 E277	97.80-97.70	EC	33.4	25.0	4.5	22.2	65	H
4043	End	F	4	N231 E279	97.89	EC	37.8	29.7	13.6	21.4	63	UN
4055	End	F	3	N231 E279	97.47	PC	22.0	19.4	3.7	19.4	58	H
4112	End	D	1	N229 E254	98.09	MOQ	61.5	32.4	9.0	23.2	46	HD
4267	End	F	4	N232 E278	98.18-98.08	SW	32.7	28.4	22.1	24.5	88	H
4737	End	D	4	N229 E254	98.69-98.59	PC	36.9	19.6	4.3	19.6	65	HD
5126	End	D	1	N230 E250	98.13	EC	51.1	37.7	30.7	31.6	81	H
5814	End	D	1	N231 E256	98.35	EC	31.1	22.9	10.2	21.0	83	H
5859	End	D	1	N231 E256	98.21	EC	29.7	23.2	13.2	21.7	73	H
6178	End	D	1	N232 E255	98.36-98.26	OB	15.6	18.6	5.3	14.3	48	SH
6259	Side	D	4	N232 E253	98.90-98.80	OB	91.5	45.6	16.1	66.8	59	SH
6807	End	D	1	N233 E254	98.3	PC	34.1	29.5	6.4	0.0	0	UN
7445	End	D	1	N234 E255	98.23	EC	36.0	26.7	6.6	20.6	62	SH
7555	End	D	4	N235 E255	98.9	EC	58.6	39.1	15.1	32.5	73	H
7653	End	D	4	N235 E256	98.86	SW	41.2	34.0	9.1	34.0	73	H
7655	End	D	4	N235 E256	99.02-98.77	EC	21.4	12.0	5.6	10.9	59	H
7658	End	D	1	N235 E256	98.32-98.27	EC	28.8	14.8	5.5	14.8	62	SH
8883	End	A	2	N221 E158	100.18	SW	50.9	36.5	15.4	36.5	59	H
9320	End	A	2	N221 E155	100.22	EC	37.2	27.6	13.6	24.1	81	H
9478	End	A	2	N222 E151	100.27	EC	25.1	30.3	6.3	30.3	44	SH
9781	End	A	2	N222 E154	100.3	EC	33.1	27.2	5.9	19.6	76	H
11239	End	A	2	N223 E154	100.16	EC	28.5	19.6	4.6	19.6	69	HD
12306	End	A	2	N225 E155	100.30-100.20	SW	24.9	11.3	6.3	7.3	60	SH
13262	End	B	2	N223 E178	100	EC	39.8	17.7	6.6	16.1	57	S
13371	End	B	2	N224 E176	100.07	EC	32.8	28.6	15.3	21.3	78	S
13727	End	B	1	N224 E178	99.82	EC	39.8	23.1	8.7	17.2	70	HD
13884	Side	B	2	N226 E175	100.06	EC	59.3	19.4	7.9	0.0	86	H
14007	Side	B	1	N225 E177	99.83	EC	54.5	36.6	7.7			
14008	Side	B	1	N225 E177	99.83	EC	64.8	22.9	10.4			
14230	End	B	1	N225 E178	99.82	EC	40.9	24.0	6.8	24.0	80	H
14735	End	B	2	N228 E176	100.12	EC	60.7	33.5	13.1	21.9	73	SH

Table B-5 Attributes of flake tools recovered from Goff Creek (48PA325). All measurements in mm.

Catalog #	Type	Area	Unit	Elev. (m)	Cultural Lvl	Mat. Type	Length	Width	Thickness	Use 1	Edge 1 Length	Mat. Worked 1	Use 2	Edge 2 Length	Mat. Worked 2	Use 3	Edge 3 Length	Mat. Worked 3
490	UF	G	N205 E199	100.13	4	SW	33.9	29.3	8.8	C	19.1	S						
549	RF	G	N206 E191	100.53-100.43	4	MOC	23.6	13.7	1.4	C	20.8	S	C	18.8	SH			
552	UF	G	N206 E191	100.53-100.43	4	EC	17.1	11.5	2.1	C	13.4	S						
557	UF	G	N206 E191	100.53-100.43	4	PC	24.6	10.1	5.7	S	18.7	H						
558	RF	G	N206 E191	100.53-100.43	4	OB	7.7	6.1	3	S	5.8	SH						
560	RF	G	N206 E191	100.53-100.43	4	UIC	22.5	10	1.7	C	13	S						
595	UF	G	N206 E191	100.33-100.23	4	OB	7.1	6.2	2	C	5.5	S						
626	RF	G	N204 E191	100.28	4	PC	41.7	22.1	9.5	0	0							
627	RF	G	N204 E191	100.28	4	PC	29.3	19.6	11.5	0	0							
665	UF	G	N204 E191	99.7	2	SW	77.2	45.6	16.2	C	47.6	S						
687	RF	G	N206 E193	100.47-100.37	4	EC	19	9.4	6.4	S	16.7	H						
775	UF	G	N208 E193	100.42-100.32	4	PC	29.5	10.9	3.7	S	23.7	SH						
780	RF	G	N208 E193	100.42-100.32	4	EC	18.1	15.5	10.1	GV	8.6	SH						
782	RF	G	N208 E193	100.42-100.32	4	SW	14	18.1	4.4	S	14	SH	S	14	SH			
789	RF	G	N208 E193	100.42-100.32	4	EC	16.3	9.4	1.9	C	7.5	S						
794	UF	G	N208 E193	100.31	4	OB	24.6	19.6	3.8	S	10.3	SH						
803	UF	G	N208 E189	100.63-100.53	4	EC	22.4	16.3	4.4	S	13.5	SH						
822	RF	G	N208 E189	100.51	4	SW	37.1	33.4	7.1	C	17.8	SH						
880	UF	G	N208 E189	99.93-99.83	4	EC	48.3	32.1	16.9	S	11.8	SH						
889	RF	G	N208 E189	99.74	2	EC	35.7	13	3.7	C	26.5	S						
909	UF	G	N208 E189	99.73-99.63	2	EC	11.1	8.9	3	S	7.1	SH						
918	RF	G	N208 E189	99.63-99.53	2	EC	18.4	8.5	2.4									
921	UF	G	N208 E189	99.63-99.53	2	SW	23	12.8	2.7	S	7.1	SH	S	11	SH			
924	UF	G	N208 E189	99.63-99.53	2	EC	13.6	7.6	2.1	C	6.2	S						
942	UF	C	N212 E245	99.20-99.10	4	SW	45.8	27.8	11.5	C	21.6	S						
952	RF	C	N212 E245	99	4	EC	35.4	38.8	9.9	S	16.9	SH						
958	RF	C	N212 E245	99.02	4	PC	26.4	17.5	5.5	S	9.5	SH	S	17.1	H	S	9	H
964	UF	C	N212 E245	99.10-99.00	4	EC	38.8	22	7.2	C	18.8	SH						
987	UF	C	N212 E245	98.54	3	EC	24.8	36.8	5.1	S	18.6	H	C	14.1	S			
1098	RF	G	N210 E191	100.34-100.24	4	PC	22.7	21.1	6.7	W	16.3	SH						
1118	UF	G	N210 E191	99.84- 99.74	2	EC	18.8	14.7	3.8	S	6.9	SH	C	16	SH			
1132	UF	G	N212 E191	100.6	4	OB	11.8	24.2	3.7	S	18.2	SH						
1141	UF	G	N212 E191	100.60-100.50	4	EC	14.4	7.3	1.5	S	9.1	SH						
1196	UF	G	N212 E191	99.70- 99.60	2	EC	22.8	9.6	3.1	C	14.7	SH	C	14.8	SH			

Table B-5 Attributes of flake tools recovered from Goff Creek (48PA325). All measurements in mm.

Catalog #	Type	Area	Unit	Elev. (m)	Cultural Lvl	Mat. Type	Length	Width	Thickness	Use 1	Edge 1 Length	Mat. Worked 1	Use 2	Edge 2 Length	Mat. Worked 2	Use 3	Edge 3 Length	Mat. Worked 3
1206	UF	G	N208 E193	100.12	4	EC	32.6	15.6	4.3	C	14.4	S						
1263	UF	G	N208 E193	99.72- 99.62	2	EC	25.7	31.2	15.7	S	12.3	H						
1276	UF	G	N231 E203	100.5	4	BT	23.1	23.7	4.6	S	6.4	SH						
1277	UF	G	N231 E203	100.53-100.43	4	EC	16.1	22.6	2.9	C	11.4	S						
1279	UF	G	N231 E203	100.52	4	MQ	22.3	21	5.3	C	18.7	SH						
1286	UF	G	N231 E203	100.49	4	SW	53	29.4	10.3	S	18.7	H	S	17.8	H			
1344	RF	C	N217 E242	99.22	4	EC	34.9	14.7	5.8	C	26.6	S						
1346	UF	C	N217 E242	99.18	4	OB	40.4	28.4	11.3	S	10.9	SH						
1362	RF	C	N217 E242	99.10-99.00	4	EC	40.3	25.4	10.5	C	17.1	S	C	40.3	S			
1383	UF	C	N217 E242	98.60-98.50	3	EC	27.4	22.7	13	S	19.8	H						
1426	UF	G	N231 E199	100.22	4	SW	52.7	46.9	19.3	S	21.1	H						
1453	UF	G	N231 E199	99.72- 99.62		EC	27.1	20.4	5.8	S	10.2	SH	C	13.3	SH			
1473	UF	C	N218 E240	99.40-99.30	4	EC	32.1	27.6	4.3	C	9.4	S						
1475	UF	C	N218 E240	99.30-99.20	4	SW	18.7	13.6	2.2	C	15.1	S						
1476	UF	C	N218 E240	99.30-99.20	4	SW	9.8	15.4	4.1	C	10.4	S						
1477	UF	C	N218 E240	99.30-99.20	4	EC	29.9	16.2	3.9	C	21.8	S						
1487	UF	C	N218 E240	99.30-99.20	4	SW	16.6	21.4	8.4	GV	5.8	SH						
1490	UF	C	N218 E240	99.19	4	EC	48	24	7.1	P	28.2	SH						
1492	RF	C	N218 E240	99.17	4	EC	19.7	16.9	4.6	C	20.6	S	C	15.7	S			
1501	RF	C	N218 E240	99.20-99.10	4	EC	12.1	14.5	1.8	C	11.8	S						
1537	RF	C	N218 E240	98.90-98.80	3	OB	9.4	13.9	2.1	C	9.2	S						
1543	RF	C	N218 E240	98.80-98.70	3	EC	22.6	21.2	6.5	S	22.2	SH						
1597	UF	C	N218 E240	98.40-98.30	3	OB	35.4	24.5	5.3	C	15.8	S						
1615	UF	C	N219 E239	99.23-99.13	4	UIC	17.8	15.2	2.9	C	12.9	S						
1653	UF	C	N220 E238	99.2	4	EC	30.5	23.8	5.7	C	12.8	S						
1663	UF	C	N220 E238	99.26-99.16	4	OB	23.5	11.6	2.9	C	12.2	S						
1665	UF	C	N220 E238	99.24	4	EC	39	20.1	3.9	S	26	SH						
1666	RF	C	N220 E238	99.16	4	SW	114.9	62.3	25.2	C	43	S						
1670	RF	C	N220 E238	99.06	4	SW	51.9	34.5	14.3	S	27.3	H						
1711	UF	C	N220 E238	98.76-98.66	3	EC	35.7	18.7	4.6	C	25	S						
1719	RF	C	N220 E238	98.66-98.56	3	EC	14.2	3.8	2.6	S	14	H						
1753	RF	C	N220 E239	99.25	4	SW	37.1	32.4	7.7	S	20	HD						
1754	UF	C	N220 E239	99.24	4	EC	35.2	20.5	7.8	S	15.8	SH						
1770	UF	C	N220 E239	99.24-99.14	4	EC	22.4	13.5	3.9	C	9.2	S						
1773	RF	C	N220 E239	99.24-99.14	4	EC	10.7	11.4	3.9	C	10.1	S						

Table B-5 Attributes of flake tools recovered from Goff Creek (48PA325). All measurements in mm.

Catalog #	Type	Area	Unit	Elev. (m)	Cultural Lvl	Mat. Type	Length	Width	Thickness	Use 1	Edge 1 Length	Mat. Worked 1	Use 2	Edge 2 Length	Mat. Worked 2	Use 3	Edge 3 Length	Mat. Worked 3
1783	RF	C	N221 E239	99.33-99.23	4	EC	28.3	18.5	7.6	S	19.1	SH						
1784	RF	C	N221 E239	99.33-99.23	4	EC	23.9	19.2	3.1	S	7.3	SH						
1790	RF	C	N221 E239	99.33-99.23	4	EC	13	21.2	5.1									
1791	UF	C	N221 E239	99.32	4	EC	41.4	26.2	7.5	S	15.7	H						
1809	RF	C	N221 E238	99.37	4	EC	31.8	22.7	10	S	26	SH	S	5.5	H			
1870	RF	C	N222 E239	99.31-99.21	4	PC	14.4	10.6	4.6	S	3.2	H						
1872	UF	C	N222 E239	99.31-99.21	4	EC	29.4	21.6	4.5	C	22	S	S	16.7	SH			
1892	RF	C	N223 E239	99.25-99.15	4	EC	25.2	18.4	3.6	S	12.3	SH						
1899	UF	E	N229 E264	98.47	4	EC	53.1	50.4	13.7	S	24.3	H						
1934	RF	E	N229 E266	98.64-98.44	4	EC	22.5	27.7	7.1	S	19.1	H						
2006	UF	C	N221 E239	99.23-99.13	4	EC	25.8	19.3	4.6	C	10.7	S						
2007	UF	C	N221 E239	99.23-99.13	4	EC	26.5	13.9	4.4	C	20.5	S						
2008	UF	C	N221 E239	99.15	4	SW	81.8	59.6	17.5	C	59.9	SH						
2021	UF	C	N222 E238	99.47-99.37	4	EC	17.6	12.4	2.9	S	12.3	SH						
2025	UF	C	N222 E238	99.47-99.37	4	EC	31.5	24.5	5.6	S	17.6	SH						
2039	UF	C	N222 E238	99.37-99.27	4	EC	12.7	15.4	3.7	S	9	H						
2048	UF	C	N222 E238	99.2	4	SW	82.1	55.1	15.2	C	63.5	SH						
2071	UF	C	N222 E240	99.21-99.11	4	EC	18.6	22	6.1	C	22	S						
2072	UF	C	N222 E240	99.21-99.11	4	EC	22.3	11.5	5.7	C	11	S						
2100	UF	C	N222 E240	98.81-98.71	3	EC	26.7	22.8	3.7	S	10.3	SH						
2119	RF	C	N222 E240	98.61-98.51	3	EC	7.4	3.9	2	C	7.4	S						
2139	UF	E	N230 E265	98.5	4	EC	22.9	22.9	2.8	C	15.2	S						
2146	UF	E	N230 E265	98.57-98.47	4	EC	19.8	18	7.8	C	16.9	SH						
2153	UF	E	N230 E265	98.5	4	BT	55.5	37.2	11.5	S	20	H						
2157	UF	E	N230 E265	98.47	4	WT	56.5	39.2	10.7	C	38	S	C	31.3	S	C	20	S
2160	UF	E	N230 E265	98.43	4	EC	30.2	23.8	5.7	S/GV	5.4	SH	S/GV	7.2	SH			
2167	UF	E	N230 E265	98.43	4	EC	45.3	32.4	5	C	33.4	S	C	20.2	S			
2177	RF	E	N230 E265	98.47-98.37	4	PC	21.4	6.5	6.4	S	21.4	H						
2187	RF	D	N231 E252	99.02-98.92	4	OB	10.5	8.4	7.3	C	8.4	S						
2198	UF	D	N231 E252	98.96	4	EC	36.9	25.7	5.2	S	7.1	SH						
2200	RF	D	N231 E252	98.94	4	OB	27.9	24.5	10.3	C	12.7	SH	S	6.6	SH			
2211	UF	C	N223 E238	99.31	4	EC	27	46	5.9	S	38.7	SH	S	20.3	SH			
2220	RF	C	N223 E238	99.27-99.17	4	EC	12.4	10	7.2	S	8.8	H						
2221	UF	C	N223 E238	99.27-99.17	4	EC	25.8	11.6	4.1	C	17.1	S						
2227	UF	C	N223 E238	99.17-99.07	4	EC	17.1	9.7	3.3	C	13.1	S						

Table B-5 Attributes of flake tools recovered from Goff Creek (48PA325). All measurements in mm.

Catalog #	Type	Area	Unit	Elev. (m)	Cultural Lvl	Mat. Type	Length	Width	Thickness	Use 1	Edge 1 Length	Mat. Worked 1	Use 2	Edge 2 Length	Mat. Worked 2	Use 3	Edge 3 Length	Mat. Worked 3
2231	UF	C	N223 E238	99.17-99.07	4	EC	27.3	24.1	10.2	S	18.7	H						
2234	UF	C	N223 E238	99.17-99.07	4	SW	29.4	36.2	10	C	27.4	S						
2238	UF	C	N223 E238	99.07	4	SW	51.6	46.4	14	C	38	S	C	36	S			
2245	UF	C	N223 E238	99.07-98.97	4	EC	43	27.5	8.9	S	8.5	SH						
2264	UF	E	N229 E263	98.5	4	EC	26.7	17.1	5.3	C	15.9	S						
2265	UF	E	N229 E263	98.57-99.47	4	OB	19.7	15.9	4	C	9.2	S						
2278	UF	E	N229 E263	98.47	4	EC	30	32.8	4.2	C	25.9	SH						
2306	UF	E	N229 E265	98.48	4	SW	28.7	19	6.8	S	17.7	H						
2324	RF	E	N229 E265	98.54-98.44	4	EC	11.4	7.8	3	C	5.6	SH						
2385	UF	E	N230 E263	98.52	4	PC	33.4	23	5.3	C	24.9	S	S	31.8	H			
2389	RF	E	N230 E263	98.47-98.37	4	EC	22.6	11.8	4.6	S/P	14.4	SH						
2394	UF	E	N230 E263	98.46	4	MQ	48.6	34.4	12.6	C	37.6	S						
2403	UF	E	N230 E264	98.53	4	PC	38.9	21.4	10.2	S	31.6	H						
2411	UF	E	N230 E264	98.52	4	SW	29	25.6	12.6	C	27.6	SH						
2432	RF	E	N230 E266	98.63-98.53	4	EC	31.2	26	3.6	S	10.8	SH	C	21.5	S			
2433	RF	E	N230 E266	98.5	4	EC	51.6	30.1	9.5	UN	31.8	UN	UN	37.6	UN			
2474	UF	D	N231 E257	98.85-98.75	4	OB	19.2	11.1	4.4	S	12.3	SH	C	19.5	S			
2475	RF	D	N231 E257	98.85-98.75	4	EC	30.8	26.1	5.2	C	16.6	SH						
2481	RF	D	N231 E257	98.75-98.65	4	OB	16.3	8.3	2.6	S	10.3	SH						
2484	UF	D	N231 E257	98.69	4	MOQ	37.2	27.8	3.8	C	23.8	SH						
2507	RF	D	N231 E257	98.05-97.95	1	MOQ	18.6	9.4	5	C	9.4	S						
2514	RF	D	N231 E257	97.95-97.85	1	EC	19	10.5	3.7	C	12.5	S						
2530	RF	E	N231 E263	98.05-97.95	3	PC	25.9	14.6	8.9	S	17.7	SH						
2539	RF	E	N233 E263	98.55	4	EC	30.3	23.5	4	S	23.2	SH						
2551	UF	E	N233 E263	98.53	4	EC	24.6	16.6	2.8	C	15.4	S						
2552	UF	E	N233 E263	98.54	4	EC	27.9	30.3	6.9	S	27.7	SH						
2564	UF	E	N233 E263	98.42	4	BT	78	43.3	7.9	S	28	SH						
2571	RF	E	N233 E264	98.61-98.51	4	EC	36.2	30.6	14.1	S	10.7	H						
2572	RF	E	N233 E264	98.59	4	EC	31.8	18.2	11	S	12.1	H						
2577	RF	E	N233 E264	98.54	4	EC	33.8	18.1	8.6	C	20.1	SH						
2665	RF	D	N231 E252	98.36	1	TSQ	45.2	27.6	12.7	C	15.2	S	B/D	10	S			
2696	UF	D	N231 E252	98.02	1	EC	37.4	10.9	3.3	C	37.4	S						
2740	RF	E	N231 E265	98.44	4	BT	91.4	63.9	31.4	S	76.8	H						
2755	UF	E	N231 E265	98.02	3	SW	30.4	26.2	6.6	S	26.2	HD						
2758	UF	E	N231 E265	97.98-97.88	3	OB	19.5	8.1	3.3	C	8.1	S						

Table B-5 Attributes of flake tools recovered from Goff Creek (48PA325). All measurements in mm.

Catalog #	Type	Area	Unit	Elev. (m)	Cultural Lvl	Mat. Type	Length	Width	Thickness	Use 1	Edge 1 Length	Mat. Worked 1	Use 2	Edge 2 Length	Mat. Worked 2	Use 3	Edge 3 Length	Mat. Worked 3
2768	UF	E	N232 E263	98.57	4	EC	28.3	42.9	8.9	S	34.7	SH						
2774	RF	E	N232 E263	98.60-98.50	4	EC	13.7	6.5	3.3	C	9.6	S						
2794	UF	E	N232 E263	98.50-98.40	4	EC	12.1	21.4	2.9	S	14.4	SH						
2800	UF	E	N232 E264	98.51	4	EC	46	62.6	24	S	44.6	H						
2838	UF	D	N231 E253	98.65-98.55	4	SW	26.2	17	3.7	S	22.7	SH						
2883	RF	D	N231 E253	98.19	1	SW	38.1	33.5	4.6	C	21.3	S						
2910	RF	E	N231 E264	98.60-98.50	4	EC	19.5	8.3	5.1	S	15.5	SH						
2911	RF	E	N231 E264	98.53	4	MOQ	100.7	37.4	25.6	C	60.7	SH						
2964	RF	E	N231 E266	97.94-97.84	3	EC	25.6	17.4	4.9	S	16	SH						
3001	UF	E	N232 E264	98.54	4	EC	28.3	18.7	6.9	S	14	SH						
3034	RF	E	N232 E265	98.60-98.50	4	PC	14.2	12.3	7.6	S	11.2	H						
3057	UF	E	N232 E265	98.41	4	SW	33.8	23.7	4.2	S	12.1	SH						
3066	RF	E	N232 E266	98.55	4	EC	28.4	18.3	7.3	S	12.7	SH						
3072	UF	E	N232 E266	98.51	4	EC	35.3	26.6	10.7	S	18.8	H						
3106	UF	E	N233 E266	98.60-98.50	4	EC	12.2	7.9	1.6	S	9.4	SH						
3112	UF	E	N233 E266	98.53	4	SW	29.4	21	3.1	C	16.2	SH	C	7.4	S			
3113	UF	E	N233 E266	98.5	4	SW	43.7	52.2	18.7	S	20.9	H						
3120	RF	E	N233 E266	98.50-98.40	4	EC	26.5	21	2.8	C	15	S						
3148	RF	E	N234 E264	98.57	4	EC	29.2	27.1	8.2	S	19.7	SH						
3160	RF	E	N234 E266	98.60-98.50	4	EC	11.9	9.3	3.2	C	7.3	S						
3166	RF	E	N234 E266	98.54	4	SW	21.5	21.1	5.8	S	21.5	SH						
3172	RF	E	N234 E266	98.53	4	MOC	27.1	30.6	3.3	S	23.6	SH						
3187	UF	E	N239 E265	98.74-98.64	4	PC	26.1	23	5.1	C	12.2	S						
3203	RF	E	N233 E265	98.5	4	PC	46	33	9.5	S	13.4	SH						
3209	UF	E	N233 E265	98.48	4	BT	68.4	57.8	13.4	S	43.2	H						
3259	UF	E	N234 E265	98.62-98.52	4	OB	24.1	13.1	5	S	10	SH						
3275	RF	E	N236 E265	98.72-98.62	4	OB	26	16.4	3.6	C	25.1	S						
3279	RF	E	N236 E265	98.62-98.52	4	EC	28.9	18	3.8									
3286	UF	E	N236 E265	98.52-98.42	4	TSQ	25	24.1	2.2	C	18.1	S						
3317	RF	E	N236 E265	97.95	3	SW	50.5	34.2	13.9									
3322	UF	E	N236 E265	97.82	3	BT	31.3	21.2	4	S/P	24.7	H						
3336	UF	E	N236 E265	97.89	3	TSQ	35.5	16.3	2.7	C	20.7	S	C	22.3	S			
3340	RF	E	N236 E265	97.92-97.82	3	SW	23.2	20.7	5.1	S	13.3	H						
3358	RF	E	N230 E264	98.60-98.50	4	OB	14.2	10.6	4.8									
3364	RF	F	N233 E277	98.15-98.05	4	SW	17.4	5.3	3	C	15.7	SH						

Table B-5 Attributes of flake tools recovered from Goff Creek (48PA325). All measurements in mm.

Catalog #	Type	Area	Unit	Elev. (m)	Cultural Lvl	Mat. Type	Length	Width	Thickness	Use 1	Edge 1 Length	Mat. Worked 1	Use 2	Edge 2 Length	Mat. Worked 2	Use 3	Edge 3 Length	Mat. Worked 3
3375	RF	F	N233 E277	98.1	4	SW	25.3	22.3	5.1	S	18.6	SH						
3397	RF	D	N228 E252	99.06-98.96	4	PC	24.9	19.4	8.6									
3403	UF	E	N239 E265	98.55	4	EC	27.3	19.1	4.8	C	18.3	S	C	10.7	S			
3458	UF	E	N239 E265	98.14-98.04	3	EC	27.4	20.6	7.9	S	16.9	SH						
3467	UF	E	N239 E265	98.04-97.94	3	EC	29.5	25.4	3	C	19.7	S						
3473	UF	E	N239 E265	98.04-97.94	3	EC	33.4	21.4	2.2	C	23.8	S						
3479	UF	E	N239 E265	97.94-97.84	3	EC	17.5	8.8	4.7	S	12.2	SH						
3514	UF	F	N231 E275	98.14-98.04	4	EC	15.1	5.7	3.5	S	8.4	SH						
3520	UF	F	N231 E275	98.14-98.04	4	EC	16	16.5	3.4	S	15.3	SH						
3541	RF	F	N231 E276	98.24-98.14	4	EC	18.4	9.7	5.7	C	17.2	SH						
3548	RF	F	N231 E276	98.06	4	EC	41.4	29.8	9.5	C	34.9	S						
3559	RF	F	N231 E276	98.02	4	EC	27.3	14.9	5.1	S/P	23.6	SH						
3562	RF	F	N231 E276	98.04-97.98	4	EC	16.9	11.7	4.9	S	10.4	H						
3569	UF	F	N231 E276	98.06	4	EC	42.5	28.1	9.3	S	19.6	SH	S	16.3	SH			
3580	UF	F	N231 E276	97.94	4	EC	24	24.6	6.5	C	18.6	S	C	8.6	S			
3587	UF	F	N231 E276	97.90-97.80	4	SW	12.9	16.1	4.9	C	10.5	S						
3588	UF	F	N231 E276	97.90-97.80	4	EC	15.4	11.4	3.4	C	14.4	S						
3609	RF	F	N231 E271	98.24	4	EC	26.5	14.2	4.5	S	18.5	SH						
3662	UF	F	N231 E271	97.83	3	EC	37.6	28.5	12.1	C	23.6	SH						
3693	RF	F	N231 E271	97.7	3	SW	45.4	25.3	11.9	S	19.2	SH						
3697	RF	F	N231 E271	97.74-97.64	3	PC	17	10.2	1.9									
3718	RF	F	N231 E277	98.09-97.99	4	EC	13.7	6.8	2.2	C	13.4	SH						
3722	UF	F	N231 E277	97.94	4	EC	36	17.5	7.6	S	19.2	H	C	18.6	S			
3723	RF	F	N231 E277	97.95	4	EC	29.1	25.7	5.6	C	20.7	SH						
3724	RF	F	N231 E277	97.9	4	EC	84.8	52.7	20.3	S	17.7	SH	C	45.3	SH			
3729	RF	F	N231 E277	97.99-97.90	4	EC	22.4	16	5.8	S	12.7	H						
3730	RF	F	N231 E277	97.99-97.90	4	OB	27.3	20.2	5.5	S	7.5	SH	S	15.6	SH			
3737	UF	F	N231 E277	97.94	4	SW	28.2	19	4.4	S	7.1	SH						
3739	RF	F	N231 E277	97.88	4	EC	52	24.5	4.7	S	11.9	SH						
3750	RF	F	N231 E277	97.90-97.80	4	EC	12	7.9	3.2	C	11	S						
3759	RF	F	N231 E277	97.62	3	OB	24.8	24.8	4.3	S	11.6	H						
3761	RF	F	N231 E277	97.70-97.60	3	EC	14.7	7.7	1.7	C	8.6	S						
3767	RF	F	N231 E277	97.63	3	OB	20.5	9.9	3.7	S	10.5	SH						
3774	UF	F	N231 E277	97.6	3	SW	27.4	16.5	9.1	S	16.8	H						
3790	UF	F	N231 E277	97.62	3	EC	41.7	18.6	18.4	S	17.3	SH						

Table B-5 Attributes of flake tools recovered from Goff Creek (48PA325). All measurements in mm.

Catalog #	Type	Area	Unit	Elev. (m)	Cultural Lvl	Mat. Type	Length	Width	Thickness	Use 1	Edge 1 Length	Mat. Worked 1	Use 2	Edge 2 Length	Mat. Worked 2	Use 3	Edge 3 Length	Mat. Worked 3
3799	UF	F	N231 E279	98.06-97.96	4	EC	7.1	10.9	3.5	S	10.5	H						
3808	UF	F	N231 E278	98.10-98.00	4	OB	6.5	4.6	1.1	C	5.2	S						
3815	RF	F	N231 E278	98.10-98.00	4	EC	9.1	3.9	2.9	C	8.9	S						
3841	RF	F	N231 E278	97.93-97.80	4	EC	21.3	13.3	4.2	S	19	SH						
3843	UF	F	N231 E278	97.93-97.80	4	EC	18.8	9.9	4.8	S	15.1	H						
3844	RF	F	N231 E278	97.93-97.80	4	OB	12.1	8.2	7.2	S	6.6	SH						
3848	UF	F	N231 E278	97.80-97.70	3	EC	26.7	21.5	8.1	C	13.1	SH						
3851	UF	F	N231 E278	97.70-97.60	3	PC	24.4	12.6	9.5	S	15.6	SH						
3852	UF	F	N231 E278	97.70-97.60	3	EC	24.5	12.1	6.2	S	12.5	H						
3858	UF	F	N231 E278	97.60-97.50	3	EC	7.4	3.9	1.5	S	7.2	SH						
3859	UF	F	N231 E278	97.60-97.50	3	PC	8.6	7.8	2.5	S	7.6	SH						
3860	RF	F	N231 E278	97.60-97.50	3	PC	10.9	6.1	2.7	S	6.2	H						
3861	RF	F	N231 E278	97.60-97.50	3	OB	11.6	7.5	1.7	S	6.5	SH						
3862	UF	F	N231 E278	97.60-97.50	3	EC	37	31.5	6.4	C	6.7	SH						
3874	RF	F	N232 E276	98.08	4	EC	43.4	26.8	9.6	S	24.8	H	S	14.4	SH			
3894	RF	F	N232 E276	98.02	4	EC	45.2	25.2	3.9	S	7.9	SH	S	31.4	SH	S	36.1	SH
3896	RF	F	N232 E276	98.05-98.00	4	EC	13.7	8.7	1.4	S	7.2	SH						
3898	UF	F	N232 E276	98.01	4	EC	31.7	26.5	15.9	S	18.7	SH						
3908	RF	F	N232 E279	98.10-98.00	4	OB	14.2	10.2	2.3	C	10.8	S						
3910	UF	F	N232 E279	98.1	4	EC	35.8	33.4	5.8	S	18.1	SH	C	27.1	S			
3931	RF	F	N232 E279	98.10-98.00	4	EC	15.9	6.6	3	S	10.2	HD						
3945	UF	F	N232 E279	97.97	4	SW	89.4	49.6	15.1	S	61.8	H						
3955	RF	F	N233 E275	98.31-98.21	4	PC	12	9.6	2.8	C	11.1	S						
3971	RF	F	N233 E275	98.21-98.11	4	EC	15.2	10.5	4.1	C	10.7	S						
3972	UF	F	N233 E275	98.11	4	EC	29.3	19.3	3.1	S	19	SH						
3976	RF	F	N233 E275	98.2	4	EC	36.2	19.9	7.1	S	16.6	SH						
3978	RF	F	N233 E275	98.11-98.01	4	TSQ	17.9	10.8	3.1									
3979	UF	F	N233 E275	98.11-98.01	4	EC	21.3	10.9	3.8	S	13.3	SH						
3982	RF	F	N233 E275	98.07	4	OB	34.7	9	4.1	S	7.8	SH	S	20.4	SH			
3988	UF	F	N233 E275	98.11-98.01	4	PC	7.7	1.9	1.7	C	7	SH						
3991	RF	F	N233 E275	98.11-98.01	4	EC	29.6	27.3	3.6	C	19.3	SH						
3993	UF	F	N233 E275	98.03	4	SW	47.7	40.4	5.9	S	17.4	H						
3998	RF	F	N233 E277	98.25-98.15	4	SW	24.7	12.3	6.5	S	13	SH						
4004	UF	F	N231 E279	98.06-97.96	4	OB	13.6	15.4	4.3	C	9.5	S						
4013	RF	F	N231 E279	98.06-97.96	4	OB	16.7	11.7	3.3	S	15	SH						

Table B-5 Attributes of flake tools recovered from Goff Creek (48PA325). All measurements in mm.

Catalog #	Type	Area	Unit	Elev. (m)	Cultural Lvl	Mat. Type	Length	Width	Thickness	Use 1	Edge 1 Length	Mat. Worked 1	Use 2	Edge 2 Length	Mat. Worked 2	Use 3	Edge 3 Length	Mat. Worked 3
4014	RF	F	N231 E279	98.06-97.96	4	OB	7.5	6	2.4	S	5.1	SH						
4016	RF	F	N231 E279	98.02	4	EC	34.6	27.7	8	S	19.3	SH						
4021	RF	F	N231 E279	98.02	4	EC	23.1	13.4	6.8	S	21.9	H	S	20	H			
4025	RF	F	N231 E279	97.96-97.86	4	EC	18.7	6.8	5.9	S	11.9	SH						
4039	UF	F	N231 E279	97.86-97.76	4	EC	34.9	12.9	5.7	S	16.5	H						
4086	RF	D	N229 E254	98.18	1	SW	40.8	60.3	8.1	C	43.6	SH						
4132	RF	D	N230 E251	98.9	4	SW	36.8	28.3	5.7	C	19.8	S						
4135	RF	D	N230 E251	98.88	4	OB	55.6	38.9	8.3	C	32.9	S						
4143	RF	D	N230 E251	98.79	4	SW	76.6	59.1	24.6	C	35.6	SH						
4209	RF	F	N232 E275	98.14	4	SW	56.8	38.5	16.1	S	16.4	SH						
4224	RF	F	N232 E275	98.10-98.00	4	SW	57.9	16.4	9.2	S	36.2	SH						
4226	UF	F	N232 E275	98.10-98.00	4	EC	8.5	7.1	2.4	S	8.5	SH						
4240	RF	F	N232 E277	98.06	4	EC	40.8	22.7	3.3	B/D	7	S						
4244	RF	F	N232 E277	98.07-97.97	4	EC	26.2	18	4.9	S	9.2	H						
4249	RF	F	N232 E277	98.03	4	OB	17.6	29.1	5.9	S	24.6	SH						
4254	UF	F	N232 E277	98.07-97.97	4	SW	17	12.1	3.7	S	9.4	SH						
4263	UF	F	N232 E277	98.07-97.97	4	EC	28.8	27.1	4.1	C	22.1	S						
4264	RF	F	N232 E277	98.07-97.97	4	SW	19.2	10	2.6	S	7.3	SH						
4266	RF	F	N232 E278	98.18-98.08	4	EC	13.5	11.1	7.9	C	12	S						
4270	RF	F	N232 E278	98.08-97.98	4	EC	21.1	15.6	2.8	C	21.6	SH						
4273	UF	F	N232 E278	98.08-97.98	4	EC	11.8	10.3	4.7	S	11.6	SH						
4276	UF	F	N232 E278	98.08-97.98	4	OB	12.9	3.8	3.1	S	12.9	SH						
4281	RF	F	N232 E278	98.07	4	SW	42	30.8	10.9	C	32.9	SH						
4283	UF	F	N232 E278	98.02	4	EC	29.4	18.5	3	S	12	SH						
4293	RF	F	N233 E276	98.15-98.05	4	OB	8.8	8.3	1.7	C	8.4	S						
4295	RF	F	N233 E276	98.09	4	EC	28.6	19.4	3.6	S	4.5	SH						
4322	RF	F	N233 E279	98.20-98.10	4	EC	12.6	17.4	5.6	C	17	SH						
4332	RF	F	N233 E279	98.10-98.00	4	OB	12.7	11.8	2.8	S	9.5	SH	S	8.1	SH			
4333	UF	F	N233 E279	98.10-98.00	4	EC	30.1	12.1	7.8	S	28.1	H						
4380	RF	F	N244 E286	97.94-97.84	4	EC	24.5	12.1	5.7	S	14.3	SH						
4423	RF	F	N233 E278	98.01-97.91	4	EC	24.6	21	7.4	S	13.5	SH						
4476	RF	F	N239 E283	97.8	4	EC	27.7	15.1	4.2	S	12.7	H						
4485	RF	F	N239 E283	97.79	4	EC	44	23.8	11.7	S	21.9	SH						
4490	RF	F	N239 E283	97.7	4	EC	38.6	26	3.1	C	18.1	S						
4496	UF	F	N239 E283	97.73-97.63	4	EC	29	15.6	7.9	S	16.4	SH						

Table B-5 Attributes of flake tools recovered from Goff Creek (48PA325). All measurements in mm.

Catalog #	Type	Area	Unit	Elev. (m)	Cultural Lvl	Mat. Type	Length	Width	Thickness	Use 1	Edge 1 Length	Mat. Worked 1	Use 2	Edge 2 Length	Mat. Worked 2	Use 3	Edge 3 Length	Mat. Worked 3
4500	RF	F	N239 E283	97.67	4	EC	26.3	25.5	9.7	S	21.5	H	S	13	SH			
4513	RF	F	N239 E283	97.57	4	EC	34	26.7	6.6	S	10.7	SH	C	9.9	S			
4519	RF	F	N239 E283	97.53-97.43	4	SW	34.3	30.8	7	S	11	HD						
4529	RF	D	N229 E252	98.88	4	EC	36.4	23.4	6.6	C	21.4	SH						
4531	RF	D	N229 E252	98.95-98.85	4	SW	20.5	11.7	4.7	S	11.3	H						
4546	RF	D	N229 E252	98.81	4	PC	19.2	12.1	5.7	C	14	S						
4568	RF	D	N229 E252	98.37	1	SW	54.6	34.5	10.9	S/P	31.4	SH						
4573	RF	D	N229 E252	98.35	1	EC	47.2	68.2	15.2	C	39.7	S	S	7.7	SH			
4608	RF	D	N228 E252	98.87	4	EC	39.6	30.2	5.2	S/P	16.4	SH						
4610	UF	D	N228 E252	98.96-98.86	4	EC	34.6	14.3	6.1	S/P	18.3	SH						
4614	UF	D	N228 E252	98.86-98.76	4	EC	17.1	10.1	2.3	S	13.5	SH						
4617	UF	D	N228 E252	98.86-98.76	4	SW	40	19.3	11.4	S	19.9	H						
4627	UF	D	N228 E252	98.66-98.56	4	SW	48.9	27.8	13.9	S	16.9	SH						
4686	RF	D	N228 E252	98.26-98.21	1	PC	14.7	13.7	4.2	C	13.7	S						
4708	UF	D	N228 E252	98.16-98.11	1	PC	11.9	7	3.9	S	8.2	H						
4772	RF	D	N229 E254	98.24	1	SW	23.6	19.9	5.7	S	18.1	SH						
4788	RF	D	N229 E254	98.26	1	PC	16.6	19.5	4.1	S	9.6	SH						
4807	RF	F	N244 E286	97.8	4	OB	27.3	27.1	8.1	S	22.7	SH						
4829	RF	F	N244 E286	97.64	4	EC	40.1	30.4	9.9	C	38.8	S						
4833	RF	F	N244 E286	97.74-97.64	4	EC	13.9	22.3	4.7	C	17.3	S						
4852	RF	D	N231 E254	99.00-98.70	4	EC	51.2	36.4	15.4	S	27.7	H	S	15.5	H			
4853	RF	D	N231 E254	99.00-98.70	4	EC	24.2	19.8	3.6	S	18.3	H						
4854	RF	D	N231 E254	99.00-98.70	4	OB	19.9	11.5	4.1	C	19.8	S						
4855	RF	D	N231 E254	99.00-98.70	4	EC	28.9	20	4.6	S	27.2	SH						
4867	RF	D	N231 E254	98.3	1	EC	30.9	15.7	8.3	S	17.7	HD						
4879	RF	D	N231 E254	98.35-98.30	1	EC	6.9	6.4	3.1	C	6.7	S						
4907	UF	D	N231 E254	98.25	1	SW	25.8	20.3	6.3	C	13.3	S						
4996	RF	D	N231 E256	98.74-98.64	4	OB	15.3	10.4	2.2	S	4.3	SH						
5021	UF	D	N229 E252	98.18	1	SW	32.2	34	9.2	S/P	24.9	SH						
5036	UF	D	N230 E250	99.37-99.12	4	EC	22.7	13.9	5	S/P	21.2	SH						
5039	RF	D	N230 E250	99.12-99.02	4	EC	64.9	25.2	6.8	C	36.1	S						
5156	UF	D	N230 E252	98.73	4	EC	26.1	14.6	11.4	S	17.4	H						
5208	UF	D	N230 E252	98.24	1	EC	28.3	20	5.3	C	22.6	H						
5273	RF	D	N230 E255	98.27	1	SW	32.5	14.8	10.7	S	10.3	H						
5303	RF	D	N230 E255	98.23	1	SW	20.2	12.8	2.7	S	12	SH	S	16.7	SH			

Table B-5 Attributes of flake tools recovered from Goff Creek (48PA325). All measurements in mm.

Catalog #	Type	Area	Unit	Elev. (m)	Cultural Lvl	Mat. Type	Length	Width	Thickness	Use 1	Edge 1 Length	Mat. Worked 1	Use 2	Edge 2 Length	Mat. Worked 2	Use 3	Edge 3 Length	Mat. Worked 3
5310	UF	D	N230 E255	98.16	1	EC	55.1	28.5	12.7	W	32.4	SH						
5418	RF	D	N230 E251	98.25	1	SW	32.4	28	3.6	C	27.3	S	C	24.7	S			
5428	RF	D	N230 E251	98.2	1	UIC	23.9	17.2	1.7	C	9.7	S	C	16.9	S			
5443	UF	D	N230 E251	98.14-98.09	1	UIC	5.5	5.6	1.1	C	5.5	S						
5514	RF	D	N231 E250	98.31	1	EC	51.6	32.7	8.4	S	16.6	H						
5554	RF	D	N231 E251	99.04-98.94	4	PC	14	4.9	4	S	4.9	SH						
5566	RF	D	N231 E251	98.84-98.74	4	EC	37.5	27.4	4.2	S	16.9	SH						
5640	RF	D	N231 E255	98.78	4	EC	45.4	33.4	7.9	S	20.6	H						
5679	RF	D	N231 E255	98.27	1	EC	29	23.8	3.5	S	18.2	SH						
5694	RF	D	N231 E255	98.25	1	EC	41.9	25.5	11.2	S	41.9	H						
5698	UF	D	N231 E255	98.23	1	TSQ	26.5	29.6	4	S	18.5	SH						
5703	UF	D	N231 E255	98.2	1	SW	56.7	46.7	15.6	C	35.2	H						
5736	RF	D	N231 E255	98.14	1	MOQ	37.3	17.6	9.4	S	12.8	H						
5751	RF	D	N231 E255	98.12-98.07	1	OB	10.3	6.6	1.6	C	10.3	S						
5765	RF	D	N232 E251	99.14-98.84	4	EC	25.9	25.8	3.3	C	14.2	S						
5829	RF	D	N231 E256	98.29-98.24	1	TSQ	18	6.9	4.4	S	6.9	H						
5889	RF	D	N231 E256	98.19-98.14	1	EC	35	23.5	6.2	S	15.9	SH						
5921	UF	D	N232 E254	99.00-98.70	4	EC	18.4	22.6	2.7	S/P	17.3	SH	S/P	21.4	SH			
5950	RF	D	N232 E254	98.31	1	SW	28.6	37	7.5	S/P	15.2	SH						
5973	UF	D	N232 E254	98.28	1	MOQ	43.1	18.2	3.1	S	11.6	SH						
5992	UF	D	N232 E254	98.26	1	SW	21.3	13.9	3.5	C	19.4	S						
5993	UF	D	N232 E254	98.24	1	BT	42.8	23.6	5.6	C	17.6	SH						
6088	RF	D	N232 E252	98.29	1	SW	32.4	20.2	5.5	S	16	SH						
6099	RF	D	N232 E252	98.28	1	MOQ	48.3	32.4	6	S	29.2	HD	C	26.9	S			
6100	RF	D	N232 E252	98.31	1	SW	34	10.9	7.2	C	27	S						
6134	RF	D	N232 E255	98.96-98.86	4	EC	17.7	24.1	2.5	GV	9.4	SH						
6141	RF	D	N232 E255	98.86-98.76	4	SW	34.5	27.9	11.5	P	14.6	SH						
6143	RF	D	N232 E255	98.86-98.76	4	OB	30.1	21.1	3.8	S	15.5	SH						
6203	RF	D	N232 E255	98.2	1	EC	41.4	25.3	10.2	S	33.2	SH	S	20.8	SH			
6213	RF	D	N232 E255	98.18	1	EC	41.8	28.1	15.8	S	15.4	H						
6222	RF	D	N232 E255	98.14	1	EC	64.6	29.8	12	S	30.6	H	S	32.5	H	S	17.3	SH
6246	RF	D	N232 E253	99.07-98.90	4	EC	40.3	23.5	5.7	S	34	SH	C	31.8	SH			
6249	UF	D	N232 E253	99.07-98.90	4	EC	38.2	18.5	3.3	C	30.8	S	C	15.3	S			
6250	UF	D	N232 E253	99.07-98.90	4	EC	18.6	20.9	10.2	S	19.9	H						
6335	RF	D	N233 E254	99.08-98.78	4	OB	9.9	9.4	2.4	S	10.7	SH						

Table B-5 Attributes of flake tools recovered from Goff Creek (48PA325). All measurements in mm.

Catalog #	Type	Area	Unit	Elev. (m)	Cultural Lvl	Mat. Type	Length	Width	Thickness	Use 1	Edge 1 Length	Mat. Worked 1	Use 2	Edge 2 Length	Mat. Worked 2	Use 3	Edge 3 Length	Mat. Worked 3
6343	RF	D	N233 E254	98.43-98.38	1	EC	15.8	10.7	5.6	S	9.4	SH						
6385	UF	D	N233 E254	98.3	1	PC	29.9	14.7	5.4	C	7.9	S						
6470	UF	D	N233 E252	98.98	4	SW	45.8	28.8	10.7	S	17.9	SH						
6471	UF	D	N233 E252	98.93	4	EC	45.4	40.8	13.3	S	29	SH						
6477	UF	D	N233 E252	98.97	4	EC	14.3	24.8	4.5	C	16.1	S						
6478	UF	D	N233 E252	98.92	4	EC	68.4	29.4	8.8	C	43.4	SH	S	15.5	SH			
6557	UF	D	N233 E252	98.25	1	EC	24.8	14.8	1.9	S	13.4	SH						
6565	RF	D	N233 E252	98.2	1	SW	66.1	27.7	9.6	S	57.8	SH	S	47.9	SH			
6590	UF	D	N233 E256	99.00-98.80	4	EC	39.1	23	2.4	S/P	30.1	SH						
6591	UF	D	N233 E256	99.00-98.80	4	EC	23.2	21.4	4	C	19.8	S						
6592	RF	D	N233 E256	98.3	1	EC	39	31.5	8.5	S/P	27.4	SH						
6629	UF	D	N232 E256	98.12	1	EC	29.2	16.2	4.1	C	16.9	S	C	23.6	S			
6631	RF	D	N232 E256	98.17-98.12	1	EC	29.5	7.9	4.4	C	10.4	S						
6670	RF	D	N233 E253	98.96-98.86	4	EC	15.9	13.4	2.4	S	10.7	SH						
6672	UF	D	N233 E253	98.95	4	OB	29.4	15	6.4	C	18.7	SH						
6704	RF	D	N233 E253	98.41-98.36	1	EC	16.3	9.5	2.7	S	11.9	SH						
6723	UF	D	N233 E253	98.31	1	EC	30.2	21.6	3.3	C	17.4	S						
6735	RF	D	N233 E253	98.28	1	EC	25.9	21.7	6.4	S	13.7	SH	S	9.9	SH			
6779	UF	D	N233 E253	98.21-98.16	1	EC	19.9	8.8	2.2	C	12.1	S						
6783	RF	D	N233 E253	98.19	1	EC	31.2	33.7	5.5	S	21.6	SH						
6803	RF	D	N233 E254	98.28	1	OB	28.1	14.1	7.2	S	18.9	SH						
6810	RF	D	N233 E254	98.28	1	SW	52.7	39.8	13.1	S	20.4	SH						
6874	RF	D	N233 E254	98.23-98.18	1	EC	14.4	6.1	3.6	S	8	SH						
6910	RF	D	N234 E255	98.90-98.80	4	SW	20.4	15.8	2.3	C	12.6	SH	C	13.3	SH			
6922	RF	D	N234 E255	98.70-98.60	4	SW	27.1	18.2	7.1	S	11	SH						
6936	RF	D	N234 E255	98.3	1	EC	32.2	27	7.6	C	27.3	S	C	20.5	S			
7004	UF	D	N233 E256	98.28	1	SW	34.5	16.8	9.2	S	19.1	H	S	13.5	H			
7065	UF	D	N233 E256	98.16	1	EC	58.8	29.7	9.6	C	33.6	S						
7088	RF	D	N233 E256	98.1	1	SW	30.2	27.7	5.5	S	24.2	SH						
7101	RF	A	N221 E152	100.33	2	EC	30.2	16.8	9.2	S	25.4	H						
7109	UF	A	N221 E152	100.32	2	EC	41.1	23.7	12.3	S	17.6	SH						
7111	RF	A	N221 E152	100.40-100.30	2	SW	16.9	10.1	4	S	9.8	SH						
7112	UF	A	N221 E152	100.31	2	EC	19.4	26.1	12.8	S	6.6	SH						
7122	RF	A	N221 E152	100.3	2	EC	32.1	16.6	11.9	S	25.9	SH						
7139	RF	A	N221 E152	100.40-100.30	2	EC	20.6	9.2	5.5	S	9.5	SH						

Table B-5 Attributes of flake tools recovered from Goff Creek (48PA325). All measurements in mm.

Catalog #	Type	Area	Unit	Elev. (m)	Cultural Lvl	Mat. Type	Length	Width	Thickness	Use 1	Edge 1 Length	Mat. Worked 1	Use 2	Edge 2 Length	Mat. Worked 2	Use 3	Edge 3 Length	Mat. Worked 3
7155	UF	A	N221 E152	100.2	2	EC	40.2	33.3	8.7	C	25.8	SH						
7221	RF	D	N233 E255	98.90-98.80	4	EC	18.3	16.6	3	S	9.4	SH	S	10.5	SH			
7309	RF	D	N233 E255	98.24	1	EC	25.1	16.9	11.2	S	16.1	H						
7361	UF	D	N234 E254	98.97-98.87	4	EC	35.3	29.3	3.4	C	15.7	S						
7400	RF	D	N234 E254	98.37-98.32	1	UIC	7	5	3.1	S	7	SH						
7467	UF	D	N234 E255	98.29	1	SW	35.7	21.5	3.1	C	27.6	S						
7498	RF	D	N234 E255	98.19	1	EC	35.5	30.3	8	S	27.5	SH	S	21.7	SH			
7551	RF	D	N235 E255	98.92-98.82	4	SW	30.5	22.7	5.1	S	23.1	H						
7554	RF	D	N235 E255	98.92-98.82	4	EC	10.7	15.9	2.7	C	13	S						
7559	RF	D	N235 E255	98.92-98.82	4	EC	12.9	14.3	5.1	S	14.2	H						
7609	RF	D	N234 E254	98.32-98.27	1	SW	33.3	11.1	9	S	28	H						
7625	RF	D	N234 E254	98.32-98.27	1	SW	29.9	12.8	9.6	S	3.6	H						
7650	RF	D	N234 E254	98.17	1	SW	44.7	36.3	14	S	11.6	H						
7660	UF	D	N235 E256	98.32-98.27	1	SW	14.4	30.1	4.2	C	19.2	SH						
7670	RF	D	N235 E256	98.32-98.27	1	TSQ	14.3	5.8	2.8	S	14.3	SH						
7680	UF	D	N235 E256	98.27-98.22	1	EC	15.8	6.1	3.1	S	9.5	SH						
7702	RF	D	N235 E256	98.2	1	EC	21.2	14.9	7.2	S	13.7	H						
7754	RF	D	N234 E256	99.00-98.54	4	SW	42.4	32.1	6.9	C	32.6	SH	S	12.9	SH			
7787	RF	D	N234 E256	98.24	1	EC	32.9	17.5	15.4	S	28.1	HD						
7826	RF	D	N235 E255	98.25	1	EC	20.8	14	9.4	S	15	SH						
7843	RF	D	N235 E255	98.24	1	SW	40.5	16.2	11.8	S	33.8	H						
7865	RF	D	N235 E255	98.2	1	EC	25.2	23.5	8.5	S/P	16	H						
7871	RF	D	N235 E255	98.19	1	SW	67.1	42.3	14	S	16.7	H	C	33.3	SH	S	9.6	H
7880	RF	D	N235 E255	98.17-98.12	1	EC	10	14.5	2.9	S/C	8.9	S						
7902	UF	A	N220 E151	100.23	2	EC	53.9	32.1	13	S	32.9	H						
7934	RF	A	N220 E152	100.22	2	PC	49.5	29.1	8.2	S/P	23.8	SH	S/P	19.1	SH			
7957	RF	A	N220 E152	100.18	2	EC	30.2	18.6	7.9	S	11.5	SH						
7983	UF	D	N229 E256	98.84-98.74	4	SW	32.4	18.3	3	C	19.7	S						
7993	UF	D	N229 E256	98.74-98.64	4	EC	14.2	13.2	3	C	10.9	S						
7994	RF	D	N229 E256	98.69	4	EC	35.4	33.9	9.7	S	20.9	H						
8041	UF	D	N234 E256	98.18	1	EC	25.7	23	7.3	S	17.3	H						
8047	RF	D	N234 E256	98.15	1	EC	27.5	28.7	3.4	S	7.7	SH	B/D	2.3	SH			
8102	UF	D	N236 E256	98.38	1	SW	24.1	15.2	4.1	S	17	SH						
8129	RF	D	N236 E256	98.23	1	EC	38.8	23.6	13.4	S	17.2	H						
8145	RF	D	N236 E256	98.18	1	SW	58.8	36.9	20.5	S	32.3	H						

Table B-5 Attributes of flake tools recovered from Goff Creek (48PA325). All measurements in mm.

Catalog #	Type	Area	Unit	Elev. (m)	Cultural Lvl	Mat. Type	Length	Width	Thickness	Use 1	Edge 1 Length	Mat. Worked 1	Use 2	Edge 2 Length	Mat. Worked 2	Use 3	Edge 3 Length	Mat. Worked 3
8157	UF	D	N236 E256	98.13	1	SW	68.6	29.7	17.7	S	16.2	SH						
8185	UF	A	N220 E155	100.22	2	BT	115.4	53.1	24.3	C	93.4	SH						
8192	RF	A	N220 E155	100.30-100.20	2	EC	22.4	25.7	1.9	P	21.2	SH	P	8.9	SH			
8193	RF	A	N220 E155	100.27	2	EC	37.7	16.9	4.7	S	26.5	SH	S	29.6	SH			
8239	RF	D	N236 E255	98.39	1	SW	27.3	21.9	6.9	C	16	S						
8252	RF	D	N236 E255	98.33	1	SW	26.1	10.5	3	C	6.7	S						
8287	RF	D	N236 E255	98.23	1	MOQ	19.3	20.1	6.9	S	7	SH						
8293	RF	D	N236 E255	98.21	1	EC	37.6	24.6	6.6	S	28.4	SH	S	18.9	SH			
8301	RF	D	N236 E255	98.23-98.18	1	EC	17	14.4	2.5	C	6.8	S						
8318	RF	D	N236 E255	98.08	1	EC	30.7	17.1	2.9	S	8.2	HD						
8388	RF	A	N221 E154	100.31	2	EC	29.7	22.1	14.2	S	13.7	H	S	21.9	H			
8406	RF	D	N229 E256	98.34-98.29	1	SW	28.5	28.9	2.9	S	19.6	SH						
8407	UF	D	N229 E256	98.34-98.29	1	SW	23.9	26.7	5.2	S	12.4	SH						
8409	RF	A	N220 E153	100.29	2	EC	34.6	31.4	8.6	S	12.2	H						
8414	UF	A	N220 E153	100.2	2	EC	54.8	27.5	6.3	C	22.6	SH						
8429	RF	A	N220 E153	100.15	2	SW	41.2	22.3	14.4	S	17.7	SH						
8440	RF	A	N220 E154	100.3	2	PC	49.6	28.7	7.2	C	31.8	S						
8443	UF	A	N220 E154	100.3	2	EC	63.5	39.1	17.6	S	31.9	H						
8449	UF	A	N220 E154	100.29	2	PC	27.5	13.9	4	S	11.9	SH						
8454	RF	A	N220 E154	100.21	2	EC	38.4	24.1	14.8	S	11.5	SH						
8476	UF	A	N220 E154	100.13	2	MOQ	31.8	29.9	5.9	S	18.1	H						
8486	RF	A	N220 E157	100.25	2	EC	21.6	22.1	6.1	S	9.7	SH						
8497	RF	A	N220 E157	100.30-100.20	2	EC	18.4	13.7	5.3	S	6.1	HD						
8542	RF	A	N221 E151	100.21	2	EC	34.5	20.3	7.1	S	11	SH						
8576	UF	A	N221 E151	100.24	2	SW	47.5	40.1	12.5	S	28.3	H						
8585	RF	A	N221 E151	100.24	2	EC	8.4	21.3	2									
8588	UF	A	N221 E151	100.24	2	OB	33.7	28.6	7.3	C	25.2	S	S	10.4	SH			
8598	RF	A	N221 E151	100.20-100.10	2	EC	10.1	12.5	1.4	C	8.4	S						
8625	RF	A	N220 E156	100.30-100.20	2	EC	21.6	10.7	5.1	C	13.2	S						
8645	RF	A	N220 E156	100.12	2	PC	25.5	26.9	5.2	S	22.7	SH						
8654	UF	A	N221 E153	100.40-100.30	2	EC	30.2	24.2	4.5	C	24	SH						
8655	RF	A	N221 E153	100.40-100.30	2	EC	38.8	19.8	7.2	S	14.8	SH						
8711	RF	A	N221 E156	100.40-100.30	2	EC	23.2	16.4	4.3	S	11.2	SH	S	8.7	SH			
8745	RF	A	N221 E156	100.21	2	EC	23.1	13	6.3	C	17.3	SH						
8795	RF	A	N221 E157	100.26	2	SW	44.7	36.2	9.2	S	10.1	SH	C	18.8	SH			

Table B-5 Attributes of flake tools recovered from Goff Creek (48PA325). All measurements in mm.

Catalog #	Type	Area	Unit	Elev. (m)	Cultural Lvl	Mat. Type	Length	Width	Thickness	Use 1	Edge 1 Length	Mat. Worked 1	Use 2	Edge 2 Length	Mat. Worked 2	Use 3	Edge 3 Length	Mat. Worked 3
8808	RF	A	N221 E157	100.30-100.20	2	EC	6.1	14.8	4.8	S	6.1	SH						
8847	UF	A	N221 E158	100.30-100.20	2	TSQ	13.9	4.5	2.7	S	12.2	SH						
8859	RF	A	N221 E158	100.30-100.20	2	EC	8.4	7.4	4.4	S	7	SH						
8866	UF	A	N221 E158	100.21	2	EC	21.8	18.8	3.6	C	15.1	S						
8882	RF	A	N221 E158	100.17	2	EC	54.8	41.9	11.9	S	14.2	SH						
8970	RF	A	N222 E150	100.40-100.30	2	EC	18.1	10.2	3.5	C	13.6	S						
9027	RF	A	N221 E154	100.3	2	EC	42.5	19.5	5.2	S	11.5	SH	C	17.3	S			
9028	UF	A	N221 E154	100.31	2	EC	31.2	18.3	6.2	S	15	H						
9051	UF	A	N221 E154	100.27	2	EC	36.3	18.5	4.9	S	17.1	SH						
9110	RF	A	N221 E154	100.11	2	EC	39.7	58.1	12.5	S	13.8	H						
9145	RF	A	N222 E158	100.40-100.30	2	MOQ	14.8	8	3.2	S	13.5	H						
9146	RF	A	N222 E158	100.40-100.30	2	SW	10.5	24.5	5.6	S	9.6	H						
9170	RF	A	N222 E158	100.30-100.20	2	EC	24.7	9.6	6.3	S	15.8	H						
9173	UF	A	N222 E158	100.30-100.20	2	EC	5.3	3.4	2.4	S	3.3	HD						
9178	UF	A	N222 E158	100.14	2	EC	62.2	30.5	12.4	C	54.2	S						
9179	RF	A	N222 E158	100.11	2	EC	39.2	26.5	17.9	S	22.1	H						
9181	RF	A	N222 E158	100.20-100.10	2	EC	14.1	9.6	6.1	S	9.3	SH						
9198	RF	A	N223 E153	100.40-100.30	2	SW	12.1	5.3	4.9	S	9.6	H						
9200	UF	A	N223 E153	100.3	2	EC	53.2	35.6	13.6	S	31.6	H						
9222	RF	A	N221 E155	100.31	2	PC	14.5	21.8	4.5	C	10	SH						
9241	RF	A	N221 E155	100.3	2	PC	20.3	21.9	4.7	S	9.3	H						
9243	UF	A	N221 E155	100.3	2	PC	12.7	21.3	3.5	S	16.2	SH						
9259	RF	A	N221 E155	100.40-100.30	2	PC	9.9	14.3	3.2	S	9.6	SH						
9316	RF	A	N221 E155	100.27	2	PC	47.3	25	13.9	S	4.5	H	S	5.3	H	S	7.8	H
9347	RF	A	N221 E155	100.17	2	EC	27.1	30.7	7.7	C	17.1	S	S	22.4	SH	C	3	S
9378	RF	A	N222 E152	100.35-100.30	2	SW	19.7	4.8	2.5	S	10.2	H						
9475	RF	A	N222 E151	100.27	2	OB	14.9	28.5	2.9	C	15.3	S	C	12.5	S			
9505	UF	A	N222 E151	100.24	2	EC	28.6	13.8	3.2	S/P	7	SH						
9520	RF	A	N222 E151	100.28	2	EC	48.8	23.1	18.1	S	26.6	SH						
9522	UF	A	N222 E151	100.28	2	EC	52.9	32	7.2	C	34.2	SH	C	34.9	SH	S/GV	7.8	H
9604	RF	A	N222 E150	100.25	2	EC	35.3	12.8	9.7	S	7.3	SH						
9617	UF	A	N222 E150	100.25	2	EC	26.7	18	5.2	S	18.7	SH						
9675	RF	A	N222 E153	100.29	2	EC	42.1	26	3.5	C	39.1	SH	S	11.8	SH	S	23.5	H
9688	UF	A	N222 E153	100.29	2	EC	57.6	31.6	14.5	C	34.6	SH						
9696	RF	A	N222 E153	100.30-100.20	2	EC	20.7	6.9	3.2	S	7.5	H						

Table B-5 Attributes of flake tools recovered from Goff Creek (48PA325). All measurements in mm.

Catalog #	Type	Area	Unit	Elev. (m)	Cultural Lvl	Mat. Type	Length	Width	Thickness	Use 1	Edge 1 Length	Mat. Worked 1	Use 2	Edge 2 Length	Mat. Worked 2	Use 3	Edge 3 Length	Mat. Worked 3
9698	RF	A	N222 E153	100.24	2	EC	26.1	16.5	2.6	S	14.4	SH						
9738	UF	A	N222 E153	100.17	2	EC	40.4	22.4	3.9	S	11.6	SH						
9744	RF	A	N222 E153	100.12	2	EC	22.9	18.9	3.8	C	19.8	SH						
9815	RF	A	N222 E152	100.2	2	EC	27.2	27.1	5.3	S/P	10.8	H						
9819	RF	A	N222 E152	100.2	2	EC	29.9	18.4	6.2	S	11.1	SH						
9827	RF	A	N222 E152	100.23	2	EC	59.9	28.5	12.7	S	13.6	SH						
9838	RF	A	N222 E152	100.30-100.20	2	SW	10.6	5.4	2.6	S	8.3	H						
9845	RF	A	N222 E152	100.20-100.10	2	EC	15.1	4.7	3	S	6.6	SH						
9849	UF	A	N222 E152	100.16	2	SW	20.2	22.6	3.8	S	7.5	SH						
9853	UF	A	N222 E152	100.10-99.95	1	SW	58.7	26.4	11.6	S	12.9	H						
9917	RF	A	N223 E151	100.55-100.40	2	SW	35.4	22.8	6.5	S	5.7	SH						
9922	UF	A	N223 E151	100.35	2	EC	48.1	34.7	10.7	S	20.2	H	S	15.3	H			
9925	UF	A	N223 E151	100.31	2	EC	16.1	26	8.4	S	10.1	H						
9935	RF	A	N223 E151	100.31	2	EC	32.1	24.2	5.7	S	6.7	SH						
9936	UF	A	N223 E151	100.31	2	EC	46.8	48	15.2	S	11.4	H						
9947	RF	A	N223 E151	100.32	2	EC	60.3	26.3	9.8	S	19.3	SH						
9970	UF	A	N223 E151	100.40-100.30	2	EC	21	12.5	3.9	S	7.4	SH						
9983	RF	A	N223 E151	100.27	2	SW	38.7	39.2	10.8	S	25.4	SH						
9987	RF	A	N223 E151	100.28	2	SW	41.4	36.2	10.7	C	35.4	SH	C	22.6	SH			
9992	RF	A	N223 E151	100.26	2	EC	51	18.9	4.2	S	10.5	SH	S	11	SH	S	15.8	SH
9995	RF	A	N223 E151	100.2	2	SW	57.4	19.7	13.3	S	33.6	SH						
10032	RF	A	N222 E154	100.27	2	EC	19.9	18.9	3.7	S	11.1	SH						
10040	RF	A	N222 E154	100.23	2	EC	9.7	19.6	6.5	S	6.6	SH						
10047	RF	A	N222 E154	100.13	2	EC	40.3	10.6	5.2	S	8.3	SH						
10076	RF	A	N222 E154	99.77	1	MOQ	31.8	39.5	8.2	S	8.2	H	S	11.9	H	S	13.1	SH
10107	UF	A	N222 E157	100.40-100.30	2	EC	63.6	30.3	14.2	S	32.9	SH	S	18.9	SH			
10110	RF	A	N222 E157	100.30-100.20	2	EC	16.8	5.3	2.4	S	15.3	SH						
10117	RF	A	N222 E157	100.27	2	OB	41.2	22.9	6.4	S	34	SH	S	34.8	SH			
10128	RF	A	N222 E157	100.30-100.20	2	EC	22.4	18.9	5.8	S	20.5	H	S	20.7	H			
10156	UF	A	N222 E157	99.90-99.80	1	EC	16.7	23.5	5.2	C	15.1	S						
10186	UF	A	N223 E150	100.24	2	EC	21.8	15.1	2.9	S	15.8	SH						
10264	UF	A	N222 E151	100.26	2	EC	13.7	24.5	3.4	S	12.4	SH						
10271	UF	A	N222 E151	100.27	2	EC	35.1	17.4	3.7	S	14.1	SH						
10284	RF	A	N222 E151	100.22	2	EC	15.6	33.6	6.3	C	16.8	S						
10289	UF	A	N222 E151	100.30-100.20	2	EC	11.9	8.2	1.7	S/P	8.6	SH						

Table B-5 Attributes of flake tools recovered from Goff Creek (48PA325). All measurements in mm.

Catalog #	Type	Area	Unit	Elev. (m)	Cultural Lvl	Mat. Type	Length	Width	Thickness	Use 1	Edge 1 Length	Mat. Worked 1	Use 2	Edge 2 Length	Mat. Worked 2	Use 3	Edge 3 Length	Mat. Worked 3
10300	UF	A	N222 E151	100.27	2	EC	34.9	21.9	7.8	S	17.7	H						
10374	RF	A	N222 E151	100.28	2	EC	27.6	13.5	6.5	S	12.5	H						
10406	RF	A	N223 E151	100.2	2	SW	63.8	32.4	17.2	S	17	SH						
10461	UF	A	N223 E154	100.40-100.30	2	EC	15.7	12.6	3.9	S	9	SH						
10477	UF	A	N223 E154	100.40-100.30	2	EC	15.3	6.4	3.4	S	9.6	SH						
10483	RF	A	N223 E154	100.35	2	EC	31.6	25.5	4.4	P	7.8	SH						
10486	UF	A	N223 E154	100.34	2	EC	25	18.9	3.8	S	11.3	SH						
10523	RF	A	N223 E154	100.27	2	EC	30.3	17.8	6.8	S/P	8.3	SH						
10531	RF	A	N223 E154	100.25	2	SW	18.7	25.6	6	S	11.9	H	S	8.7	H			
10622	RF	A	N223 E150	100.20-100.10	2	EC	24.8	19.3	4.1	C	20.3	S	C	17.7	S			
10632	UF	A	N223 E150	100.20-100.10	2	EC	14.4	7.1	2.9	C	12.4	S						
10633	UF	A	N223 E150	100.20-100.10	2	EC	14.6	3.7	3.2	C	4.2	S						
10644	UF	A	N223 E152	100.39	2	SW	21.6	17.4	3.2	S	8.3	SH						
10649	RF	A	N223 E152	100.38	2	SW	45.5	31.8	9.3	S	17.8	H	S	25.8	H			
10653	UF	A	N223 E152	100.39	2	SW	17	21.9	4.3	S	7.7	H						
10658	RF	A	N223 E152	100.40-100.30	2	EC	13.9	17.6	8.9	S	12	SH						
10681	RF	A	N223 E152	100.26	2	SW	54.7	31.2	8.6	S/P	22.8	SH						
10763	UF	A	N223 E152	100.30-100.20	2	EC	18.7	15.1	7.1	S	11.9	H						
10890	RF	A	N223 E157	100.30-100.20	2	EC	12.4	9.4	7	S	4.7	H						
10903	UF	A	N223 E157	99.95	1	SW	17.2	35.4	10.3	C	23.4	SH						
10907	UF	A	N223 E157	100.00-99.90	1	EC	20.7	9.6	1.7	S	14.8	SH						
10954	RF	A	N224 E153	100.38	2	EC	40.5	28.3	19.8	C	17.8	S						
10958	RF	A	N224 E153	100.35	2	EC	47.8	36.3	13.5	S	19.1	H	S	18.2	H			
10964	UF	A	N224 E153	100.34	2	OB	32.7	23	2.9	C	27.1	S						
10967	UF	A	N224 E153	100.32	2	EC	35.2	26.5	2.9	S	9.2	SH	S	7.2	SH			
10975	UF	A	N224 E153	100.31	2	EC	41.9	35.5	12.1	C	22.8	S						
10980	UF	A	N224 E153	100.40-100.30	2	EC	10.5	17	3.4	C	13.3	S	C	8.9	S			
11011	UF	A	N223 E155	100.41	2	EC	24.8	13.9	6.3	S	8.7	SH						
11016	UF	A	N223 E155	100.36	2	SW	36.7	14.2	3.8	C	20.2	S						
11060	UF	A	N223 E155	100.34	2	EC	40.1	19.7	10.3	S	16.2	S						
11116	UF	A	N223 E155	100.27	2	EC	41.5	27.9	12.6	S	19.2	SH	S	7.4	SH			
11161	UF	A	N223 E155	99.91	1	TSQ	31.5	23.9	9.8	S	13.4	SH						
11173	UF	A	N223 E155	99.90-99.80	1	EC	24.6	7	1.8	S	9.4	SH						
11195	UF	A	N224 E155	100.38	2	EC	34.2	20.3	2.5	C	16.6	S	C	18.2	S			
11285	RF	A	N224 E150	100.3	2	EC	30.3	16.6	6.5	C	15.7	S						

Table B-5 Attributes of flake tools recovered from Goff Creek (48PA325). All measurements in mm.

Catalog #	Type	Area	Unit	Elev. (m)	Cultural Lvl	Mat. Type	Length	Width	Thickness	Use 1	Edge 1 Length	Mat. Worked 1	Use 2	Edge 2 Length	Mat. Worked 2	Use 3	Edge 3 Length	Mat. Worked 3
11329	UF	A	N224 E154	100.36	2	EC	23.1	10.6	3	S	14.6	SH						
11333	UF	A	N224 E154	100.35	2	EC	25.9	19.3	5.6	S	12.5	SH						
11337	RF	A	N224 E154	100.3	2	EC	28.3	26.1	3.6	S/GV	8.9	SH	S/GV	10.1	SH			
11343	UF	A	N224 E154	100.37	2	EC	38	15.7	4.8	S	9.8	SH						
11353	UF	A	N224 E154	100.40-100.30	2	EC	18.7	17	5.1	S	11.3	SH						
11354	RF	A	N224 E154	100.40-100.30	2	EC	7.6	7.8	4.5	S	7	H						
11355	RF	A	N224 E154	100.40-100.30	2	EC	11.6	8	2.8	S	11	SH						
11389	RF	A	N224 E154	100.34	2	EC	40.8	10.5	6.7	S	18.1	SH						
11466	RF	A	N224 E151	100.31	2	EC	20.4	9.3	6.3	S	17.4	SH						
11477	RF	A	N224 E151	100.40-100.30	2	EC	23.9	20.2	4.1	S	18.8	SH						
11588	RF	A	N224 E152	100.40-100.30	2	EC	16.9	12.7	6	S	10	H						
11589	UF	A	N224 E152	100.40-100.30	2	EC	26.8	17.5	5	S	19.5	H						
11615	RF	A	N224 E155	100.37	2	EC	21.6	9.1	2.2	S	14.1	SH						
11658	RF	A	N224 E155	100.38	2	EC	33.6	27.4	15	S	18.4	H						
11661	UF	A	N224 E155	100.35	2	EC	41.9	28.8	4.4	C	21.4	S						
11689	UF	A	N224 E155	100.36	2	MOC	41.7	31	11.2	S	10	SH						
11750	UF	A	N224 E155	100.31	2	EC	37.4	28.3	7.3	S	23.9	H						
11799	UF	A	N224 E155	100.2	2	OB	14.5	18.1	5.9	S	13.8	SH						
11861	UF	A	N224 E152	100.3	2	EC	30.1	33	12.9	S	26.6	H						
11874	UF	A	N224 E152	100.3	2	EC	33.6	12.9	6	S	9.6	H						
11888	RF	A	N224 E152	100.3	2	SW	28.4	24.8	8.7	S	24.5	SH	S	18.4	H			
11895	RF	A	N224 E152	100.40-100.30	2	EC	16.2	4.8	2.1	S	11.4	SH						
11911	UF	A	N224 E152	100.28	2	EC	55	39.8	7.1	S	12.6	S						
11934	RF	A	N224 E152	100.28	2	EC	47.4	25.6	6.8	S	9.4	H	S	7.8	H			
11942	RF	A	N224 E152	100.26	2	EC	24.5	22.8	6.7	S	19.1	SH	S	12.6	H			
11982	UF	A	N224 E152	100.29	2	EC	63.5	26.7	14.6	S	16	H	S	10.3	SH			
12002	RF	A	N224 E154	100.40-100.30	2	EC	24.2	23.9	4.1	S/P	22.2	SH	S/P	10.8	SH			
12007	UF	A	N224 E154	100.29	2	EC	51.7	24.6	11.2	C	44.3	S	C	33.6	S			
12016	UF	A	N224 E154	100.29	2	EC	27.9	28.6	14	S	22.2	SH						
12019	UF	A	N224 E154	100.29	2	EC	46	29.5	6	S	9.8	SH						
12024	RF	A	N224 E154	100.29	2	EC	47.6	19.1	6.4	S	16.1	H						
12034	UF	A	N224 E154	100.14	2	SW	50.9	35.7	10.9	P	23.9	SH						
12103	RF	A	N224 E157	100.36	2	EC	40.7	33.8	5.8	S	17.7	SH						
12128	RF	A	N224 E157	100.26	2	TSQ	47.9	41.5	17	S	19.4	SH						
12137	UF	A	N224 E157	100.30-100.20	2	EC	9.7	5.9	2.7	S	7.2	SH						

Table B-5 Attributes of flake tools recovered from Goff Creek (48PA325). All measurements in mm.

Catalog #	Type	Area	Unit	Elev. (m)	Cultural Lvl	Mat. Type	Length	Width	Thickness	Use 1	Edge 1 Length	Mat. Worked 1	Use 2	Edge 2 Length	Mat. Worked 2	Use 3	Edge 3 Length	Mat. Worked 3
12159	RF	A	N225 E154	100.43	2	EC	27.2	13.3	8.9	S	12.4	SH						
12167	RF	A	N225 E154	100.50-100.40	2	EC	7	4.5	2.7	C	7.4	S						
12204	UF	A	N224 E153	100.23	2	SW	72.1	46.4	22.5	S	19.1	SH						
12207	UF	A	N224 E153	100.28	2	OB	43.3	28.9	4.2	C	28.5	S						
12211	RF	A	N224 E153	100.30-100.20	2	EC	24.2	15	5.8	S	8.8	SH						
12212	UF	A	N224 E153	100.30-100.20	2	OB	25.6	18.1	4.1	C	7.5	S						
12215	RF	A	N224 E153	100.30-100.20	2	EC	16.3	12.1	3	S	11.9	SH						
12216	UF	A	N224 E153	100.30-100.20	2	EC	7.8	16.8	1.8	S	15.1	SH						
12219	UF	A	N224 E153	100.29	2	EC	19.3	14.6	4.7	S	6.7	SH						
12239	RF	A	N224 E153	100.11	2	SW	104.8	80.4	42.7	S	70.5	H						
12375	RF	B	N223 E177	99.95	2	EC	20.4	27.6	7	C	15	SH						
12441	RF	A	N224 E152	100.30-100.20	2	EC	20.9	5.8	5.4	S	9.2	SH	S	6.7	SH			
12501	RF	A	N224 E158	99.90-99.80	1	EC	16.1	14.8	2.9	S	11.8	SH	S	9.9	SH			
12511	RF	A	N225 E162	100.38	2	EC	39	17.2	7.4	S	23	SH						
12573	UF	A	N226 E162	100.10-100.00	1	EC	10.3	12.9	5.7	C	10.3	SH						
12596	RF	B	N222 E178	100.13-100.04	2	EC	41	11.3	8.6	S	24.2	SH						
12602	UF	A	N224 E155	100.30-100.20	2	EC	24.8	28.5	6.8	GV	6.3	SH						
12704	RF	A	N224 E156	100.40-100.30	2	SW	27.3	14.6	3.7	GV	5.5	SH						
12741	UF	B	N225 E177	100.06	2	OB	25.3	19.1	5.9	C	15.8	S						
12755	UF	B	N225 E177	100.03	2	EC	32.6	20.7	3.7	S	17.2	S	S	20.6	S			
12780	UF	B	N225 E177	99.82	1	EC	32.6	20.3	3.6	C	22.6	SH	C	13	SH	C	20.9	SH
12781	UF	B	N225 E177	99.83	1	EC	41	17.1	7.2	C	25.8	SH	S	16.3	S			
12795	UF	B	N225 E177	99.82	1	EC	50	34.6	9.4	C	18.3	SH	S	17.5	SH	C	15.3	SH
12796	RF	B	N225 E177	99.82	1	EC	32.2	27.1	6	GV	8.8	SH	S	13.2	S	S	19.1	SH
12800	UF	B	N225 E177	99.83	1	EC	31.9	17.2	5.1	S	19.7	SH						
12820	UF	A	N225 E154	100.39	2	EC	39.8	29.2	16.7	S	18.8	SH						
12839	UF	A	N225 E154	100.40-100.30	2	EC	26.7	17.4	8.6	S	15.9	SH						
12848	RF	A	N225 E154	100.27	2	EC	28.6	26.3	7.8	S	23.6	H						
12868	UF	A	N225 E154	100.27	2	EC	10.8	19.6	3.3	C	8.2	S						
12875	UF	A	N225 E154	100.30-100.20	2	EC	11.7	18.9	4.5	S	14.4	H						
12905	UF	B	N222 E177	100.12-100.00	2	PC	25.9	17.7	5.9	C	20.8	SH	S	11.5	SH			
12910	UF	B	N222 E177	100.00-99.90	2	EC	27	19.4	5.5	S/P	14.6	SH						
12916	UF	B	N222 E177	99.98	2	SW	20.6	16.3	4.1	C	15.7	SH						
13063	UF	B	N222 E177	99.76	1	TSQ	36.1	23.7	8.7	S	11.8	SH						
13133	RF	B	N223 E176	99.9	2	SW	60.1	31	17.3	S	22.2	SH						

Table B-5 Attributes of flake tools recovered from Goff Creek (48PA325). All measurements in mm.

Catalog #	Type	Area	Unit	Elev. (m)	Cultural Lvl	Mat. Type	Length	Width	Thickness	Use 1	Edge 1 Length	Mat. Worked 1	Use 2	Edge 2 Length	Mat. Worked 2	Use 3	Edge 3 Length	Mat. Worked 3
13134	UF	B	N223 E176	99.91	2	SW	32.1	19.5	8	C	27.3	S	C	14	S			
13159	UF	B	N223 E176	99.88	1	SW	52.4	28	10	S	32.6	SH	S	43	SH			
13170	UF	B	N223 E176	99.83	1	SW	50.7	43.4	15.5	C	30.4	S						
13176	UF	B	N223 E176	99.85-99.80	1	PC	29.7	18.3	3.5	S	12.4	SH						
13220	RF	B	N222 E178	100.00-99.90	2	EC	6.5	3.9	1.5	S	6.5	S						
13232	RF	B	N222 E178	99.86	1	SW	38.7	26.1	13.7	S	19.3	S						
13280	RF	B	N223 E178	99.99	2	EC	22.3	19.4	7.6				C	13.7	S			
13281	RF	B	N223 E178	99.99	2	SW	28.1	19.6	8.6	S	19.5	SH						
13299	UF	B	N223 E178	99.86	1	TSQ	23.3	28.6	6	S	10.8	SH						
13301	RF	B	N223 E178	99.86	1	EC	21.4	12.6	4.5	S	10.3	SH						
13339	UF	A	N223 E156	100.36	2	EC	20.8	16.8	13.3	S	9	H						
13341	RF	A	N223 E156	100.37	2	EC	28.5	17.1	10.5	S	12.9	H						
13365	UF	B	N224 E176	100.1	2	SW	38.3	31.1	4.6	C	21.5	S						
13401	UF	B	N223 E177	99.88	1	SW	52.3	29.7	12	S	32.2	S						
13415	RF	B	N223 E177	99.86	1	SW	88.5	58	27.3	GV	9.7	SH						
13470	UF	B	N224 E177	100.06	2	EC	30.8	20	9.2	S	17.4	SH						
13474	RF	B	N224 E177	100.10-100.00	2	EC	13.5	6.8	1.7	S	10.2	S						
13538	UF	B	N224 E177	99.82	1	SW	34.7	25.9	6.8	S	10.1	SH	S	13.7	SH	C	17.5	SH
13543	RF	B	N224 E177	99.84	1	SW	34.9	18.3	5.6	C	20.9	SH	S	15.4	SH			
13544	RF	B	N224 E177	99.84	1	SW	31.9	16.8	6.7	S	9	S						
13545	UF	B	N224 E177	99.83	1	SW	33.8	18.7	7.5	C	25.1	SH	C	29.6	SH			
13546	UF	B	N224 E177	99.83	1	UIC	33	15.3	4.7	C	25	SH	C	20.7	SH			
13567	UF	B	N225 E176	100.06	2	EC	43.9	26.2	14.9	C	16.9	SH						
13607	RF	B	N224 E176	99.99	2	EC	21.5	14.9	5.6	S	8.6	H						
13608	RF	B	N224 E176	99.96	2	EC	25.1	16.9	9.2	S	15.4	SH						
13636	RF	B	N224 E176	99.83	1	SW	44.1	29.9	13.8	S	21.2	H	S	17.2	SH			
13648	RF	B	N222 E178	99.75	1	WT	46.2	39	9.4	S	22.2	S						
13665	RF	B	N224 E178	100.02	2	EC	40.8	17.1	10.8	S	14.2	SH	S	16.9	SH			
13675	RF	B	N224 E178	100.05-100.00	2	EC	21.1	15.9	5.7	S	11.2	SH						
13681	UF	B	N224 E178	100.05-100.00	2	EC	18.9	25.3	3.7	C	13.2	S						
13708	RF	B	N224 E178	99.91	2	SW	63.1	39.7	11.8	S	38	H						
13739	RF	B	N225 E175	100.10-100.00	2	SW	10.1	6.7	2.4	S	9.5	SH						
13741	UF	B	N225 E175	100.04	2	SW	65.8	61.6	27	C	34.7	SH	C	32.1	SH			
13751	RF	B	N225 E175	100.10-100.00	2	EC	22	19.1	3	S	13.4	SH	C	13.3	SH			
13789	RF	B	N225 E178	100.23-100.09	2	OB	25.4	25.7	5.9	S	13.4	SH						

Table B-5 Attributes of flake tools recovered from Goff Creek (48PA325). All measurements in mm.

Catalog #	Type	Area	Unit	Elev. (m)	Cultural Lvl	Mat. Type	Length	Width	Thickness	Use 1	Edge 1 Length	Mat. Worked 1	Use 2	Edge 2 Length	Mat. Worked 2	Use 3	Edge 3 Length	Mat. Worked 3
13802	RF	B	N225 E176	100.03	2	EC	16.2	14	4.9	S	13.2	SH						
13816	UF	B	N225 E176	100.00-99.90	2	SW	12.2	8.4	5	S/P	8.4	SH						
13826	RF	B	N225 E176	99.94	2	EC	57.8	41.8	10.3	C	29.9	SH						
13832	RF	B	N225 E176	100.00-99.90	2	EC	13.6	8.5	2.5	S	13.6	S						
13837	RF	B	N225 E176	99.90-99.80	1	EC	17.3	8.7	2.5	S	17.3	S						
13857	RF	B	N226 E175	100.13	2	EC	40.9	23.9	6.3	S	29.9	SH						
13877	RF	B	N226 E175	100.20-100.10	2	EC	5.1	4.4	3.9	S	4.7	SH						
13889	RF	B	N226 E175	100.02	2	EC	62.6	33	4.5	S	50.3	SH	C	17.9	S			
13901	RF	B	N226 E175	100.01	2	EC	55.2	27.9	10.9	S	21.3	H						
13925	RF	B	N226 E175	99.95	2	EC	30.6	28.9	12.1	S	12.9	SH	S	11.8	SH			
13937	RF	B	N226 E175	99.99	2	SW	127.5	83.2	49.2	CH	56.8	UN						
14001	RF	B	N225 E177	99.83	1	EC	28.8	19.1	3	C	23.3	S						
14002	UF	B	N225 E177	99.83	1	EC	30.4	18.5	3.3	C	24.2	S						
14003	UF	B	N225 E177	99.83	1	EC	39.1	21.1	4.2	C	30.4	S	C	11.6	S			
14004	UF	B	N225 E177	99.83	1	EC	31.7	20.9	3.5	C	27.1	S	C	19.5	S			
14005	UF	B	N225 E177	99.84	1	EC	37.2	20.6	3.3	C	26.1	SH	C	26.4	SH			
14006	UF	B	N225 E177	99.83	1	EC	52.5	17.8	4.1	S	17.7	SH	C	23.9	SH	C	35.2	SH
14009	UF	B	N225 E177	99.82	1	EC	30.9	18	5.2	S	23.4	SH						
14020	UF	B	N225 E179	100	2	EC	19.4	19.4	6.3	S	15	H						
14085	RF	B	N225 E179	99.83	1	SW	34.6	19.2	13.8	S	15.1	H						
14114	UF	B	N225 E179	99.82	1	SW	39.1	19.3	6.4	S	13	SH						
14143	UF	B	N225 E179	99.84	1	SW	25.6	21.4	6.4	S	5.4	SH						
14186	RF	B	N225 E179	99.81	1	SW	32.8	11.1	4.8	S	21.8	SH						
14193	RF	B	N225 E179	99.8	1	SW	29.4	22.9	10	S	10	SH						
14207	RF	B	N225 E178	100.03	2	EC	49.5	26.3	8.6	GV	13.7	SH						
14231	UF	B	N225 E178	99.82	1	EC	29.2	21	7.3	S	13	SH	S	22.7	SH	S	17.7	SH
14252	RF	B	N225 E178	99.80-99.70	1	SW	11	12.9	2.6	UN	2.2	S	S	9.1	S	S	8.4	S
14259	RF	B	N226 E176	100.1	2	EC	19.6	23.6	5.7	S/GV	7.1	SH						
14270	RF	B	N226 E176	100.13-100.10	2	EC	9.2	7.5	2.5	S	7.5	SH						
14290	UF	B	N226 E176	100.05	2	EC	22.6	7.4	80.1	S/P	7.4	SH						
14337	RF	B	N226 E176	99.91	2	TSQ	52.9	46	13.2	S	14.3	SH	S	28.7	SH			
14408	UF	B	N227 E175	100.20-100.10	2	SW	26.4	9.8	4.4	S	11.4	H						
14464	UF	B	N227 E175	100.00-99.90	2	EC	17.4	12.5	5.7	S	11.6	S						
14509	RF	B	N227 E176	100.04	2	EC	34.1	18	13	S/P	18.8	SH						
14522	UF	B	N227 E176	100.06	2	EC	22.2	5.2	5.2	S	8	SH						

Table B-5 Attributes of flake tools recovered from Goff Creek (48PA325). All measurements in mm.

Catalog #	Type	Area	Unit	Elev. (m)	Cultural Lvl	Mat. Type	Length	Width	Thickness	Use 1	Edge 1 Length	Mat. Worked 1	Use 2	Edge 2 Length	Mat. Worked 2	Use 3	Edge 3 Length	Mat. Worked 3
14693	UF	B	N226 E177	99.8	1	EC	30.2	24.4	9.1	C	20.8	SH	C	22.4	SH			
14741	RF	B	N228 E176	100.13	2	EC	57.2	30.7	13.2	S	26.1	H						
14781	RF	B	N228 E176	99.98	2	SW	50.3	50.8	7.9	S	50.8	H	S	16.8	SH	C	37.3	SH
14797	RF	B	N228 E176	99.86	1	EC	38.8	20.1	14.7	S	22.8	SH						
14900	UF	B	N227 E179	100.06	2	EC	26	18.8	4.1	S	18.9	SH						
14903	UF	B	N227 E179	100.08	2	SW	32.2	26.9	10.2	S	8.2	H						
14931	UF	B	N227 E179	99.83	1	SW	56.8	26.9	14.5	S	26.4	SH						
14953	UF	B	N228 E175	100.11	2	EC	21.1	25.3	6.2	S	11.2	SH						
14973	RF	B	N228 E175	100	2	EC	45.1	25.3	12.1	S/P	15.8	H						
14986	RF	B	N228 E175	100	2	SW	26.9	11.7	8.7	S	14.6	SH						
15017	RF	B	N228 E176	99.85-99.80	1	EC	20.9	28.6	15.2	S	16.9	H						
15020	UF	B	N228 E176	99.80-99.75	1	SW	10	12.4	2.3	C	7.6	S						
15076	RF	B	N229 E175	99.99	2	EC	52.3	30.8	7.6	S	9	SH						
15077	UF	B	N229 E175	99.9	2	MQ	43.2	53.9	13.1	C	32.2	SH	C	44.2	SH	C	36.2	SH
15087	RF	B	N229 E177	100.16	2	EC	25.5	26	8.5	S	20.5	SH						
15093	RF	B	N229 E177	100.11	2	SW	18.1	28.2	8.7	S	14	H	C	17.1	SH			
15116	RF	B	N227 E178	99.8	1	MOQ	22.3	21.3	4.3	S/P	13.3	SH	S/P	18.5	SH	S/P	16.2	SH
15120	RF	B	N227 E178	99.79	1	MOQ	17.3	25.3	4.1	S/P	15.3	SH						
15145	UF	B	N228 E177	100.03	2	SW	30.1	16	7.9	S	5.6	SH						
15213	UF	B	N229 E177	100.08	2	EC	61.6	28	9.5	C	37.1	SH						
15220	RF	B	N229 E177	100.08	2	EC	20.3	20.5	5	S	9.9	SH						
15257	RF	B	N228 E175	99.85	1	MOQ	46.8	34.4	9.2	S/P	31.9	SH						
15284	RF	B	N229 E176	100.08	2	EC	39.8	16.7	16.7	S	33	H						
15288	UF	B	N229 E176	100.06	2	SW	30.7	16.4	5.4	S/P	7.9	SH						
15327	RF	B	N229 E176	99.71	1	EC	45.5	41.2	7.5	C	16.5	SH						
15396	RF	B	N222 E176	100	2	EC	35.3	14.2	10	S	20.5	H						
15397	UF	B	N222 E176	100.01	2	SW	28.6	21.4	9.4	S	12	H						
15420	UF	B	N222 E176	99.97	2	EC	25.2	18.4	10.1	S	10.7	H						
15452	RF	B	N222 E176	99.87	1	EC	42.7	36.1	6.5	S	34	SH	S	31.4	SH			
15484	RF	B	N222 E176	99.82	1	TSQ	50.4	37.3	14.3	S	23.1	SH						
15499	UF	B	N222 E176	99.74	1	SW	27.5	27.5	5.2	C	20.6	SH						

APPENDIX C

MACROBOTANICAL ANALYSIS OF SITE 48PA325.

Prepared for:

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Report #HPMS-03-2015

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Introduction:

Macrobotanical analysis was conducted on six block areas (Block A – Block F) which included several heat altered firepits from Site 48PA325. This was done to ascertain if charred macrofloral and non-macrofloral remains were present. If present, then insights into understanding prehistoric subsistence and subsistence patterns can lead to a better understanding of seasonality of site occupation, the possibility to reconstruct past plant and animal compositions and resource utilization patterns. The overall results yielded two species of fuel wood which were identified as Douglas-fir (*Pseudotusuga menziesii*) and aspen/cottonwood or willow (*Populus* sp./ *Salix* sp.). Carbonized macrobotanical remains included several small pieces of carbonized Process Edible Tissue (PET) from a tuber starchy plant species, several pieces of carbonized cactus PET, several possible Buffaloberry (*Shepherdia argentea*) seed fragments, a few legume seeds, several unknown seeds and several Douglas-fir pine needles. Other non-cultural macrobotanical remains included carbonized and unburned sclerotia (*Cenococcum* sp.) spores. Unburned macrobotanical remains were present and included goosefoot (*Chenopodium* sp. seeds, a composite (sunflower family) seed fragment and Douglas-fir pine needles. Zoological remains included one gastropod egg. Insect fragments were also present but were not collected.

Methodology:

The light fraction was passed through a ¼” screen sieve, a 2.0mm, 1.0mm and 500μm sieves. Separating the light fraction into different sizes allows for more manageable viewing thereby decreasing the amount of time required to analyze a feature. Recovered macrofloral materials were identified using the author’s seed and charcoal collection and wood and seed identification manuals (i.e., Boonstra et al. 2006a, Boonstra et al. 2006b, Core et al. 1979, Davis 1993, Hoadley 1990, Hurd et al. 1998, Kirkbride et al. 2000, Martin and Barkley 2000, Musil 1978, Panshin and Zeeuw 1970, Young and Young 1992).

Plant names are listed by both their common name and scientific name. Scientific nomenclature of plant names changes over time (see Dorn 2001; Scianna and Majerus 2002). Due to this, the new scientific name will be used throughout this report if appropriate. The term “sp.” (such as *Pinus* sp.) indicates the plant has been identified to the genus level but not to the species level. The term “seed” represents seeds, caryopses and/or achenes.

Results:

<u>Block A, Feature 1, SE 1/4, N222 E154, 100.26-100.20 m, FS#50</u>

FS#50 yielded one unburned thistle seed which was not collected. Charcoal was present but it was too small for identification or collection. Insect fragments were absent in the light fraction.

<u>Block A, Feature 1, SE 1/4, N222 E154, 100.20-100.12, FS#83</u>

FS#83 yielded one unknown carbonized seed fragment. Charcoal was present in the light fraction and was identified as Douglas-fir (*Pseudotusuga menziesii*). The charcoal was not collected.

<u>Block A, Feature 1, NW 1/4, N223 E153, 100.30-100.24 m, FS#69</u>

FS#69 yielded one unknown carbonized seed fragment. Charcoal was present in the light fraction and was identified as Douglas-fir (*Pseudotusuga menziesii*). The charcoal was not collected.

<u>Block A, Feature 1, NE 1/4, N223 E154, 100.25-100.20 m, FS#146</u>
FS#146 yielded one possible carbonized Buffaloberry (*Shepherdia argentea*) seed fragment and four pieces of unknown starchy tuber PET fragments. Charcoal was present and was identified as Douglas-fir (*Pseudotusuga menziesii*). The charcoal was not collected. Insect fragments were absent in the light fraction.

<u>Block A, Feature 1 NE1/4, N223 E154, 100.20-100.10 m, FS#164</u>
This sample yielded no macrobotanical remains. Insect fragments were also absent in the light fraction.

<u>Block A, Feature 2, N223-E154 Level 5, 100.25-100.16, FS#139</u>
FS#139 yielded one complete and two fragmented carbonized legume seeds. Also present was one possible carbonized Buffaloberry (*Shepherdia argentea*) seed fragment. Cactus (*Opuntia* sp.) PET was present and was represented by five pieces. Finally there were three carbonized seed fragments from unknown plant species. Charcoal was present in the light fraction and was identified as Douglas-fir (*Pseudotusuga menziesii*). The charcoal was not collected. Insect fragments were absent.

<u>Block B, Feature 8, N225 E176, 100.05-100.03, FS#26</u>
FS#26 yielded several pieces of unknown starchy PET. Charcoal was present but it was too small for identification and it was not collected. Insect fragments were absent in the light fraction.

<u>Block B, Feature 14 N1/2, N229 E176, 99.90-99.80, FS#32</u>
FS#32 yielded one unburned gastropod egg. Charcoal was present but it was too small for identification. The charcoal was not collected. Insect fragments were absent in the light fraction.

<u>Block B, Feature 14, N1/2, N229 E176, Level 6, 99.80-99-70, FS#33</u>
FS#33 yielded unburned sclerotia (*Cenococcum* sp.) spores. Charcoal was present and was identified as Douglas-fir (*Pseudotusuga menziesii*). The charcoal was not collected. Unburned insect fragments were present in the light fraction but were not collected.

<u>Block B, Feature 14, N1/2, N229 E176, Level 7, 99.7-99.6, F.S.#34</u>
FS#34 yielded no macrobotanical remains. Insect fragments were also absent in the light fraction.

<u>Block D, Feature 16, N232-E255, Level 2, 98.86-98.76, FS#11</u>
FS#11 yielded several both burned and unburned sclerotia (*Cenococcum* sp.) spores. Charcoal was present and was identified as aspen/cottonwood or willow (*Populus* sp./ *Salix* sp.). The charcoal was not collected. Insect fragments were present but were not collected.

<u>Block D, Feature 17, N235 E256, 98.07-98.02 m, FS#68</u>
FS#68 did not yield any macrofloral or insect remains. Charcoal was present and was identified as Douglas-fir (*Pseudotusuga menziesii*). The charcoal was not collected.

<u>Block D, Feature 17, N255-E255, 98.04-97.80, FS#123</u>

FS#123 did not yield any macrofloral or insect remains. Charcoal was present and was identified as Douglas-fir (*Pseudotusuga menziesii*). The charcoal was not collected.

Block E, Feature 19, N232-E266, 98.48-98.38 m, FS#25

FS#25 yielded two unburned sclerotia (*Cenococcum* sp.) spores. A large amount of charcoal was present and was identified as aspen/cottonwood or willow (*Populus* sp./ *Salix* sp.). The charcoal was not collected. Insect fragments were also present but were not collected.

Block F, Feature 20, N231-E277, FS#17

FS#17 yielded two carbonized pieces of an unknown tuber species. Unburned macrobotanical remains included five Douglas-fir (*Pseudotusuga menziesii*) pine needles. The charcoal was also identified as Douglas-fir. Insects were present but were not collected.

Block F, Feature 20, N231-E277, 98.00-97.97, FS#75

FS#75 yielded one unburned sclerotia (*Cenococcum* sp.) spore. Two pieces of charcoal were present and were identified as Douglas-fir (*Pseudotusuga menziesii*). The charcoal was not collected. Unburned insect fragments were present but were not collected.

Block F, Feature 21, N233 E278, 98.01-97.96 m, FS#26

FS#26 yielded seven unburned sclerotia (*Cenococcum* sp.) spores. Charcoal was present and was identified as Douglas-fir (*Pseudotusuga menziesii*). The charcoal was not collected. Unburned insect fragments were present but were not collected.

Block F, Feature 22, N231-E275, 98.14-98.04 m, FS#11

FS#11 did not yield any macrofloral remains. Some charcoal was present and was identified as Douglas-fir (*Pseudotusuga menziesii*). The charcoal was not collected. Unburned insect fragments were present but were not collected.

Block F, Feature 22, N232 E275, 98.08-97.98 m, FS#25

FS#25 did not yield any macrofloral or insect remains. Charcoal was present but it was too small for identification and it was not collected.

Block F, Feature 22, N1/2, Level 3, 98.01-97.96, FS#29

FS#29 yielded one unburned composite (sunflower family) seed fragment. Charcoal was present but it was too small for identification. Unburned insect fragments were present but were not collected.

Block F, Feature 23, N231 E277, 97.67-97.53 m, FS#72

Feature 23, yielded several carbonized PET fragments from an unknown tuber species. Several pieces of charcoal were present and were identified as Douglas-fir (*Pseudotusuga menziesii*). Unburned insect fragments were present but were not collected.

Discussion:

Macrobotanical analysis was conducted on six block areas (Block A – Block F) at site 48PA325. This was done to ascertain if charred macrofloral and non-macrofloral remains were present. If present, then insights into understanding prehistoric subsistence and subsistence patterns can lead to a better understanding of seasonality of site occupation, the possibility to reconstruct past plant and animal compositions and resource utilization patterns. The overall results yielded two species of fuel wood which were identified as Douglas-fir (*Pseudotusuga menziesii*) and aspen/cottonwood or willow (*Populus* sp./ *Salix* sp.). According to Tennessen *et al.*, "Accurate taxonomic identification is an essential part of archaeological wood analysis. However, making identifications more precise than the genus level is usually not possible since species within the same genus typically possess very similar cellular morphology (Tennessen *et al.* 2002:521). With that said, both species recovered from the archaeological soil and feature samples are still present today in and around site 48PA325.

The Carbonized macrobotanical remains from both cactus and a starchy tuber species strongly suggest plant processing occurred at site 48PA325. Cactus can be consumed from the spring through the fall, however, tubers are generally collected and consumed in the spring to early summer months. With that said, the presence of the possible burned Buffaloberries and legume seed and unknown carbonized seed fragments suggests a fall occupation. Therefore, it is likely site 48PA325 represents both a spring/early summer through fall occupation.

The presence of the unburned seeds and pine needles probably represents modern and prehistoric seed rain and should also be dismissed. The presence of the sclerotia spores, both burned and unburned are not culturally significant and should be dismissed. Sclerotia is a soil fungus which "appears to be ubiquitous" and is found in multiple ecosystems (McWeeney 1989:227) and is not culturally significant. Also, the presence of the one gastropod egg should also be dismissed as intrusive and not culturally significant.

To summarize, carbonized cactus and starchy PET fragments were recovered from site 48PA325 along with several carbonized seeds suggesting a site occupation ranging from spring through the fall. It is unlikely given the small amount of recovered carbonized macrobotanical remains that plant processing was the primary function or purpose of site 48PA325. It is more likely these remains represent cooking activities which occurred on a regular basis in association with other functions/activities that occurred at site 48PA325.

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APPENDIX D

LaRamie Soils Service

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Laramie, WY 82070

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ETHNOBOTANICAL REPORT
Goff Creek Site (48PA325)

Prepared for

DR. DAN EAKIN
OFFICE OF WYOMING STATE ARCHAEOLOGIST
LARAMIE, WYOMING 82070

Prepared by

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CELESTE I. HAVENER
Ethnobotanist
and
MICHAEL MCFAUL
Principle Geoarchaeologist/Owner

September 4, 1997

Geoarchaeology • Geomorphology • Pedology

Introduction

An ethnobotanical sample from Platte county in Wyoming was examined to identify botanical material preferences.

The samples yielded fuelwood, and one insect head.

Methods

Organic and geologic material from the sample was separated using an elutriator. The elutriator separates or 'floats' organic matter free from the non-organic sediment. The organic material was then passed through 4 mm, 2 mm, 1 mm, and 0.5 mm sieves. Multiple sieve sizes allow manageable division of samples for viewing to enhance the seed keying. Organic material was identified using a Fisher 30X power stereoscope. Seeds and charcoal samples were classified to family and species by comparison with the Havener/LaRamie Soils Service and the Rocky Mountain Herbarium seed collections.

The geologic matrix of the sample was also sieved with 4mm, 2mm, and 1mm sieves and examined for items relating to human use. However, no material relevant to human occupation.

Summary

The sample contained insufficient material to interpret. Charred fragments were present in the sample, however most of the material was less than 0.355 in size. The lack of material prevents interpretation of the hearth's use.

LaRamie Soils Service Flotation Report
LRSS# 131WYO97
Examined by Celeste Havener,
Ethnobotanist/Lab Director
Site: 48PA325 Feature: 14, Block B, N229 E176
Level 7 99.8-99.7 South half N 17-58, E 00-04
Contact: Dan Eakin, Office of the Wyoming
State Archaeologist
Date received: 4/29/97 **Date report submitted:** 8/1/97

> **Key Results**
> **Organics:** Cheno-am seeds, *Asteraceae* seed, fuelwood is *Populus/Salix*.
> **Interpretation:** Hearth possibly used for food processing.

Recovered:

Material in the light fraction included fuelwood, five hair fragments (four brown, one white). Charred material included one charred Cheno-am seed and two charred Cheno-am fragments, and one charred *Asteraceae sp.* seed fragment. Fuelwood in the 4-mm fraction and 2-mm fractions was 100% (*Populus sp./Salix sp.)* cottonwood or willow.

The heavy fraction contained no material relevant to human occupation.

Interpretation:

The charred seeds, both Cheno-am and *Asteraceae* are some of the most common food sources of the plains Indians. The sie of the fragment of *Asteraceae* seed suggests it is a sunflower (*Helianthus annus)* seed, although the fragment contains minimal landmark features. The type of fuelwood (cottonwood/willow family) suggests a nearby water source. Since the seeds identified in the sample were food sources the hearth could have been used for food processing.

Sample size: 1.07 liters
Fraction sizes:
4mm= 0.03 g, 1 piece of charcoal
2mm= 0.06 g
1mm = 0.06 g
0.5mm= 0.10 g
0.355mm= 0.07 g

Pg. 2 131WYO97 Feature 14, Block B, N229 E176

Figure Key

U=uncharred

C=charred

Light Fraction

Scientific Name	Common Name	Part	Whole U	Whole C	Frag C	Frag U	Comment
No Floral remains							
Asteraceae sp. (Helianthus sp.)	sunflower	seed				1	Labeled As 131
Chenopodiaceae/Amaranthaceae	Cheno-am, pigweed, goosefoot	seed		1		2	Labeled CA 131
Non-floral remains							
Hair					5		Labeled H 131

Charcoal

4mm	Scientific Name	Common Name
100%	Populus/Salix	cottonwood/willow

2mm	Scientific Name	Common Name
100%	Populus/Salix	cottonwood/willow

LaRamie Soils Service Flotation Report
LRSS# 133WYO97
Examined by Celeste Havener,
Ethnobotanist/Lab Director
Site: 48PA325 FS-38
Feature 14, Block B, N229 E176 L.7 99.7-99.6 m
South Half, 31-54N, 64-93E
Contact: Dan Eakin, Office of the Wyoming State Archaeologist
Date received: 6/97 **Date report submitted:** 8/28/97

Key Results
Organics: Fuelwood unidentifiable because of size and condition.
Interpretation: Not enough botanical remain to interprete.

Recovered:

Organic material identified in this sample included fuelwood and one insect head. Fuelwood was not recovered in the 4-mm fraction, the 2-mm fraction contained only one piece of fuelwood. Unfortunately it was to decomposed to identify.

The heavy fraction contained no material relevant to human occupation.

Interpretation:

The sample contained insufficient material to interpret. The sample contained charred fragments, but most of the material was less than 0.355mm in size. The lack of material prevents interepretation of the hearths use.

Sample size: 1.05 liters
Fraction sizes:
4mm= 0.00 g,
2mm= 0.01 g
1mm = 0.01 g
0.5mm= 0.02 g
0.355mm= 0.02 g

Present vegetation: Not reported (3/97).

Pg. 2 I33WY097 Feature 14, Block B, N229 E176 L.7 99.7-99.6 m

Figure Key

U=uncharred

C=charred

Light Fraction

Scientific Name	Common Name	Part	Whole U	Whole C	Frag U	Frag C	Comment
No Floral remains							
Non-floral remains							
Insect	heads				1		Labeled I 133

Charcoal

4mm	Scientific Name	Common Name

No 4 mm sample.

2mm	Scientific Name	Common Name

One piece of indistinguishable fuelwood.

LaRamie Soils Service Flotation Report
LRSS# 134WYO97
Examined by Celeste Havener,
Ethnobotanist/Lab Director
Site: 48PA325 **Feature 14 S1/2**
Block B, N229 E176, L.6 99.8-99.7 m
Contact: Dan Eakin, Office of the Wyoming State Archaeologist
Date received: 4/29/97 **Date report submitted:** 11/20/97

Key Results
Organics: Cheno-am seed, *Polygonaceae* seed, fuelwood is *Populus/Salix*.
Interpretation: The hearth could have been used for food processing.

Recovered:

The charred material in the light fraction included one *Polygonum convolulus* (wild buckwheat) seed, one charred *Chenopodiaceae sp.* seed and fuelwood. Fuelwood in the 4mm fraction was 85% *Populus/Salix sp.* (cottonwood/willow) with 15% *Pinus sp.* (pine). The 2-mm fraction contained 90% *Populus/Salix sp.* (cottonwood/willow) with 10% *Pinus sp.* (pine).

No material relevant to human occupation was identified in this sample.

Interpretation:

The charred seeds, both *Chenopodiaceae sp.* and *Polygonaceae convolulus* are common food sources of the Plains Indians (Gilmore, 1977). The *Polygonaceae* family contains many members that were used as food sources, including bistort. The fuelwood is from the cottonwood/willow family and suggests a nearby water source. The seeds identified in the sample were food sources indicating the hearth could have been used for food processing.

Sample size: 12.71 liters
Fraction sizes:
4mm= 0.51 g, 100%charred
2mm= 0.62 g, 90% charred, 10% uncharred
1mm = 0.55 g
0.5mm= 0.79 g
0.355mm= 0.78 g

Gilmore, Melvin
1973 *Uses of Plants by the Indians of the Missouri River Region*. University of Nebraska Press. Lincoln, Nebraska.

Pg. 2 134WYO97 Feature 14 S1/2, Block B, N229 E176, L.6 99.8-99.7 m

Figure Key

U=uncharred

C=charred

Light Fraction

Scientific Name	Common Name	Part	Whole U	Whole C	Frag U	Frag C	Comment
No Floral remains							
Polygonum convolulus	wild buckwheat	seed		1			Labeled PC 134
Chenopodiaceae/Amaranthaceae	Cheno-am, pigweed, goosefoot	seed		1		2	Labeled CA 134
Non-floral remains							
None recovered							

Charcoal

4mm	Scientific Name	Common Name
85%	Populus/Salix	cottonwood/willow
15%	Pinus sp.	pine

2mm	Scientific Name	Common Name
90%	Populus/Salix	cottonwood/willow
10%	Pinus sp.	Pine

APPENDIX E

STRATIGRAPHIC POLLEN ANALYSIS AT GOFF CREEK (48PA325), NORTHWESTERN WYOMING

By

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Paleo Research Labs Technical Report 96-82

Prepared For

Wyoming Division of Cultural Resources
Laramie, Wyoming

February 1997

INTRODUCTION

Goff Creek (48PA325) is located at an elevation of approximately 6400 feet in the Shoshone National Forest in Park County, northwest Wyoming. Thirty-seven stratigraphic pollen samples were examined to provide paleoenvironmental interpretations between approximately 6,000 BP and the present. The base of this record may represent a Paleoindian deposition; however, sediment accumulation between this level and approximately 6,000 BP was minimal or perhaps removed.

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. Zinc bromide (density 2.1) was used for the flotation process. The samples were mixed with zinc bromide and centrifuged at 1500 rpm for 10 minutes to separate organic from inorganic remains. The supernatant containing pollen and organic remains is decanted and diluted. Zinc bromide is again added to the inorganic fraction to repeat the separation process. After rinsing the pollen-rich organic fraction obtained by this separation, all samples received a short (20 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 50 to 300 pollen grains at a magnification of 400-600x. Pollen preservation in these samples varied from very good to poor. Comparative reference material collected at the Intermountain Herbarium at Utah State University and the University of Colorado Herbarium was used to identify the pollen to the family, genus, and species level, where possible.

Pollen aggregates were recorded during identification of the pollen. Aggregates are clumps of a single type of pollen, and may be interpreted to represent pollen dispersal over short distances, or the introduction of portions of the plant represented into an archaeological setting. Aggregates were included in the pollen counts as single grains, as is customary. The presence of aggregates is noted by an "A" next to the pollen frequency on the pollen diagram.

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

An estimated relative charcoal value was assigned to each sample based on the total quantity of apparently burned organic debris in the samples. It should be stressed that these values are estimated and do not reflect charcoal counts.

VEGETATION

The Goff Creek site is located in the upper Shoshone Valley where three types of steppe communities occur along terraces and adjacent slopes of the river. A vegetation survey in this area lists vegetation within numerous vegetation communities in the region, including steppe communities along the terraces (Keith Duholm, personal communication, 1988). Relevant vegetation is discussed below. While these descriptions list typical plants, much variation was noted within each vegetation community.

Wyoming Sagebrush Steppe

Wyoming sagebrush steppe is noted at lower elevations and has approximately 20% cover. Wyoming big sagebrush (Artemisia tridentata spp. Wyomingensis) is dominant, although rabbitbrush (Chrysothamnus nauseosus and C. viscidiflorus) also were noted. Although eight species of grass grow in the area, only three are abundant and include needle-and-thread (Stipa comata), bluebunch wheatgrass (Agropyron spicatum), and thickspike wheatgrass (A. dasystachyum). Nearby slopes support bluebunch wheatgrass and Sandberg's bluegrass (Poa sandbergii). Notable forbs include pussytoes (Antennaria microphylla), Hoods phlox (Phlox Hoodii), plains prickly pear (Opuntia polyacantha), Hooker's sandwort (Arenaria hookeri), and milkvetch (Astragalus miser).

Montane Sagebrush Steppe

The Montane sagebrush steppe occurs on both terraces and slopes in the central and western portions of the project area. This vegetation community is noted at higher elevations than the Wyoming sagebrush steppe. Total cover varies from 35 to over 80%, due largely to more dense grass cover. Shrubs include montane big sagebrush (Artemisia tridentata spp. vaseyana) and wax currant (Ribes cereum). Grasses are dominated by Idaho fescue (Festuca idahoensis). Other grasses include Sandberg's bluegrass and blue bunch wheatgrass. Local forbs include pussytoes, Hood's phlox, lupine (Lupinus argenteus), stoneseed (Lithospermum ruderale), western aster (Aster occidentalis), wild buckwheat (Eriogonum umbellatum), cut-leaf fleabane (Erigeron compositus), and toadflax (Comandra umbellata). Balsamroot (Balsamorhiza sagittata) occurs rarely on the adjacent slopes.

Greasewood Flats

The Greasewood Flats steppe community is limited to the T2 terrace along the river. Vegetation cover averages 20%. Greasewood (Sarcobatus vermiculatus), rubber rabbitbrush (Chrysothamnus nauseosus), and big sagebrush constitute the shrubs. Grasses include mutton grass (Poa fendleriana), alkali grass (Puccinellia nuttalliana) and Great Basin wildrye (Elymus cinereus). Western wheatgrass (Agropyron smithii) also was present. Forbs included plains prickly pear, pussytoes, western aster, narrowleaf Indian paintbrush (Castilleja angustifolia), toadflax, and fleabane (Erigeron pumilus), lupine, and wild rose (Rosa acicularis).

Gravel Strand

The Gravel Strand Community occurs along the North Fork and tributary streams, especially Sweetwater Creek. Sparse vegetation along the gravels and sands is influenced strongly by stream flooding. Thickets of Coyote willow (Salix exigua) along with narrowleaf cottonwood (Populus angustifolia) grow in finer soils and less frequently flooded areas. Open areas support willowherb (Epilobium sp.), wild licorice (Glycyrrhiza lepidota), yarrow (Achillea millefolium), Aster campestris, Sagina saginoides, Arnica sororia, and horsetails or scouring rushes (Equisetum arvense and E. laevigatum), and a small sagewort (Artemisia michauxiana). Introduced taxa include hay, red clover (Trifolium pratense), alfalfa (Medicago sativa), timothy (Phleum pratense), smooth brome (Bromus inermis), and sweetclover (Melilotus officinalis). Other introduced weeds include Canada thistle (Cirsium arvense), Canada bluegrass (Poa compressa), and redtop (Agrostis stolonifera).

Shrub Carr

Shrub Carr, which grows on wet soils with a fine texture near streams, is dominated by thick stands of willows (Salix lutea) and a few other shrubs such as red-osier dogwood (Cornus stolonifera) and water birch (Betula occidentalis). Tall forbs include burning nettle (Urtica divica), avens (Geum macrophyllum), cow parsnip (Heracleum sphondylium), Canada goldenrod (Solidago canadensis), geranium (Geranium richardsonii), Aster foliaceus, and a tall willowherb (Epilobium ciliatum).

Gallery Forest

Sandy and silty sediments near the river and gravelly sediments upstream support the Gallery Forest community. Scattered narrowleaf cottonwood dot this generally open community. Juneberry (Amelanchier alvifolia) sometimes forms thickets and may be associated with wild roses (Rosa acicularis and R. woodsii), snowberry (Symphoricarpos alba), and silverberry (Elaeagnus commutata). Balsam poplar (Populus balsamifera) may replace narrowleaf cottonwood, and buffaloberry (Shepherdia canadensis) often forms thickets with silverberry (Eleagnus sp.). Virgin's bower (Clematis columbiana), a vine, may occur with these shrubs. Grasses noted in this community include Kentucky bluegrass (Poa pratensis, introduced), needle-and-thread, western wheatgrass, and smooth brome. Scattered forbs include false Solomon's seal (Smilacina stellata), lupine (Lupinus argenteus), Missouri goldenrod (Solidago missouriensis), narrowleaf Indian paintbrush), nodding wild onion (Allium cernuum), and milkvetch (Astragalus alpinus). Regions farthest upstream support plants similar to those noted in the Shrub Carr, as well as and fleabane (Erigeron subtrinervis).

Douglas Fir Terrace Woodland

Douglas Fir Terrace Woodland is confined to mostly fine soils with some rocks along the river. Open to nearly closed stands of Douglas fir (Pseudotsuga menziesii) dominate this zone. Occasional limber pine (Pinus contorta), Rocky Mountain juniper (Juniperus scopulorum), and quaking aspen saplings (Populus tremuloides). Snowberry shrubs are common. Slender wheatgrass (Agropyron trachycaulum) is the only abundant grass. Common forbs include false Solomon's seal, wild geranium (Geranium viscassissimum), and fairy bells (Disporum trachycarpum). Occasional forbs include Oregon grape (Mahonia repens), showy fleabane (Erigeron speciosus), wild strawberry (Fragaria virginiana), wild avens, a large senecio (Senecio triangularis), horsetail (Equisetum arvense), and baneberry (Actaea rubra).

Douglas Fir Forest

North-facing slopes south of the river support a Douglas fir forest with a nearly closed canopy and a dense ground cover of needle duff. Few ground cover plants grow in this area. Grasses include scattered blue bunch wheatgrass (Agropyron spicatum), western grass (Leucopoa kingii), a native bromegrass (Bromus inermis var. Pupurscens), and mountain ricegrass (Oryzopsis micrantha). Wolfberry (Symphoricarpos oreophilus) is the most common shrub, and current (Ribes sp.), raspberry Rubus idaeus), Oregon grape, ground or common juniper (Juniperus communis), and rose (Rosa acicularis) are present occasionally. Forbs include pussytoes, toadflax, milkvetch, blue-eyed Mary (Collinsia parviflora), wild strawberry, and an aster (Aster peregrinus).

Subalpine Terrace Woodland

Douglas Fir Woodland is replaced by Subalpine Terrace Woodland in and along upper portions of the river. A closed canopy of Engelmann spruce (Picea engelmannii), subalpine fir (Abies lasiocarpa), and lodgepole pine may be interspersed with small meadows. Shrubs include common juniper, snowberry, Wood's rice, buffaloberry (Shepherdia canadensis), and honeysuckle (Lonicera involucrata). Water birch is confined to moist areas. Low shrubs include bearberry (Arctostaphylos uva-ursi), Oregon grape, twinflower (Linnaea borealis) and pyrola (Pyrola chlorantha). A variety of forbs grow in the meadows and include lupine, fireweed (Epilobium angustifolium), meadow rue (Thalictrum venulosum), monkshood (Aconitum columnbianum), goldenrod (Solidago multiradiata), Indian paintbrush (Castilleja miniata), Harebell (Campanula rotundifolia), Jacob's ladder (Polemonium pulcherrimum), geranium, avens, burning nettle, and false dandelion (Agoseris aurantiaca). Grasses are sparse and are limited to smooth brome and haregrass (Agrostis scabra).

Sedge Meadow

Sedge Meadow occurs rarely and is dominated by sedge (Carex sp.). Foxtail barley (Hordeum jubatum) and Great Basin wild rye (Elymus cinereus) occur occasionally. Scattered forbs include cinquefoil (Potentilla gracilis), water hemlock (Cicuta douglasii), and Canada milkvetch (Astragalus canadensis).

DISCUSSION

Thirty-seven stratigraphic pollen samples were examined from a stratigraphic profile at the Goff Site (48PA325). A persistent gravel lens in the lower portion of the profile appeared to represent a single flood event and was not sampled for pollen. Stratum associations were defined in the field.

In addition to cataloging pollen and spores present in these samples, relative quantities of charcoal were estimated for each sample. These quantities varied from approximately 5% in the surface sample to approximately 50% in some of the subsurface samples. The low frequencies of apparently burned material in the upper samples may reflect fire suppression activities in the historic period.

Sample 37, collected from 0-5 cm (Table 1), represents the modern vegetation. The fact that this sample is dominated by Pinus pollen (Figure 1, Table 2) is consistent with described local vegetation. Small quantities of Juniperus, Abies, Picea, Pseudotsuga, and Salix pollen represent other local trees in the vicinity of the site. Shrubs, forbs, and grasses also were evident in the pollen record and are represented by moderate quantities of Artemisia and Poaceae pollen and small quantities of High-spine Asteraceae, Cheno-am, Cyperaceae, Ephedra nevadensis-type, cf. Polygonum, and scabrate Rosaceae pollen.

The base of the stratigraphic record, Stratum IIb (Bt), is estimated to be of Cody age, based on recovery of artifacts. This stratum exhibits a pollen record dominated by Pinus pollen with a moderate quantity of Liguliflorae pollen and very little Artemisia pollen. Poaceae pollen is nearly absent, being recorded only in sample 1 from the base of the record. Small quantities of Juniperus, Picea, Pseudotsuga, Low-spine and High-spine Asteraceae, Cheno-ams, Sarcobatus, Cyperaceae, and Shepherdia define other local vegetation. Many of the pollen types are accompanied by aggregates, indicating that much of the pollen represents local vegetation. Recovery of a few starch granules indicates the deterioration of grass seeds and/or starchy roots/tubers. Selaginella densa spores indicate the presence of little club moss, which grows on exposed rocks. The estimated relative charcoal frequency indicates the likelihood of forest fires with some regularity. Low pollen concentrations are consistent with the depth and age of these samples. Overall, the pollen signature from the paleoindian period is consistent with presence of pines, Douglas fir, and Liguliflorae, with minor amounts of other trees, shrubs, forbs, and grasses. Recovery of a moderately large quantity of Liguliflorae pollen is consist with relatively moist sediments. The small amount of Artemisia pollen may represent a small quantity of local sagebrush or regional presence of a steppe-type vegetation.

Stratum S-IIa yielded an estimated age of 6,000 BP for sample 5. This indicates either an extremely slow deposition between the paleoindian interval or removal of sediments between the paleoindian period and approximately 6,000 BP. Stratum IIa exhibits a pollen signature somewhat different from that in the paleoindian period. The Pinus pollen frequencies are erratic, but still elevated, while the Liguliflorae pollen frequencies are larger. The Artemisia pollen frequency is still relatively small, but increasing, while the Poaceae pollen frequency remains small. Both pollen types are accompanied by aggregates, indicating that sagebrush and grasses were part of the local vegetation. Shepherdia pollen is noted to increase slightly and was accompanied by aggregates, indicating that buffaloberry shrubs were part of the local vegetation. Small quantities of Acer, Juniperus, Pseudotsuga, High-spine Asteraceae, Opuntia, Cheno-ams, Poaceae, and Phlox-type pollen represent other local trees, shrubs, and forbs. The continued presence of Selaginella densa spores indicates that little club moss is still present on rocks. A few obviously redeposited pollen grains are noted indicating decomposition of underlying bedrock. The estimated relative charcoal frequency remains moderate. The total pollen concentration remains relatively low in these samples. During Stratum IIa quantities of pine appear to fluctuate. Douglas fir becomes slightly more abundant toward the end of this stratum. Liguliflorae still appears to be the dominant ground cover, indicating relatively wet ground.

Stratum III exhibits a pollen record markedly different from Stratum IIa and IIb. A radiocarbon age of 5200 BP is associated with sample 7. The base of this stratum bears some similarities in content to Stratum IIa. Sample 8 (160-165 cm) appears to represent the transition between the established paleoenvironmental conditions and new conditions. This sample exhibits pollen from several trees, including Alnus and Betula-type, which are not represented in lower samples. In general, Pinus pollen frequencies are smaller in the upper samples, with the exception of sample 12, the uppermost sample of this stratum. Liguliflorae pollen is elevated in most of these samples, and Artemisia pollen remains only slightly elevated. Recovery of aggregates of both pollen types indicates that both sagebrush and a dandelion-type composite were members of the local vegetation. Poaceae pollen increases dramatically, and aggregates were recorded, indicating an increase in the local grass population after 5200 BP. Small quantities of Alnus, Betula-type, Picea, Pseudotsuga, Salix Low-spine and High-spine Asteraceae, Brassicaceae, Opuntia, Caryophyllaceae, Cheno-am, and Shepherdia represent other local trees, shrubs, and forbs noted in Stratum III. Recovery of Alnus aggregates in samples 8 and 11 indicates that these trees grew relatively close to the area sampled. Recovery of larger quantities of Liguliflorae pollen accompanied by Alnus and Betula-type pollen indicates very wet soil conditions. The estimated relative charcoal increases in these samples, suggesting that fires became more numerous. This interpretation is consistent with the severe reduction in Pinus and reduction in Pseudotsuga pollen and increase in both Liguliflorae and Poaceae pollen, the latter two of which are typical components of meadows. Total pollen concentration was lowest in the lower portion of Stratum III. Stratum III appears to represent a period of forest fires and relatively open vegetation habitats.

A persistent gravel lens approximately 15 cm thick is noted between Strata III and V, providing a break in continuity in the pollen record. This stratum might represent a single depositional event.

The base of Stratum Va displays significantly different characteristics than the top of Stratum III. Artemisia pollen frequencies are suddenly elevated, while Liguliflorae pollen frequencies are depressed, although both pollen types continue to be accompanied by aggregates. This appears to represent colonization of meadows by sagebrush, thus increasing the relative quantities of sagebrush to grasses and members of the composite family similar to dandelion (Liguliflorae). This signature also is consistent with drying of the meadow sediments. These conditions continue from sample 13 through sample 16, which are associated with a radiocarbon age of approximately 4000 BP. The Poaceae pollen frequencies are similar to those noted at the top of Stratum III, indicating a continuation of the grass population. In these samples small quantities of Betulaceae, Alnus, Juniperus, Picea, and Pseudotsuga pollen, as well as the moderate quantity of Pinus pollen, document local trees. Small quantities of High-spine Asteraceae, Campanulaceae, Caryophyllaceae, Cheno-ams, Ephedra nevadensis-type, Eriogonum, and Shepherdia pollen represent local forbs and shrubs. Starch granules continue to be present and monolete spores increase, indicating an increase in the local fern population. Selaginella densa spores become less frequent, suggesting that little club moss became less abundant. The estimated relative charcoal frequencies drop slightly at the base of Stratum Va, increasing toward the middle of the stratum, indicating a slight reduction, then an increase in fire levels to approximately those noted in Stratum III. The forests appear to be recovering, in the lower portion of Stratum Va, as is evidenced by the slight increase in Pinus pollen frequencies in these samples compared to most of the Pinus pollen frequencies noted in Stratum III. This portion of the record indicates the establishment of a significant population of sagebrush in the vicinity of the site and might reflect the presence of a steppe vegetation community.

Samples 17 to 21 display elevated Liguliflorae, moderate Artemisia, and relatively low Pinus pollen frequencies. This corresponds to the interval of increased estimated relative charcoal counts. In addition, the Poaceae pollen frequencies drop toward the end of this interval. This pattern is consistent with the continuation of fires and an increase in soil moisture. Samples 22 and 23 display increased Pinus and Pseudotsuga pollen frequencies accompanied by a decrease in the estimated relative charcoal frequency, which suggests recovery of local woodlands and fewer fires. Recovery of Pseudotsuga aggregates suggests that Douglas fir was at its maximum in the time period represented by samples 22 and 23. Samples 24-26, representing the upper portion of this stratum exhibit changes in pollen frequencies, as well as total pollen concentration. The upper portion of Stratum Va is described as a pedogenic A-horizon. This interval appears to have been one of soil stability with respect to the increasing pollen concentration toward the upper surface of Stratum Va. Tree cover appears to have been sparser and ground cover included primarily Liguliflorae and grasses, which are typical in wet areas. Artemisia pollen frequencies decline, which is compatible with the interpretation of wetter sediments. Small quantities of Caryophyllaceae, Cheno-am, Cyperaceae, Lonicera-type, Polemonium-type, Eriogonum, cf. Polygonum, Shepherdia, and cf. Valeriana pollen represent local forbs and shrubs, most of which grow well in relatively mesic habitats. The small quantity of Ephedra pollen may reflect regional shrubs Ferns remain a part of the local vegetation, as evidenced by the recovery of monolete spores and trilete spores, which are noted more regularly throughout Stratum Va. Selaginella densa spores are noted, but only in small quantities. Stratum Va appears to represent an interval of forest fires, the establishment of a significant sagebrush population, which dwindled through time, and the re-establishment of large quantities of Liguliflorae-type composites in a relatively wet meadow that included grasses and other plants. The incidence of fire appears to have decreased in the upper portion of this stratum.

Stratum VIb, an A-horizon, is poorly defined in the area in which this stratigraphic column was collected. A radiocarbon age of 2600 BP is associated with this horizon. The pollen signature is characterized by a moderately low Pinus pollen frequency, a low Artemisia pollen frequency, and a moderately high Liguliflorae pollen frequency. The Poaceae pollen frequency also is moderate. Small quantities of Alnus, Juniperus, and Pseudotsuga pollen indicate local trees. Small frequencies of Low-spine and High-spine Asteraceae, Coryphantha-type, Caryophyllaceae, Cyperaceae, Ephedra nevadensis-type, Lonicera-type, Eriogonum, Shepherdia, and cf. Valeriana pollen represent local and/or regional forbs and shrubs. Continued presence of Artemisia, Liguliflorae, and Poaceae aggregates indicate that sagebrush, a dandelion-type composite, and grasses were part of the local vegetation. Ferns continue to be present in the local vegetation, since monolete spores were recovered. The estimated relative charcoal frequency was moderate in samples from Stratum VIb, suggesting moderate fire frequency. A relatively open vegetation community dominated by Liguliflorae-type composites and including grasses is suggested by this record. Conifers comprised the dominant woodland trees, although alder also was present.

Stratum VII includes the upper 45 cm of sediment. The lowermost sample (28) is very similar in pollen content and total pollen concentration to sample 27, which suggests that the conditions prevailing during the formation of the A-horizon may have lasted into the lower portion of this stratum. Two basic patterns are visible in Stratum VII above sample 28. Samples 29 and 30 exhibit elevated Pinus pollen frequencies accompanied by severely depressed Liguliflorae pollen frequencies. The Artemisia and Poaceae pollen frequencies continue at low to moderate levels. Small quantities of Alnus, Juniperus, Picea, and elevated Pseudotsuga frequencies complete the record of trees present in the area. Small quantities of High-spine Asteraceae, Cheno-am, and Cyperaceae pollen represent local forbs and possibly shrubs. Ferns continue to be part of the local vegetation. The estimated relative charcoal frequency declines in these samples and the total pollen concentration is relatively low. This appears to be an interval affected by drying and experiencing fewer forest fires. The pine population rebounded, resulting in a more closed canopy vegetation community. The Liguliflorae-type composites no longer provided the dominant ground cover, but gave way to grasses. This suggests a drying of the sediments.

The upper eight samples did not receive Lycopodium tablets, so pollen concentration values are not available for samples above 40 cm. This appears to be a time of transition between a woodland with interspersed wet meadow and a steppe vegetation community. The upper portion of Stratum VII (samples 31-37) are characterized by moderate Pinus pollen frequencies and moderate to moderately large Artemisia pollen frequencies. The quantity of Liguliflorae pollen declines throughout this zone, as does High-spine Asteraceae pollen. Poaceae pollen frequencies are at their highest values, indicating that grasses are most abundant in this relatively recent interval. The estimated relative charcoal frequencies increase in the lower portion of this interval, then drop off in sample 35, which may represent modern fire suppression activities. Small quantities of Alnus, Juniperus, Abies, Picea, Pseudotsuga, and Salix pollen represent other local trees. Small frequencies of Apiaceae, Low-spine Asteraceae, Caryophyllaceae, Cheno-am, Sarcobatus, Cyperaceae, Ephedra nevadensis-type, Phlox-type, cf. Polygonum, Eriogonum, Ranunculaceae, Rhus, scabrate Rosaceae, and Shepherdia pollen represent other local forbs and shrubs. The steppe vegetation communities have become dominant in the immediate vicinity of the site, as they are today.

The fungal spore, Sporormiella, represents a dung fungus that becomes more abundant in historic period sediments following the historic introduction of grazing animals. Its increasing presence in historic samples has been noted in numerous palynological studies (Davis, 1987).

Sporormiella fungal spores are not confined to the dung of introduced grazers, but also occur in dung from moose, wild sheep, deer, elk, caribou, and rabbits. The increase of Sporormiella spores in historic sediments may relate to changing land use patterns and increase in the length of time that herds of animals occupy any given area. Sporormiella spores are observed in samples at depths of 5-10 and 20-25 cm in depth, indicating the probability that these sediments contain at least some material from modern or historic deposits.

SUMMARY AND CONCLUSIONS

The stratigraphic pollen record at site 48PA325 is a dynamic representation of vegetation change between the paleoindian occupation and present. Stratum IV, not represented in the pollen record, probably represents a very short hiatus of undetermined age, possibly a single event. The pollen record at the top of Stratum III and the bottom of Stratum Va exhibit significant differences that suggest a longer hiatus. Sagebrush is well established on the terrace at the beginning of Stratum Va, indicating a major change in vegetation.

Major visible elements of vegetation change in the pollen record revolve around Pinus, Pseudotsuga, Artemisia, Liguliflorae, and Poaceae pollen. Pines appear to have been most abundant during the paleoindian interval and prior to approximately 5000 BP. Pinus pollen frequencies reach these levels again only at the base of Stratum VII and in the modern sample. Pseudotsuga pollen frequencies often display movement in the same direction as Pinus pollen, indicating that the wooded areas have supported both pine and Douglas fir since the Cody occupation. At times when pines were abundant, sagebrush was far less abundant than it is today. Sagebrush appears to have been a common element of the vegetation in open areas when pines were more sparse beginning between 5000 BP and 4000 BP and continuing to the present. Liguliflorae-type composites appear to have been the dominant ground cover prior to Stratum IV. Grasses did not become a significant element of the meadow vegetation until after 5200 BP. Liguliflorae-type composites persisted as a major element of the local meadow vegetation until approximately the Neoglacial in the upper portion of Stratum Va. Conditions appear to have become noticably drier near the beginning of Stratum VII, which resulted in a significant decline in the Liguliflorae-type composite population and an increase in sagebrush. Establishment of a sagebrush steppe vegetation community appears to have been relatively recent in this area.

Alder appears to have been part of the local tree population from at least 5000 BP. Juniper appear to have become more numerous in Stratum VII, although increases in Juniperus pollen in relatively recent sediments might reflect better preservation of these younger pollen grains. Spruce appears to be more abundant beginning with Stratum Va than it was previously.

High-spine Asteraceae were more abundant from the base of Stratum Va until fairly recently. Cheno-ams appear to be more abundant in the recent samples than at any time in the past. This probably reflects introduction of new weedy species. Buffaloberry appears to have been a consistent member of the vegetation community in the vicinity of this site. Lonicera (honeysuckle) appears in the pollen record betweeen approximately 4,000 BP and the Neoglacial, then disappears.

Description of modern vegetation communities reflect the modern associations of plants. The pollen record from these stratigraphic sediments indicates that at least some of these associations are relatively recent. Liguliflorae pollen is interpreted to be a good indicator of soil moisture, since members of this group of plants often grow in moist to soggy ground along streams and in wet meadows. In general, fluctuations in Liguliflorae pollen are counter to those of Artemisia pollen. Sagebrush is expected as a component of drier vegetation communities and is an indicator of the modern steppe vegetation communities. The driest intervals occur at the base of Stratum Va, approximately 4000 BP and throughout most of Stratum VII.

The quantity of arboreal pollen is an indicator of the fluctuating density and openness of the woodland with its accompanying meadows or steppe vegetation. The abrupt changes in frequencies of Pinus and Liguliflorae pollen in the lower samples may reflect intermittent deposition and fluctuating vegetation communities between the Cody occupation and approximately 5200 BP. This portion of the pollen record appears truncated when compared with the much longer sequence from 5200 BP to the present.

TABLE 1
PROVENIENCE DATA FOR SAMPLES FROM SITE

Sample No.	Depth (in cm bpgs)	New Stratum	Sediment/Level Description	Date (BP)	Pollen Counted
37	0-5	VII	Very dark grayish brown, bedded, discontinuous wavy nonparallel slightly pebbly silty very fine sand (SVIIa), slope wash, to sandy very fine pebbly (SVIIb), debris flow		301
36	5-10	VII			301
35	10-15	VII			301
34	15-20	VII			301
33	20-25	VII			201
32	25-30	VII			102
31	30-35	VII			101
30	35-40	VII			101
29	40-45	VII			76
28	45-50	VII			202
27	50-55	VII			201
26	55-60	VIb	A horizon, Black, massive, anthropogenically influenced, slightly pebbly sandy silt loess enriched slope wash	2600	201
25	60-65	Va	Dark brown, massive, slightly pebbly silty fine sand, alluvial fan distributary channel overbank		201
24	65-70	Va			201
23	70-75	Va			101
22	75-80	Va		4070 $\pm$ 70	101
21	80-85	Va			201
20	85-90	Va			201
19	90-95	Va			201
18	95-100	Va			101
17	100-105	Va			51
16	105-110	Va			101
15	110-115	Va			101
14	115-120	Va			101
13	120-125	Va			101

Sample No.	Depth (in cm bpgs)	New Stratum	Sediment/Level Description	Date (BP)	Pollen Counted
		IVa	Persistent gravel lens Dark grayish brown, single grained, fine pebbly gravel, alluvial fan distributary channel deposit		
12	140-145	III	Brown to very dark grayish brown, discontinuous even parallel bedded, intermittently anthropogenically modified, sandy silt to clayey silt, alluvial fan distributary channel sheet wash overbank deposit		151
11	145-150	III			151
10	150-155	III			101
9	155-160	III			102
8	160-165	III			101
7	165-170	III		5200	151
6	170-175	IIa			201
5	175-180	IIa		6000	201
4	180-185	IIa			201
3	185-190	IIb	Dark brown, massive, slightly pebbly silty very fine sand, bioturbated slope wash		211
2	190-195	IIb		Cody	109
1	195-200	IIb			201

TABLE 2
POLLEN TYPES OBSERVED IN SAMPLES FROM SITE 48PA325

Scientific Name	Common Name
ARBOREAL POLLEN:	
Acer	Maple
Betulaceae	Birch family
Alnus	Alder
Betula-type	Birch
Juniperus	Juniper
Pinaceae	Pine family
Abies	Fir
Picea	Spruce
Pinus	Pine
Pseudotsuga	Douglas fir
Quercus	Oak
Salix	Willow
NON-ARBOREAL POLLEN:	
Apiaceae	Parsley/carrot family
Asteraceae:	Sunflower family
Artemisia	Sagebrush
Low-spine	Includes ragweed, cocklebur, etc.
High-spine	Includes aster, rabbitbrush, snakeweed, sunflower, etc.
Liguliflorae	Includes dandelion and chicory
Brassicaceae	Mustard family
Cactaceae	Cactus family
Coryphantha	Pin cushion cactus
Opuntia	Prickly pear cactus
Campanulaceae	Blue bell family
Caryophyllaceae	Pink family
Cheno-am	Includes amaranth and pigweed family

Sarcobatus	Greasewood
Cyperaceae	Sedge family
Ephedra nevadensis-type	Mormon tea
Ephedra torreyena-type	Mormon tea
Lonicera	Honeysuckle
Onagraceae	Evening primrose family
Poaceae	Grass family
Polemoniaceae	Phlox family
Phlox-type	Phlox
Polemonium-type	Jacob's ladder
Polygonaceae	Knotweed/smartweed family
Eriogonum	Wild buckwheat
Polygonum	Knotweed
Ranunculaceae	Buttercup family
Rhus trilobata-type	Squawberry
Rosaceae	Rose family
Rosaceae (striate)	Rose family including Prunus (chokecherry, plum), Potentilla, and others
Shepherdia	Buffaloberry
Valeriana	Valerian
Indeterminate	Too deteriorated to identify
SPORES:	
Monolete	Fern spore
Selaginella densa	Little clubmoss
Trilete	Fern spore
Trilete Polypodiaceae-type	Polypodiaceae family of ferns
Sporormiella	Dung fungus

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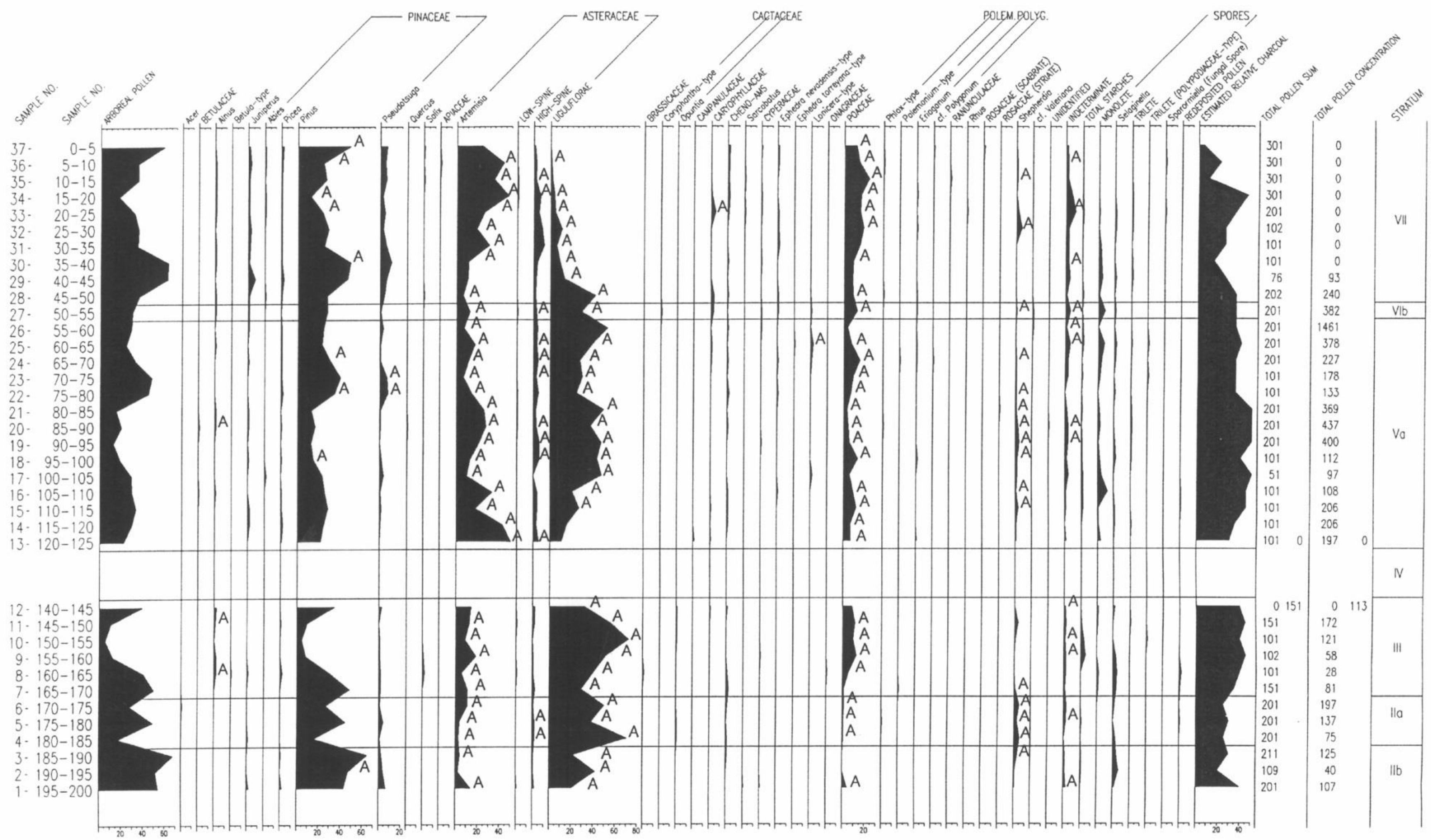

FIGURE 1. POLLEN DIAGRAM FOR SEDIMENT COLUMN AT SITE 48PA325.