THESIS

SURFACE LITHIC SCATTERS IN THE CENTRAL ABSAROKAS OF WYOMING

Submitted by

Paul Burnett

Department of Anthropology

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WE HEREBY RECOMMEND THAT THE THESIS PREPARED UNDER OUR SUPERVISION BY PAUL BURNETT ENTITLED: SURFACE LITHIC SCATTERS IN THE CENTRAL ABSAROKAS OF WYOMING BE ACCEPTED AS FULFILLING IN PART REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS.

Committee on Graduate Work

Adviser

Department Head

ABSTRACT OF THESIS

SURFACE LITHIC SCATTERS IN THE CENTRAL ABSAROKAS OF WYOMING

This thesis provides baseline data on the variability of prehistoric lithic scatters documented across surfaces in the central Absaroka Range of northwestern Wyoming. Prehistoric hunter-gatherer behaviors and landscape attributes driving this variability are interpreted, and the dimensions controlling archaeological variability in this montane setting are defined. Themes of behavioral continuity and change are common to researching human systems, and in the Absaroka Range this research is especially relevant for anthropologists and earth scientists studying Holocene change.

A total of 26,478 records of flaked stone data have been documented *in situ* within the montane watersheds of the Upper Greybull and Wood rivers, collectively referred to as the “Upper Greybull” for brevity. To describe the archaeological variability of these data, the periods of prehistoric human occupation are first defined. The method of lithic cross-dating is used on the projectile point sample (n = 224) to establish this sequence of prehistoric occupation. These artifacts were spread across 1050 km^2, and variability in the abundances of projectile points is assumed to roughly reflect the intensity of occupation in the area. The results conform to other montane chronologies in the region, showing that the montane landscapes of the central Rocky Mountains were used maximally during the Late Archaic period (ca. 3000 - 1500 Radiocarbon Years Before Present [RCBP]), and that this land use was sustained but may have been slightly lower during the Late Prehistoric period (ca. 1500 – 250 RCBP). Land use earlier in the Holocene is evident, but it appears to have more than doubled during the Late Archaic.

Artifact diversity associated with the diagnostic projectile points reflects some of the behavioral diversity of the hunter-gatherers that lived in this ecosystem. A GIS is used to create artifact clusters that are compared in terms of three variables: size (number of artifacts), toolstone variability, and artifact type variability. While small clusters are by far the most populous, assemblages of all sizes occur in all elevations of the Upper Greybull. Large high elevation clusters were produced at toolstone procurement

workshops, whereas large clusters in the low and middle montane elevations were made during residential camping activities.

To compare the variability in toolstone and artifact types in these assemblages, two indices are developed: the Toolstone Variability Index (TVI) and the Artifact Type Variability Index (AVI). These indices provide useful structure for the comparison of artifact assemblages not only in the Upper Greybull, but from any sample of assemblages with artifact type and toolstone data. Upper Greybull clusters exhibit a wide range of sizes and TVI and AVI values, but there is a tendency for clusters to have similar characteristics rather than each cluster being unique. This similarity reflects patterned settlement and subsistence behavior in response to topography and resource availability.

Variability in cluster toolstone proportions are largely conditioned by proximity to source areas. The nearest obsidian sources are on the western side of the Greater Yellowstone Ecosystem (GYE), and its presence in the Upper Greybull on the eastern side of the GYE indicates that hunter-gatherer mobility patterns of the GYE included seasonally-patterned east-west intermontane travel in the course of a year. Most obsidian is associated with late Holocene time periods (post-3000 RCBP), indicating that patterned intermontane mobility regimes may not have been as common in the early Holocene as they were later.

Cluster artifact type proportions vary widely across the Upper Greybull. Both typical and atypical artifact type proportions are found throughout the sampled space. In the lower elevations (below ca. 2800 masl), projectile points are atypically abundant. These are the product of retooling activities conducted at residential camps. Artifact type proportions are more variable in clusters not containing projectile points, and the majority of these clusters reflect task-specific non-residential activities.

Changing projectile point abundance and obsidian content indicates that the intensity of hunter-gatherer land use involving intermontane travel across the GYE increased after 3000 RCBP, and perhaps as early as 5000 RCBP, but reasons for this increased travel are unclear. Although regional mobility appears to have changed through time, artifact type proportions remained relatively unchanging in the Upper Greybull. This reflects low diachronic variability in local hunter-gatherer behaviors through time, amidst changes in regional mobility patterns. The intensity of land use changed through time, but similar behaviors were employed when hunter-gatherers used the Upper Greybull landscape. This synthesis of surface lithic scatters in the Upper Greybull is proof that meaningful interpretations of prehistoric behavior can be drawn from an individual artifact-based approach to surface archaeological documentation.

Paul Burnett
Anthropology Department
Colorado State University
Fort Collins, CO 80523
Summer 2005

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CHAPTER 1: INTRODUCTION

In 2002, Dr. Lawrence C. Todd of the Department of Anthropology at Colorado State University initiated field research around the Upper Greybull River, along the eastern flank of the central Absaroka Range in northwestern Wyoming (Figure 1.1). By the end of 2004, this research generated 26,478 lines of newly recorded individual flaked stone artifact data. Only seven previously recorded prehistoric localities are in the surveyed area. No artifacts were relocated at one site (48PA87). Artifacts were located at one small previously recorded site (48PA49), but they were not documented because of time constraints. Artifacts were newly documented at the other five previously recorded prehistoric sites (Appendix A, Table A.1). Compared to these seven previously identified localities, the amount of newly documented material is astonishing. A total of 128 prehistoric localities were newly identified, as well as 29 isolated artifacts (Appendix A, Table A.1). From the dearth of previously recorded sites, it hardly needs to be noted that the prehistory of the area is poorly understood.

Surface lithic scatters are defined as assemblages of flaked stone artifacts, located at least partially on the Earth's surface, that are occasionally accented by other archaeological material, such as hearths, fire-altered rock, groundstone, soapstone, and bone. While the ultimate goal of this research is to synthesize data on the Upper Greybull lithic scatters to interpret diachronic changes in montane hunter-gatherer land use, the flaked stone database (26,478 entries) is analyzed to address two proximate research topics: chronology and assemblage variability. First, little is known of the chronology and intensity of Holocene occupation in the Upper Greybull specifically or the Absarokas in general. To address this problem, an archaeological chronology is built by lithic cross-dating projectile points documented in the Upper Greybull with those documented in sites around the region. Relative abundances of these points are used to approximate the changing intensity of land use through time.

The second research problem is that the variability of surface lithic scatters in the central Absarokas is unknown, and as a result, inferred patterns of prehistoric land use in this high country are largely conjectural. A unique, simple method of artifact clustering using coordinated GPS/GIS

(Geographic Positioning System/Geographic Information System) technology is used to systematically cluster artifact assemblages in the Upper Greybull. Then, three aspects of cluster variability are described: assemblage size, toolstone (i.e., lithic raw material) abundance, and morphological artifact type abundance. The artifact clusters are compared across space and through time (i.e., chronology of occupations), and interpretations of the chronology of hunter-gatherer land use are offered that are based on the variability evident in these surface lithic scatters.

This chapter provides an ecological and paleoecological overview of the project area, and establishes the theoretical and hypothetical underpinnings of this approach to surface lithic scatters. In Chapter Two, the chronology of prehistoric occupation in the Upper Greybull is established by cross-dating (when possible) 224 projectile points with those recovered from dated stratigraphic contexts. A review of pertinent regional archaeology is presented for each prehistoric time period, and the Upper Greybull diagnostics are articulated with this context.

In Chapter Three an easy and replicable method of artifact clustering is presented and the diversity of these clusters is described with respect to three variables: assemblage size, toolstone diversity, and artifact type diversity. Most documented artifacts in the Upper Greybull were provenienced with recreational GPS receivers. The accuracy of these receivers is analyzed because it defines the minimum scale appropriate for the interpretation of spatial patterning between artifacts. To group these proveniences into spatial clusters, they are projected in a GIS and a buffer zone is created around every provenience at a set radius (2.5 m). These buffers join when they overlap, and this defines the artifact cluster populations. The cluster data are clipped from the GIS projection and placed into a cluster database for analysis.

In addition to an analysis of cluster sizes in Chapter Three, two newly defined and simple indices are presented as heuristics for interpreting cluster variability. The Toolstone Variability Index (TVI) is used to evaluate the variability in cluster toolstone composition, and the Artifact Type Variability Index (AVI) allows comparison of the degree to which various morphological artifact types are represented in each cluster. Both indices are derived by comparing the composition of the cluster samples with that of the complete artifacts sample from the project area. While the indices are informative with respect to landscape archaeological patterning, when compared among clusters with diagnostic projectile points they expose the structure of assemblage variability through time. Chapter Four includes a summary of the results, interpretations of diachronic changes in prehistoric land use, and suggestions for future research.

Upper Greybull Ecosystem

Evolving for the last 50 million years, the Upper Greybull ecosystem consists of highly complex and interacting abiotic and biotic components. Focusing on geology, soil, climate, flora, fauna, and paleoclimate, a review of this ecosystem will set the stage for the following interpretations of artifact distributions and prehistoric montane hunter-gatherer land use.

Geology and Soil

The Absaroka Range flanks the western edge of the Big Horn Basin in northwestern Wyoming and southwestern Montana. Located on the northwest side of the range is the Yellowstone Plateau. Following the Laramide Orogeny (ca. 70 to 40 million years ago [Knight 1994:11]), the Absaroka Volcanic Province was formed via magmatism initiated by lithospheric extension of two North American mantle plates (Hiza 1999:124, 159). Rapidly rising from the northwest to the southeast between 54 and 43 million years ago, the volcanic province covered 25,000 km^2 (Hiza 1999:11, 35). Repeated magmatism, secondary deposition, and cementation of igneous rocks during the Eocene produced a volcanic plateau comprised largely of igneous intrusions and redeposited igneous material. Subject to 45 million years of erosion and mass wasting, this plateau is a rugged, dissected montane landscape with elevations ranging from 2200 meters above sea level (masl) at the base of the montane Wood River to 4009 masl atop Francs Peak, the highest of the Absarokas (Figure 1.1).

Bedrock geology in the project area is predominantly conglomerates and breccias of the Wiggins Formation with interspersed intrusive igneous rocks – some of which cap the high peaks in the study area (USGS 1994). Intrusive igneous rocks underlie the Wiggins Formation and are exposed in cliffs in the lower reaches of the montane Greybull and adjacent watersheds. A Paleozoic block of limestone and sandstone is located adjacent to one large intrusive igneous body at the top of the North Fork of the Wood River and is known as Dollar Mountain (Figure 1.1). Three main units have been described in this sedimentary block: Tensleep Sandstone/Amsden Formation, Madison Limestone/Darby Formation, and Bighorn Dolomite/Gallatin Limestone/Gros Ventre Formation/Flathead Sandstone (USGS 1994). These units are both chert- and quartzite-bearing, and are discussed with other toolstone in Chapter Three.

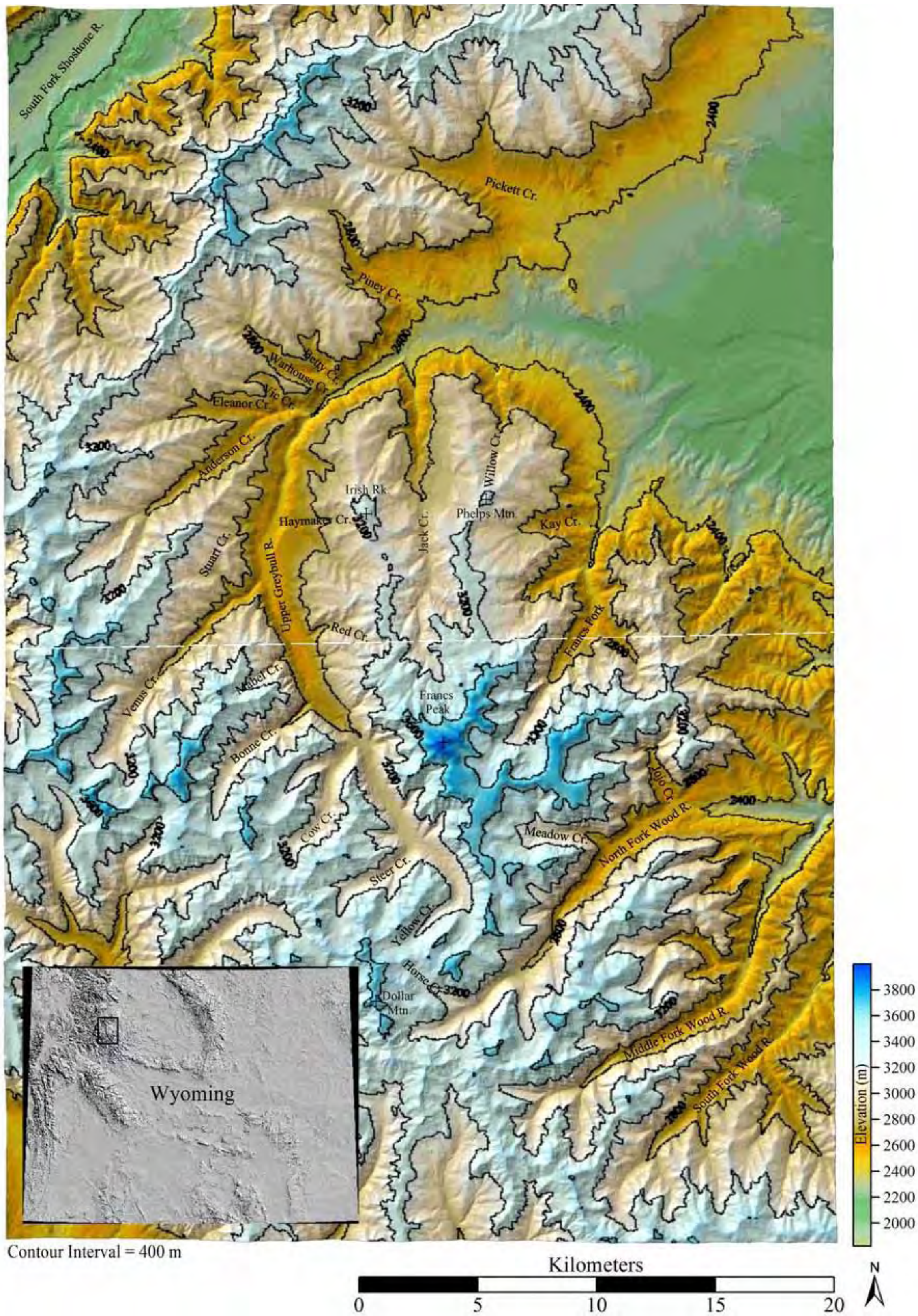


Figure 1.1. Location of project area in the central Absarokas. Exact locations are confidential. Data provided by EROS (1999) and WWRC (1997).

Several alluvial and colluvial deposits that would seemingly be considered surface geological features are of a scale to be considered bedrock features. Most notable are the Quaternary landslide deposits that flank nearly the entire eastern edge of the Absaroka Range (USGS 1994). In our study area, these landslide deposits are located in the lower elevations of the montane Greybull River and adjacent tributaries (i.e., Jack Creek, Piney Creek, and Pickett Creek). Quaternary alluvium and colluvium deposits are located throughout the study area, with the most extensive glacial deposit located below the cirque basins in the North Fork of the Wood River. This deposit stretches for approximately 12 km along the valley floor (USGS 1994). Large glacial deposits stretch over 5.5 km in Upper Venus Creek, and similarly extensive glacial deposits are located in Upper Anderson Creek watersheds. Both of these are major western tributaries of the montane Greybull River (Figure 1.1).

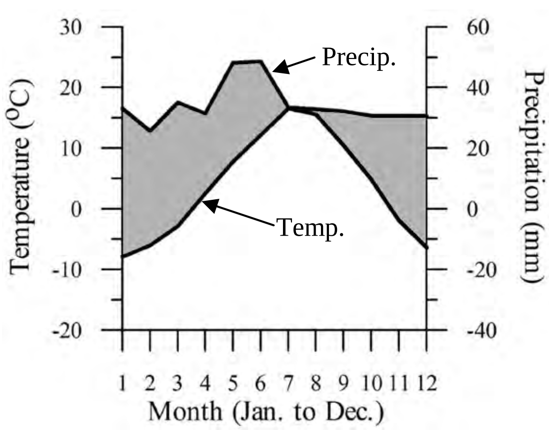
Surface geological data from the area can be summarized into three major categories: exposed bedrock, slopewash and colluvium, and landslides (Case et al. 1998). Highest elevations are dominated by exposed bedrock with interspersed pockets of glacial regolith, colluvium, and alluvium. Surfaces midway down the mountain are dominated by slopewash and colluvium with minor amounts of bedrock, residuum, alluvium, and glacial deposits. Below these slopewashed mountainsides, the surface geology is characterized almost entirely as landslides mixed with minor amounts of slopewash, residuum, Tertiary landslides, and bedrock exposures. As a whole, this surface geology reflects 45 million years of erosion, with high-elevation resistant bedrock giving way to mass wasting features at the lower elevations.

In the rugged Absarokas, soil variability is high and is controlled by climate, biota, relief, parent material, and time (Jenny 1941). Soils of the central study area are typically comprised of thin loams with a high gravel content (i.e., loamy skeletal; Munn and Arneson 1999). These soils occur in topographically-mediated mosaics similar to the patterning observed in the plant communities. On the drier sagebrush and grassland slopes are cold mollisols (Typic Haplocryolls), while relatively dry forested and parkland soils consist of lesser developed alfisols (Typic Haplocryalfs). The alfisols have a thinner organic-rich A-horizon than the mollisols, yet they exhibit signs of age in their pedogenic clay development. Inceptisols are found in moister forest patches (Typic Dystrocryepts), along streams (Histic Cryaquepts), and above 2900 masl under alpine meadows (Humic Dystrocryepts). Lithic Cryorthents co-occur with rock outcrops and consist of unhorizonated shallow soils with a high lithic content (Munn and Arneson 1999).

The shallow nature and high gravel content of many of these soils is of particular archaeological relevance. Although not quantified, it appears that most of the surfaces in the Absaroka uplands are covered with only a thin mantle (under approximately 30 cm) of Holocene sediment, while the lowlands and concave slopes have experienced deeper sedimentation. As the sediments of the uplands slowly churn through the taphonomic processes of the near surface (see below), they expose and bury artifacts. In contrast, the deeper lowland sediments and sediments filling concave slopes have a higher likelihood of preserving stratigraphic contexts below this active near-surface zone.

Climate

The continental climate of the central Absarokas varies greatly with altitude. Modern mean annual temperatures range from -5 ^{o}C in the montane uplands to around 2 ^{o}C in the lower foothills (Curtis and Grimes 2004). The Parameter-Elevation Regressions on Independent Slopes Model (PRISM) predicts that mean annual precipitation (MAP) of the study area varies between 450 and 800 mm with altitude (Daly and Taylor 1998). Annual potential evapotranspiration is estimated to range between 400 mm/yr in the high country and 450 mm/yr in the foothills elevations (Knight 1994:33). From these estimates, it appears that annual precipitation and potential evaporation are relatively equal in the foothills below the montane Absarokas, with water surpluses increasing with elevation. Drought stress is clearly more severe in the Bighorn Basin than it is in the mountains to the west (Figure 1.2).



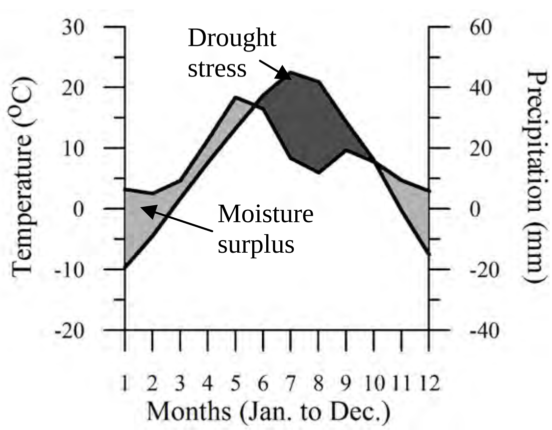


Figure 1.2. Modified Walter-Lieth climate diagrams (Walter and Lieth 1967) for Yellowstone Park (a) northwest of the Upper Greybull (at 1890 masl) and Worland (b) in the Bighorn Basin southeast of the project area (1237 masl). Note the higher drought stress in the Bighorn Basin than in the mountains to the west. Yellowstone Park data are averaged from 98.8 years of data between 1886 and 1987, and Worland data are averaged from 30 years between 1961 to 1990 (Vose et al. 1992).

Seasonality of precipitation in the Greater Yellowstone Ecosystem (GYE) is largely influenced by orography, where the western portions are characterized as winter wet/summer dry and the eastern portions are winter dry/summer wet (Whitlock and Bartlein 1993). This pattern is confounded by elevation, as the high country generally receives a greater percentage of winter precipitation than the lower elevations (Whitlock et al. 1995). Western portions of the GYE are more heavily influenced by Pacific weather patterns, and summer precipitation in the east is driven primarily by monsoons generated in the Gulf of Mexico (Tang and Reiter 1984, cited in Whitlock et westerly storm cells as they are forced above the mountains and cooled.

Prehistoric montane winter camps have been documented in the eastern GYE (see below) and their positioning might be a result of this orographic drying effect and concordant habitability of the eastern montane elevations. The project area is located in the high country on the eastern edge of the montane GYE, and because of this positioning it might have sustained prehistoric lower montane winter residences. The area receives a relatively equal mixture of both winter and summer precipitation compared to areas west to the Snake River plain (winter wet) or immediately east to the Bighorn Basin (winter dry). Given this complex east/west relationship, late Quaternary proxies of precipitation such as pollen data from the montane western GYE (e.g., Whitlock and Bartlein 1993; Whitlock et al. 1995) may not be applicable to patterns in the Upper Greybull area.

Biota

The mosaic of plant communities in the central Absarokas is largely the result topography (Bailey 1998:124-127). Precipitation increases with altitude, and variability in solar radiation, evapotranspiration, and effective moisture is heavily influenced by aspect. These interacting controls (elevation and aspect) cause moister north faces to be dominated by spruce-fir stands at lower montane elevations of the study area, while the south faces at the same elevation are often covered with Mountain Big Sagebrush (*Artemisia tridentata wyomingensis;* Wyoming Gap Analysis 1996a). Given this delicate balance, prolonged oscillations in effective moisture are hypothesized to have caused these communities to continually reorganize; each species responds at its own pace and with concordant time lags in its response to changing nutrient availability (Lauenroth and Sala 1992).

Tree canopy cover increases with elevation and coincident reductions in water stress. Both spruce-fir (predominantly *Picea engelmannii* and *Pseudotsuga menziesii*) and whitebark pine (*Pinus albicaulis*) stands are common at elevations above 2800 masl. Plant communities on the east and west faces are more variable than those on the north and south faces, but alpine meadows interspersed with sagebrush (*Artemisia* spp.) and whitebark pine (*Pinus albicaulis*) are common between 2300 and 3200 masl on the drier slopes with dense spruce-fir and whitebark pine stands on the moister aspects. Above 3200 masl is meadow tundra and exposed bedrock. Periglacial patterned ground (i.e., freeze-thaw polygons) commonly covers slopes above 3300 masl. Nearly all of the archaeological sampling conducted in the Upper Greybull area has been in sub-alpine and alpine meadows, open parklands, and tundra. Areas with dense tree canopy cover are often difficult to traverse and have minimal bare ground exposure, making artifact discovery unlikely. As a result, these areas have been minimally surveyed.

Mammalian populations are predicted to be highest along waterways and to decrease with increased elevation (Wyoming Gap Analysis 1996b). Dominant artiodactyls occupying the area today include cattle (*Bos* spp.), moose (*Alces alces*), and pronghorn *(Antilocapra americana*) in the lower and middle elevations and elk (*Cervus elaphus*), pronghorn, and mountain sheep (*Ovis canadensis*) in the higher elevations during the summer. These species retreat down country with the heavier snows of winter. Prehistoric bison (*Bison bison*) density was likely highest in the lower montane settings, but a bison horn sheath found in a cirque basin at 3330 masl (Site 48PA2721) indicates that they occupied the higher alpine meadows as well. Other fauna that currently inhabit the study area include grizzly bears (*Ursus arctos horribilis*), black bears (*Ursus americanus*), wolves (*Canis lupus*), coyotes (*Canis latrans*), bobcats (*Lynx rufus*), snowshoe hares (*Lepus americanus*), yellow-bellied marmots (*Marmota flaviventris*), and northern pocket gophers (*Thomomys talpoides*), among several others.

Paleoclimate

North American climatic oscillations have been linked to a periodicity of approximately 1500 calendar years (cal BP) for the last 14,000 years (Viau et al. 2002). These oscillations are primarily driven by variability in solar forcing (Bond et al. 2001), which alters atmosphere-ocean interactions. Atmosphere-ocean interactions primarily attributed to the North Atlantic region indirectly drive terrestrial climatic episodes synchronously across North America (Viau et al. 2002).

The Pinedale glaciation (Figure 1.3) in the Wind River Range of Wyoming occurred from approximately 23,000 to 15,000 cal BP (Chadwick et al. 1997). During this time, upper timberlines in northern Wyoming region were 600-1200 m lower than modern timberlines and much of the Yellowstone Plateau was glaciated (Romme and Turner 1991). Pollen data from across most of North America and Europe indicate a brief interstadial shift toward warmer and drier conditions at 13,800 cal BP (Viau et al. 2002). In pollen data (Figure 1.3) from the high country of the GYE (ca. 3150 m), this transition appears several hundred years later, around 13,300 cal BP and is represented by a shift from sagebrush steppe/tundra associations to a rapid influx of subalpine conifers (Fall et al. 1995).

The Altithermal dry period (Antevs 1948) is evident in several paleoclimatic proxies across Wyoming and the central United States (Mayer and Mahan 2004 and references therein). Relative aridity is documented in the northern Bighorn basin woodrat middens after 9170 cal BP, reaching a maximum at 5450 cal BP (Lyford et al. 2002). Erosion and aeolian activity are evident across the Wyoming Basin at this time (Mayer and Mahan 2004), especially between approximately 8000 and 5500 RCBP (8855-6330 cal BP[1] [Reimer et al. 2004]). After this dry period, the climate shifted toward a cooler and wetter regime than it had been for the previous three millennia. This shift toward a more mesic regime decreased the elevation of the lower timberline in the eastern GYE (Reider et al. 1988; Romme and Turner 1991) and initiated neoglaciation in some mountain cirques (Denton and Karlen 1973; Wendland and Bryson 1974), possibly producing the Alice Lake Alloformation in the Wind River Range glacial chronology (Figure 1.3c; Dahms 2002). The mesic phase lasted from around 4400 to 2700 RCBP (ca. 4963-2815 cal BP) and is evident in pollen and macrobotanicals from woodrat middens of the northern Bighorn Basin (Lyford et al. 2002), as well as in mammalian fauna recovered from Lamar Cave in Yellowstone National Park (Hadly 1996). Overbank stream deposits produced during this time in Yellowstone are also interpreted as representing mesic conditions (Meyer et al. 1992), and dune stability is evident across the Wyoming Basin at this time (Mayer and Mahan 2004). Pollen data from across North America center this transition to 4030 cal BP (Viau et al. 2002). Estimates of temperature and precipitation shifts during this late Holocene wet period suggest the northern Bighorn Basin was around 1.2 ± 0.7 ^{o}C cooler and 12.4 ± 6.5 mm wetter in January and around 3.2 ± 0.8 ^{o}C cooler and 6.9 ± 3.7 mm wetter in July.

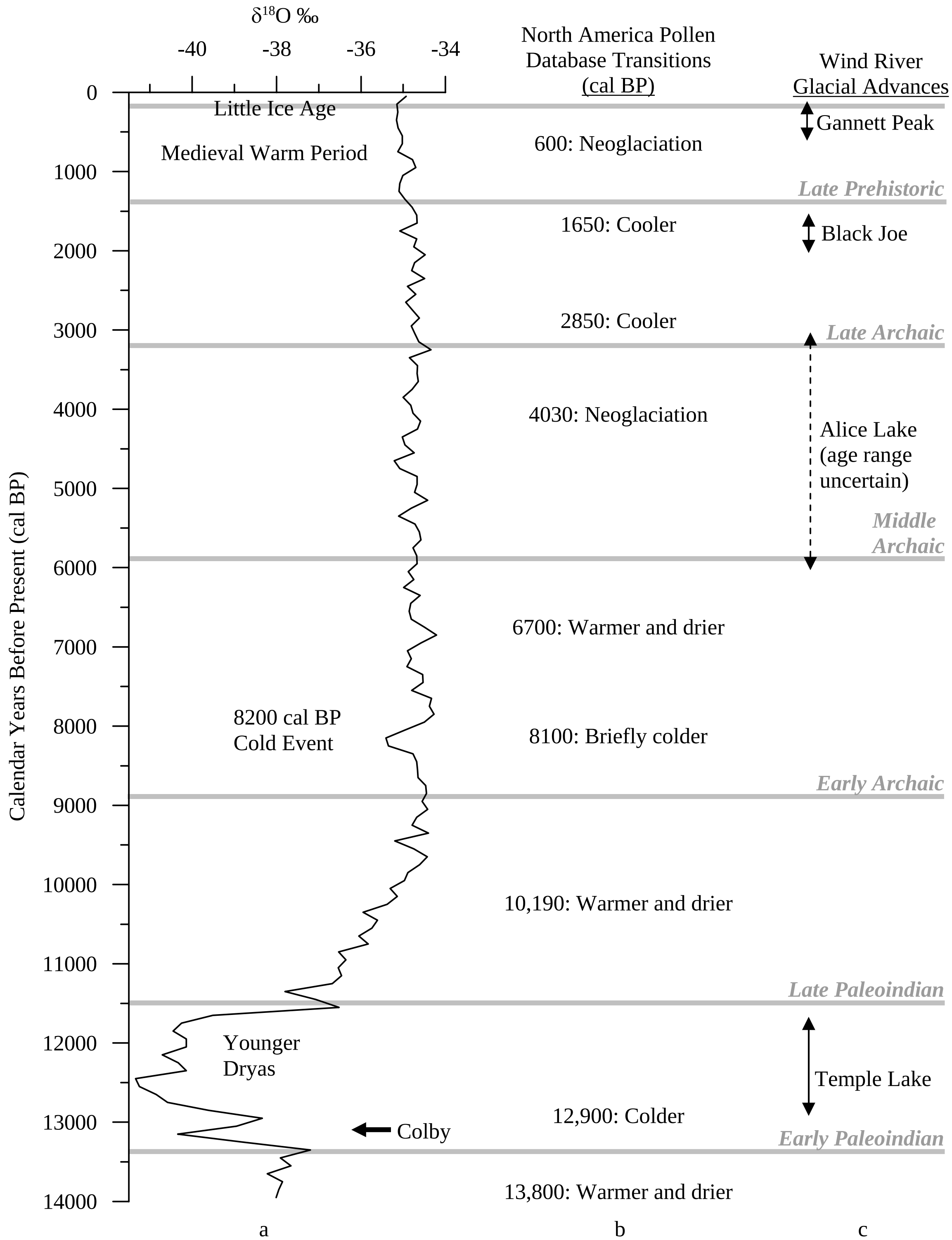


Figure 1.3. Comparison of GRIP2 oxygen isotope ratios (a) with North American pollen transitions (b; Viau et al. 2002) and the the Wind River glacial chronology (c; Dahms 2002). The "Colby" arrow refers to the earliest occupation of the Bighorn Basin, the Colby Site (ca. 13,131 cal BP, 11,200 ± 200 RCBP [Frison and Todd 1986:22]). Archaeological time periods are marked in gray. Oxygen isotope data provided by the National Snow and Ice Data Center, University of Colorado at Boulder, and the WDC-A for Paleoclimatology, National Geophysical Data Center, Boulder, Colorado.

Northern Bighorn Basin woodrat middens indicate a return to more xeric (summer dry/winter wet) conditions after 2700 RCBP (ca. 2815 cal BP), a time when the middens became accented by Great Basin flora (Lyford et al. 2002). Shifting weather patterns from the Pacific and/or decreased intensity of the Gulf of Mexico summer monsoon season are likely causes of this change in midden composition. Hemispheric transitions between ~2850 to ~1650 cal BP (Bryant and Holloway 1985; Denton and Karlen 1973; Harvey 1979; Vaiu et al. 2002) spawned neoglaciation in the Wind River Range, producing the Black Joe Alloformation (Figure 1.3c; Dahms 2002). Of four dune fields in the Wyoming Basin, all were active from approximately 2000 to 3000 RCBP, indicating that this may have been a cold and dry period across Wyoming (Mayer and Mahan 2004). The Medieval Warm Period, centered at 1000 cal BP, was a rapid episode of warming that separates two glacial alloformations in the Wind River Range. The Little Ice Age began around 600 cal BP and culminated at 300 cal BP. Little Ice Age neoglaciation is associated with the Gannett Peak Alloformation in the Wind River Glacial Chronology (Figure 1.3c; Dahms 2002), and stability of dunes in the Wyoming Basin (Mayer and Mahan 2004) indicates that the Little Ice age was moister than the late Holocene cold period associated with the Black Joe Advance (Figure 1.3; Dahms 2002).

Climate change coincident with fifty million years of erosion has produced a topographically complex land surface. The lower montane elevations are dominated by huge alluvial and mass wasting features. Uplands are characterized by mostly thin soils on convex slopes, with sediment depth and likelihood of preserved archaeological stratigraphy predicted to increase with slope concavity. These uplands were carved by Quaternary glaciation that produced U-shaped valleys bordered by colluvial aprons and moraines in the upper montane elevations.

This topographically-rough ecosystem is characterized by patchy plant communities mediated by elevation, slope, and aspect. Bare ground (i.e., artifact) visibility is heavily influenced by the plant mosaics and their controlling variables (i.e., elevation, slope, and aspect). Sagebrush and grass-covered slopes were sampled for surface archaeology as opposed to those under the tree canopy because the litter layer and higher aboveground biomass in the trees severely limits ground visibility. These plant mosaics have been continually shifting in response to climatic variation and the nature of surface lithic scatters (e.g., artifact visibility and density) changes systemically with these climatic and biotic shifts.

Surface Lithic Scatters

Surface lithic scatters, defined above, are a vital component of the record of prehistoric hunter-gatherer behavior. However, deriving behaviorally meaningful interpretations from them is not an easy task. Adding to the challenge is an *in situ* data collection protocol that includes no artifact collection. By not collecting artifacts, nodule analyses (Kelly 1985:166) and refitting are not possible, and this limits the interpretation of reduction episodes. For purposes of this thesis, in-field documentation of surface lithic scatters still has two advantages over excavation and/or mass collection strategies.

First, the cost of observing large archaeological surfaces can be lower than that of subsurface deposits (Dunnell and Dancey 1983; Ebert 1992:9). In-field analysis has also been interpreted as less costly than collection with subsequent analysis and curation (Beck and Jones 1994; Dunnell and Dancey 1983;). Dunnell and Dancey (1983) agree that surface archaeology has two major advantages and that the lower cost is one of them, but their second stated advantage is that surface data are more amenable to regional analysis than subsurface data. Reasons for this second advantage are unclear, since subsurface data should have no disadvantages over surface data in regional analysis. Furthermore, it is the subsurface sites that offer chronological control over surface assemblages, and an atemporal regional analysis of surface archaeology would severely limit the depth of research questions.

The second major advantage of in-field surface artifact documentation is that it allows the artifacts to be left *in situ* following documentation, thus requiring no collection, curation, and unnecessary damage to prehistoric archaeological matrices. Leaving artifacts in situ also allows the record to be monitored or reexamined for diachronic change of the surface record. Excessive walking across archaeological sites can cause damage that should not be ignored (Beck and Jones 1994), but humans are only one of a host of fauna that modify site surfaces. Recording a site is not likely much more destructive than an elk herd trampling the sediment or a hunting camp positioned in a site area. Disruption to archaeological matrices during an in-field documentation also pales in comparison to the destruction of archaeological context by collection and excavation. A fierce antagonist to in-field analyses involving no collection is Butler (1979), who considers a no-collection strategy more destructive to archaeology than collection, and even furthermore, he states that “archaeologists who do not make artifact collections… do not make a contribution to the discipline” (Butler 1979:795). Some of the frustrations of a no-collection policy include not having the capacity to perform additional analyses on artifacts and to prevent them from being lost from view or collected; however the level of detail of in-field artifact documentation has increased considerably over the past quarter century. GPS receivers, digital calipers, and handheld computers are more common components of archaeological field gear, and detailed epoxy molds of artifacts even be made in the field in a matter of minutes (Todd and Burnett 2003).

While Butler is correct that in-field analysis is time consuming, considering the breadth of field technology currently available combined with the irrevocable harm that collection does to archaeological matrices, non-collection is the best option unless the resource is immediately threatened. Another coping strategy for non-collection is to use a sliding scale of detail during the documentation process (Figure 1.4a). By altering the detail (i.e., transect spacings and the number of attributes recorded), larger areas can be documented in smaller time with less detail. When the time is warranted, small areas can documented with a higher resolution (Burger et al. 2004). Steps taken to maximize the amount of area while minimizing the amount of time (Figure 1.4b) are certainly concerns for contractors and clients, but the quality of archaeological documentation (i.e., detail) should be a concern for all archaeologists. This sliding scale of detail is applicable to all archaeological survey and excavation methods. Cultural resources management (CRM) surveys often cover large areas, and in attempts to minimize the amount of time that it takes to complete the survey and documentation, the level of detail is limited. Academic excavations, as another extreme, often cover small areas with extremely high detail, and thus take more time to cover a unit of space.

When the Laboratory for Human Paleoecology at CSU began conducting controlled archaeological surveys and in-field documentation, a major component of the approach was that methodological concordance was needed between excavation and survey data so the two datasets would be seamless in their comparability (Burger et al. 2001). Included in this perspective is the idea that the same level of detail should be used whether in a bonebed or on a survey surface. As the in-field analysis in the Upper Greybull entered its second year (2003), we felt the need to increase the rate of documentation for the sake of covering more area. Because documenting the same amount of material in less time was not considered feasible, this led us reduce the amount of detail in the documentation protocol (Figure 1.4). In contrast to the full recording of between 19 and 33 variables per artifact in the field, only 8 variables were recorded under the rapid documentation protocol (Appendix A, Table A.3), known as Data Acquisition Maximization and Noodling (DAMN). "Noodling" refers to nonsystematic survey. DAMNing sites is a way to observe more area on some sites by sacrificing detail on others (Figure 1.4a). The decision of whether to DAMN or not to DAMN is made both on a site-specific basis and with regard to the size of the area to be surveyed and the available time to document the material.

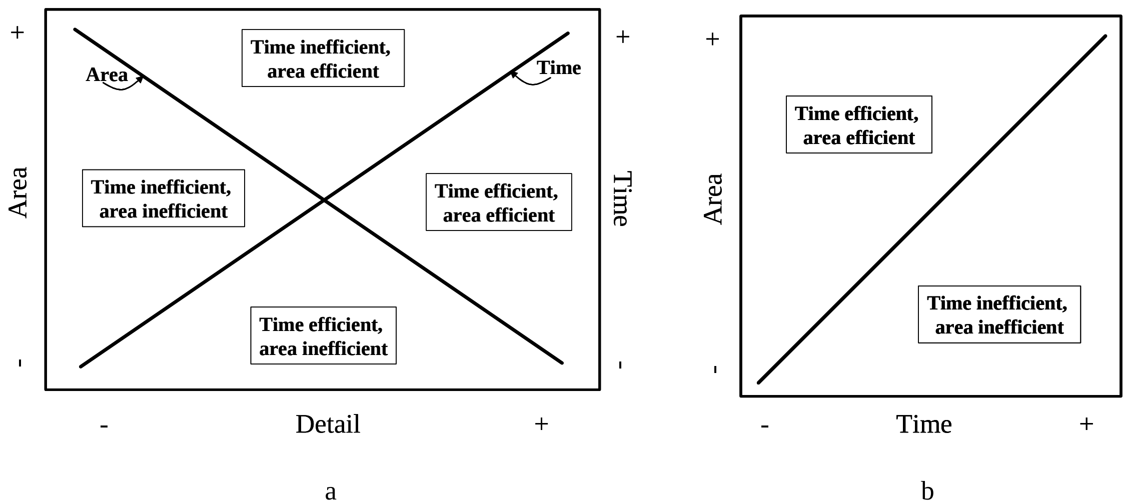


Figure 1.4. Modeled relationships between the level of detail used in the documentation process, area covered, and time spent in the documentation process (a), and the relationship of time and area, regardless of detail (b). These models also highlight how surveys can be either efficient or inefficient with respect to time and area.

In a comparison between in-field and laboratory artifact documentation, Beck and Jones (1994) demonstrated that metric measurements and certain qualitative attributes such as toolstone type and the amount of cortex present can be reliably recorded in the field. The highest degree of variation between field and laboratory coding occurred in the assessments of bifacial reduction stage and symmetry (75 and 66 percent agreement, respectively). Studies of in-field interobserver variability in the Upper Greybull have begun (Johnston et al. 2004), but sampling bias precludes a meaningful analysis of variability in attribute documentation[1]. Because measuring the dimensions of all artifacts with calipers was considered to be too time consuming in the field, Beck and Jones (1994) recommended using size grades for approximating the size of debitage. Calipers were used for all measurements of artifacts in the Upper Greybull, and to adjust

[1] Johnston et al. (2004) deliberately selected artifacts with ambiguous attributes in the first study of inter-observer variability in the Upper Greybull. Because of this sampling design, the results of this study do not approximate the recording variability of randomly sampled artifacts.

for time (Figure 1.4), size grades are a low cost alternative and might slightly increase the speed of maximum length measurements.

One difficulty in researching surface archaeology exclusively is that it is difficult to assess the degree to which the surface artifacts and/or features represent the subsurface record. Occasional soil probing with small cores and pinflags were used to determine sediment depth, but these do not provide data regarding the archaeological content in the subsurface. While some sites in the Upper Greybull are exposed on bedrock and saprolith having a low likelihood of containing buried archaeological components (e.g., 48PA2740-48PA2743), all sites are presumed to have buried archaeological material, at least in the taphonomically active zone (TAZ) of the near-surface.

At the Tenderfoot site in the Gunnison Basin of central Colorado, Stiger (2001:122) noted significant differences between the surface and subsurface artifacts across a 428 m^2 excavation block, and the depth of most cultural material was only 20 cm! Such differences have led him to use surface documentation not as an end point in data collection but rather as a starting point for data collection via excavation (Stiger 2001:117, 156-157). This view of surface scatters offering little more than a potential area to excavate is not new (e.g., Gould 1977:153; Hole and Heizer 1973:163; Ruppé 1966:133, cited in Dunnell and Dancey 1983). However, the Upper Greybull archaeological sample is largely from the Washakie Wilderness Area of the Shoshone National Forest, a place where excavation is not feasible and knowledge of the prehistoric artifacts in this area must be gained from the surface. Even if surface populations of artifacts are statistically different than subsurface populations, there is no reason to presume that the surface data are by necessity without value (Dunnell and Dancey 1983).

Complex formational histories in the Upper Greybull ensure that interpreting human behavior in these contexts is a challenging task. A very dense lithic scatter was found above timberline on the floor of a Pleistocene hanging valley (Site 48PA2726; Figure 1.5). The artifacts were somewhat difficult to document, because they were only exposed underwater in a shallow thalweg that was iced-over in the summer mornings and running with very cold snowmelt by mid-day. In this case, there were clearly subsurface artifacts on either side of this small stream, but the observational space of this scatter was determined by the course and breadth of the stream, and the patterning observed was more a result of this process than one of human behavior.

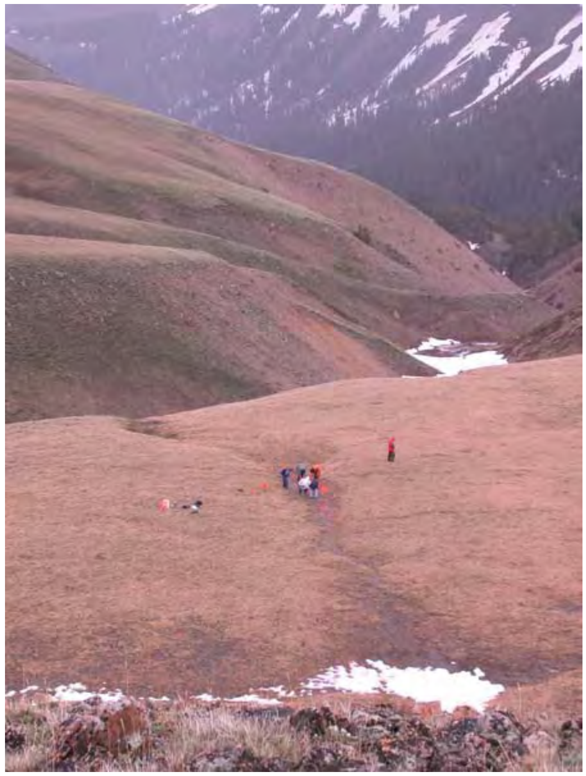


Figure 1.5. Site 48PA2726, exposed only in a snowmelt thalweg. Photograph by L. C. Todd.

Biota uniquely mediate the exposure of surface artifacts. Aside from the floral determinants of artifact visibility, animals also influence visibility. Animal trails cut into archaeological matrices, and rodent burrows churn sediments that are sufficiently deep for tunneling. Rodent burrows exposed burned sagebrush in a very dense site approximately 725 masl lower the hanging valley mentioned above (48PA2744). In a near-treeline setting, rodents exposed an Early Archaic projectile point and associated debris in an alpine meadow (site 48PA2802), and a nearby creek similarly exposed Early Archaic artifact-bearing sediments, causing artifacts to roll down the banks of the creek as colluvium (site 48PA2803). This setting is not unique to this one site. Stream downcutting has taken artifacts from thin sod mantles and redeposited them as slope colluvium in at least three other alpine meadow/tundra sites (sites 48PA2721, 48PA2723, and 48PA2798; Figure 1.6). These examples show that ground cover, including sediment and vegetation limits the extent of observable archaeological material, and that biotic and abiotic processes (e.g., rodent burrowing and stream downcutting) all influence the exposure of archeological materials. The archaeological samples of the Upper Greybull are in all ways a product of biotic and abiotic taphonomic processes, and it cannot be assumed *a priori* that they represent the diversity of artifacts once deposited.

Figure 1.6. Site 48PA2721, where the abiotic taphonomic process of downcutting is moving artifacts from a sod mantle to colluvial slopes. Photograph by P. Burnett.

Sampling Design as Taphonomic Agent

Sampling design affects the properties of the samples (e.g., sample abundance, artifact sizes, spatial distribution, etc.; Burger et al. 2004; Plog et al. 1978; Wandsnider and Camilli 1992). Landscape Taphonomy studies the transition of particles (e.g., bones, flaked stone, etc.) from a living system to a sedimentological system to an analytical system (modified from Burger et al. n.d.). All abiotic and biotic (including cultural) ecosystem processes that affect these transitions fit under the umbrella of Landscape Taphonomy. Sampling design is a human (biotic) process, and as a result, researching the effect that sampling design has on archaeological documentation is a component of Landscape Taphonomy.

In developing concepts of Landscape Taphonomy, Laboratory for Human Paleoecology researchers have been manipulating the sampling frame used in surface surveys as part of ongoing property-based investigations aimed at understanding the nature of archaeological samples (Burger 2002; Burger et al. 2004; Todd et al. 2000). One component of this ongoing research involves investigating the affects of varying survey methods on the documentation of surface artifacts, partly to evaluate what is missed on one scale by sampling the same space with greater observer intensity. A portion of a site (48PA2772) was resurveyed ten days after its initial documentation. The initial documentation consisted primarily of intensive nonsystematic “noodling” across the site surface by an average of four groups of two fieldschool students for six days. Artifacts were recorded upon encounter, and the groups moved around the site until a reduction in artifact encounter rate suggested the site had been completely recorded. Permanent ink markers (Sharpie® Fine Point) were used during the initial recordation to place black dots (i.e., “Sharpie® dots”) on the skyward surface of the artifacts so that they would not be recorded twice.

For the resurvey of this site, a 20-x-50 m Modified-Whittaker sampling plot was used. Embedded in this outer frame are 13 subplots (one 5-x-20 m plot, two 2-x-5 m plots, and ten 0.5-x-2 m plots; Burger et al. 2004; Stohlgren et al. 1998). The outer plot was walk surveyed with a transect spacing of 70 cm, and the subplots were crawl-surveyed with transect spacings of 30 cm. In all, 130 m^2 were both walked and crawled at shoulder-to-shoulder spacing. While a detailed explanation of this sampling design and its applications for archaeology is beyond the scope of this thesis (see Burger 2002; Burger et al. 2004), the relevant issue here is that resampling the area at a higher resolution added to the distribution of artifacts and modified the archaeological document of the newly sampled area (Figure 1.7).

Resampling an area at higher resolution can merge once discrete artifact concentrations and add density to those previously defined. While methodologically frustrating, the archaeologist as a taphonomic agent must not be viewed as “bad;” just as viewing other taphonomic agents such as ants and rill erosion as “bad” adds unnecessary connotations to natural earth surface processes. After the taphonomic processes have had their last contribution to the artifact data, a sample of surface artifacts remains that represents their population to an unknown degree. Having addressed some of the taphonomic processes shaping the Upper Greybull artifact samples, their variability is now explored.

Introduction to Upper Greybull Lithic Scatters

Prehistoric artifact scatters on surfaces in the central Absaroka study area are dominated by flaked stone. Minor amounts of groundstone, worked soapstone (Figure 1.8; Adams 2003), and fire-altered rock have been found as well. Except for a few surface bone scatters, the perishables that were deposited with the stone artifacts have since decomposed. There have been very few features documented in the Upper Greybull project area, but of the two that have been identified, one is a shallow, deflated basin hearth (48PA523), and another is a rock-filled basin hearth exposed in a cutbank profile (48PA2811). Probably because the area lacks the natural quartzite that creates easily identifiable fire-cracked rock, there have been no documented areas where fire-cracked rock is anything but a very minor component of the entire site assemblage. Fire-altered rock likely exists in greater proportion than was documented, but it is difficult to

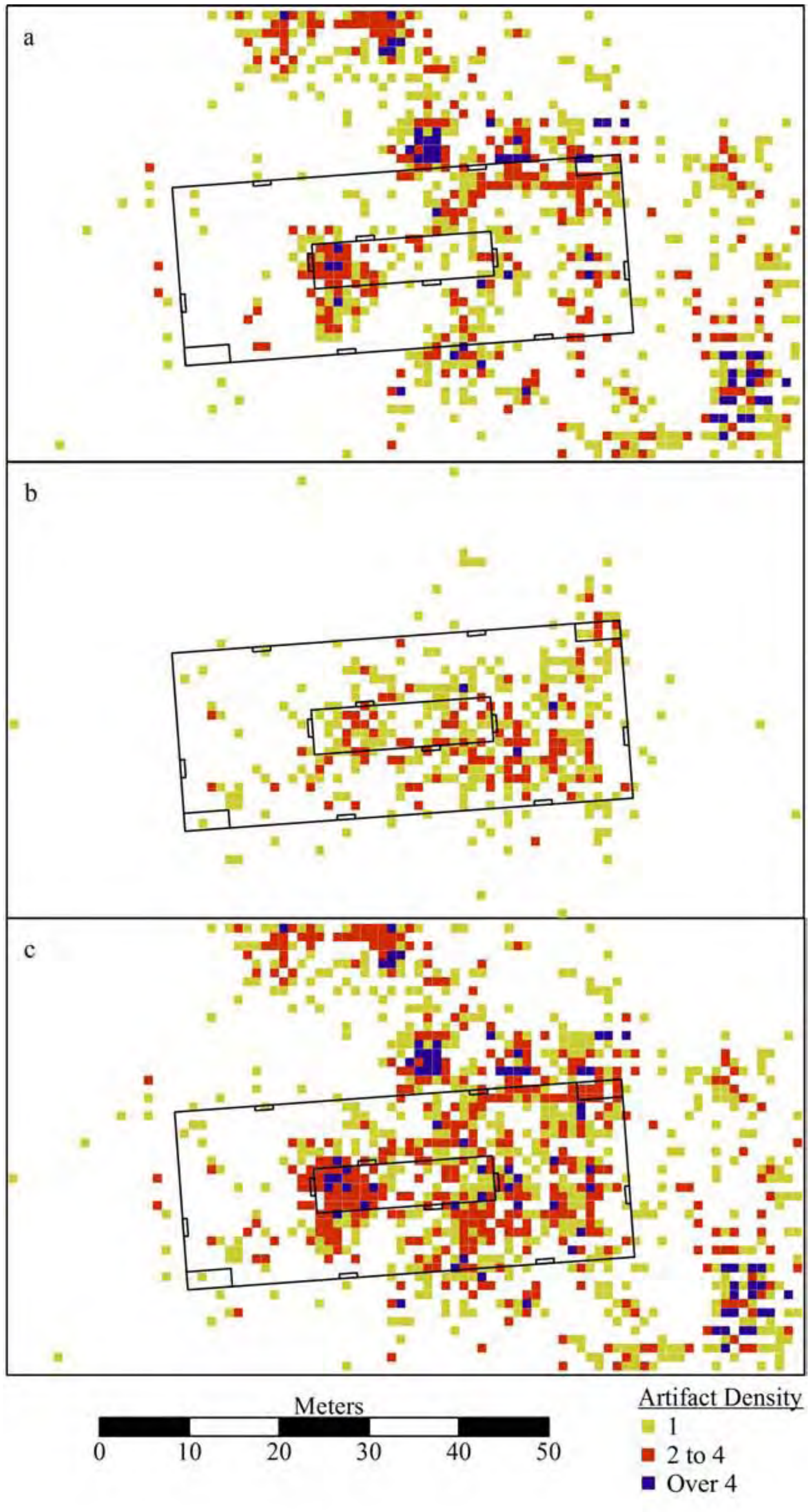


Figure 1.7. Artifact distribution in the vicinity of 50-x-20-m Modified-Whittaker plot at site 48PA2772, prior to resampling (a); 515 artifacts newly recorded (not documented during the nonsystematic survey; b); and the composite of previously and newly documented artifacts (c). Accuracy limitations of the uncorrected handheld GPS caused some artifacts located in the plot to have proveniences outside the plot boundary (b).

identify due to the presence of natural cobbles derived from the underlying Wiggins Formation conglomerate on most surfaces documented during this research. These natural cobbles do not produce heat fractures that are readily identifiable as fire-cracked rock.

Figure 1.8. Soapstone (steatite) artifacts from the Upper Greybull, including a pipe from Site 48PA2744 (a), and bead (b) and pendant (c) from Site 48PA2772.

Projectile point morphology has changed somewhat predictably through the prehistoric occupation of the region (Frison 1991; Husted 1969; Husted and Edgar 2002; Mulloy 1958). Using projectile points from radiocarbon dated strata in the region allows the ages of some of the Upper Greybull projectile points to be approximated (a method known as lithic cross-dating). This chronology of the Upper Greybull project area is presented below. Dating points based loosely on quantitative data but largely on qualitative attributes is not very robust, but it sets the stage for more sophisticated dating research, and it allows those areas where point morphologies are especially ambiguous or are lacking altogether to be targeted for further dating research.

Spatiotemporal Hypothesis

People often ponder the temporal relationship between projectile points and associated debris on a surface lithic scatter. How do we evaluate the temporal relatedness among surface debris? For example, finding a Budweiser® can 2 m away from an arrow point does not imply that the prehistoric hunters drank beer. When is it appropriate to assume that things related in space are also related in time? This question naturally arises in subsurface research as well, but geoarchaeologists have several methods for addressing such questions.

Barring evidence to the contrary, artifacts and features that are close in space to diagnostic projectile points are hypothesized here to also share a close temporal relationship. This hypothesis is evaluated using all the projectile points that are somewhat temporally diagnostic (200 of 224). “Somewhat diagnostic” points (e.g., “unspecified Archaic”) were left in the sample in the occasion that they would be associated with a point that was definitely not from the same time period. Such an association would identify the cluster as multicomponent (consisting of more than one occupation). In some instances, these broadly defined “somewhat diagnostic” categories are not informative, but in others they have diagnostic value.

The locations of these diagnostic points were projected in ArcView® GIS 3.2, and were buffered at radii of 2.5 m, 5 m, and 10 m. These buffers were set to join if they overlapped, which produced a set of well-defined clusters of two or more projectile points that were less than 5 m, 10 m, and 20 m apart from each other (Figure 1.9).

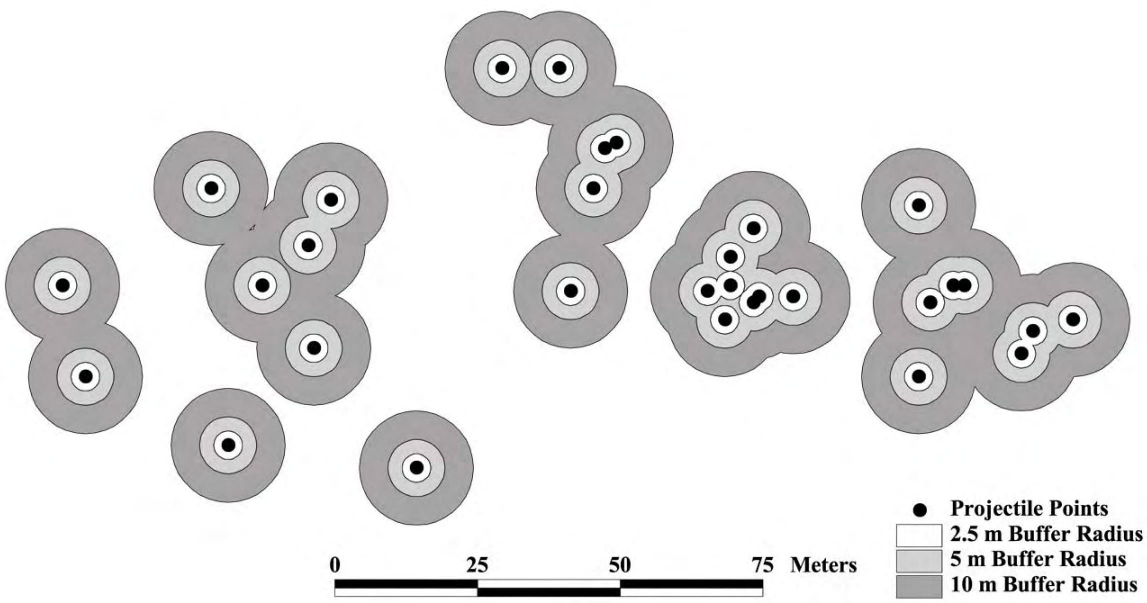


Figure 1.9. Buffers around projectile points at Site 48PA2744. Note that the number of clusters is dependent upon the scale of the buffer radius.

The 5 m buffer radius appears to be the best at including projectile points while minimizing overlap with the buffers of points from other time periods (Table 1.1). Of the somewhat diagnostic projectile points that are less than 20 m from another point (10 m buffer radius), there is only a 42 percent likelihood that they are from the same time period (e.g., Late Archaic). In other words, 42 percent of the time when two projectile points are less than 20 m from each other, they are from the same time period. Decreasing this distance between points to less than 10 m produces a 65 percent likelihood that the points are from the same time period. Interestingly, decreasing the distance to only 5 m between points did not increase the probability of them being from the same time period (64 percent). Only two sites had clusters with points from different time periods that were under 5 m apart (48PA2744 and 48PA2768), while there are seven cases where the projectile points are from the same time period and less than 5 m apart from each other (Sites 48PA2741, 48PA2744, and 48PA2772, and 48PA2818). These data indicate that when two prehistoric artifacts are less than 10 m apart from each other, there is a 65 percent likelihood that the two artifacts were produced during the same time period.

Table 1.1. Projectile point cluster data, including buffer radius, number of points grouped with other points, number of point clusters with diagnostics from only one time period, and number of multicomponent point clusters.

Buffer Radius	Number of Points Clustered	Number of Single Component Point Clusters	Number of Multicomponent Clusters
2.5	26	7	4
5	52	11	6
10	95	10	13

This small exercise provides an assurance that nondiagnostic archaeological material that is spatially associated with projectile points tends to also be temporally related, but that this relationship is not all absolute. The goal here was not to assign exact numbers to this relationship, but rather to show that it is reasonable to operate under this spatiotemporal hypothesis. Exchanging space for time in this manner is an important concept, and it is one that all the following work is founded upon. The range of behaviors that could have led to the temporally-affiliated artifact concentrations in the Upper Greybull is discussed next, and this provides a theoretical context for the chronological overview of the region's prehistory.

Models of Prehistoric Montane Behavior

> Because so many factors affect the organization of a technology, there are no simple equations between idealized types of technology or tools (e.g., curated) and idealized types of hunter-gatherer systems (e.g., collectors). (Ingbar 1992:173)

This statement by Ingbar is especially apt in light of the previous section on the taphonomy of surface assemblages. Archaeological surface samples might or might not represent the depositional populations, and even the populations might or might not represent the hunter-gatherer behavioral systems from which they were made! While artifact samples may not represent the behaviors that deposited them, ethnographic research has provided archaeologists with a range of hunter-gatherer behaviors to anticipate for different regions of the earth. A brief review of hunter-gatherer theory as it relates to the central Rocky

Mountains will provide a framework for interpreting prehistoric behavior from the artifacts documented in the Upper Greybull.

Forager/Collector Continuum

Binford (1980) describes the variability in hunter-gatherer subsistence and settlement patterns as a continuum between foraging and collecting. In general, forager communities move to resources as they become available, using predominantly an encounter strategy on a daily basis and supplying food as it is needed without an emphasis on storage (Binford 1980:5). Foragers commonly move residences several times a year, with the number of moves and the distance between moves largely dependent upon the productivity of ecosystem components (e.g., flora, fauna, and abiotic resources such as toolstone) but also dependent on cultural variables such as conflict avoidance and seasonal aggregations. Foragers typically operate in small bands for most of the year and do not construct elaborate living quarters. In Murdock's database on hunter-gatherers (Murdock 1967 in Binford 1980:15), fully nomadic foragers were most common in the warmer equatorial climates with long growing seasons that support year-round availability of resources. Two site types are expected from foraging behavior: *residential camps* where all members of a group sleep and perform subsistence activities and *locations* where extractive tasks were carried out (Binford 1980:9).

Collector settlement and subsistence organization contrasts to that of foragers and is defined by the need to mitigate the effects of seasonality on available resources (Binford 1980:10). This need arises most common in temperate climates typified by restricted growing seasons. These groups operate logistical hunting and gathering trips using only a portion of the band in task-oriented forays where a portion of the products of such endeavors are returned to the residential camp for use by the whole group (Binford 1980:10).Binford (1980:10) uses ethnographic data to suggest that five types of sites are anticipated productions from a collector orientation. Just like foragers, collectors produce *residential camps* and *locations*, but small logistically organized task groups also produce *field camps*, *stations*, and *caches* as well.

Collectors move residential camps less than foragers do, but the distance of each move can be longer (Bamforth 1997 using data from Kelly 1983). More effort is reasonably expended on living structures (e.g., semi-subterranean house pits) in a collector strategy because they are used for a longer duration than those of foragers. These structures or other living quarters (e.g., caves and rockshelters) often include storage pits, because the collector strategy of limited mobility requires food storage for at least a portion of the year, especially mid-winter to early spring. Field camps are temporary hubs of task-oriented procurement activities. Stations are planning locations such as hunting blinds or overlooks. Food caches are made as a storing response when task groups procure a greater bulk of food than can be immediately consumed, whereas caches of toolstone, nets, or other materials are made in response to either risk reduction in a resource-poor environment or in anticipation of future need at the same location. Lastly, foragers appear to have more limitations on maximum group size than do collectors, whose range of variation overlaps foragers but also includes groups of much larger sizes than a foraging subsistence can support (Bamforth 1997). While these generalizations mask much of the variability of ethnographically documented people, they serve as a framework for modeling hunter-gatherer land use in the Upper Greybull.

Bender and Wright (1988) interpret surface archaeological data from the northern Tetons as best accommodated by a broad spectrum, logistically oriented collector model. They derive a number of site types and associated assemblage characteristics (Table 1.2) from those of Binford (1980), and these are used in analyzing their sample from the northern Tetons of Wyoming. As will be seen, Upper Greybull data conform to these types to some degree, but they vary in other important ways.

Table 1.2. Bender and Wright's (1988) collector-based site types for the northern Tetons.

Base Camp:	High artifact frequency and diversity, large site area in accessible location
Secondary Base:	Middle range of artifact frequency and diversity
Special Use Hunting:	Low artifact frequency
Special Use Quarrying:	Dense primary production debris
Special Use Gathering:	Features and artifacts at base camp

Loendorf (1973:52-53) proposes a model for the Pryor Mountains of southern Montana, predicting that immovable dwellings were used in the foothills and the upper montane areas were used during the spring and summer months. Metcalf and Black (1997) suggest that Archaic people of the Colorado Rocky Mountains lived in the mountains throughout the year and were also logistically oriented. They use data from the Yarmony Pit House and other sites in the northern Colorado Rockies to suggest that the Archaic hunter-gatherers lived year-round in the area. Additionally, these hunter-gatherers employed a regularly scheduled broad spectrum strategy that involved procuring a wide range of food and storing a portion of the food collected during summer logistical forays to be consumed in winter residences that included pit houses. Metcalf and Black (1997) also modify Binford's (1980) collector site types for their model of archaeological site types in the Colorado Rocky Mountains (Table 1.3), and theirs is viewed here as more inclusive than that of Bender and Wright (1988). Both sets of authors suggest that the archaeological data conform best to an interpretation of a prehistoric montane collector strategy with an emphasis on seasonally scheduled activities.

Table 1.3. Metcalf and Black's (1997) model for interpreting logistical behavior from mountain sites of the central and southern Rocky Mountains, derived from Binford (1980).

Residential Base:	Hearths, structures, utilized faunal and floral remains, storage facilities, high-diversity tool assemblage with men's and women's tools/work areas, debitage reflective of late-stage tool manufacture and tool maintenance, and secondary refuse.
Winter:	Substantial structures with interior hearths, storage facilities, and accumulated trash middens.
Location:	Lack of domestic features, low tool diversity, greater specificity of function. Facilities indicative of function such as bonebeds, game drives, milling implements. Lithic procurement subset – numerous cores and rejected/broken early-stage tools, dense chipped stone accumulations with a high incidence of debris and core reduction flakes; possible digging and knapping tools.
Field Camp:	Hearths, structures, utilized faunal and floral remains, low to medium tool diversity, little secondary refuse, no storage facilities, debitage reflective of late-stage tool manufacture and maintenance. Low to medium diversity tool assemblages. Generally lower lithic densities than residential bases and lithic extractive locations. Where associated with locations some specificity of function indicated by assemblage.
Cache:	Concentrations of highly utilized lithic items (blanks, cores, flake blanks), isolated storage facilities. Examples might include whole-element faunal remains, rock piles covering meat caches, cairns encasing lithic caches and pits.
Station:	Situated at a good overlook, assemblages, if present, are marked by low lithic density, low tool diversity, debitage either absent or reflective of casual knapping in late stage manufacture or maintenance, and faunal remains either absent or indicative of on-the-spot consumption.

In contrast to the views of Bender and Wright (1988), Loendorf (1973), and Metcalf and Black (1997), Larson (1997) accepts the idea of a collecting strategy used with a foraging strategy during the Early Archaic in the basins of central and western Wyoming, but she rejects the idea that hunter-gatherers in the mountains of northern Wyoming used a dominantly collector strategy. She and Francis (1997) interpret data from the Bighorn Basin and Mountains as indicating a strictly forager strategy during the Early Archaic. Binford (1980:15) would likely predict a dominantly collector orientation on the basis of the "temporal incongruity" of resources alone. While a collector strategy seems most likely the dominant behavioral orientation in the Upper Greybull, a review of regional archaeological data from the Absarokas will add flesh to these theoretical bones.

Regional Data on Settlement and Subsistence Organization

Bison and mountain sheep dentition indicate that the Bugas-Holding site in the northeastern Absarokas was occupied for 4 or 5 months between October or November and March or April during the Late Prehistoric period (Rapson 1990:137). During this occupation, a series of hunting episodes resulted in predominantly mountain sheep bones being delivered to, processed, and scattered across a terrace in the snowy lower montane valley of the Sunlight Basin in the Absarokas. What these people did in the warmer months after occupying Bugas-Holding is difficult to determine, but Metcalf and Black's (1997) model predicts that they would forage in the mountains, with the groups focusing on those elevations optimal for food procurement. Artiodactyl density and floral ripening schedules likely motivated group mobility. Moving down in elevation to the intermontane basins would also be logical, since the plants would ripen there before they would in the higher country. Encounter hunting or small logistical forays would likely have contributed to the diet during the late spring and summer months, but hunting is predicted to have increased in the fall and early winter for purposes of storage for mid- to late-winter and early spring consumption when deep snow limits mobility. In the fall, predictable large pre-rut mountain sheep aggregations could have numbered 45 to 65 head in the montane valleys (Rapson 1990:91). These aggregations are hypothesized to have been a major reason that mountain sheep are common components of archaeofauna in the Absarokas.

The Dead Indian Creek Site is also located in the Sunlight Basin, and again similar to the Late Prehistoric occupation at Bugas-Holding, the McKean occupation at Dead Indian Creek appears to have spanned several winter months (Frison and Walker 1984). Unlike the Bugas-Holding assemblage, the dominant species in the McKean component at Dead Indian Creek was mule deer (a Minimum Number of Individuals [MNI] of 50) and not mountain sheep (MNI = 16).

A similar pattern to Dead Indian Creek is at Lookingbill, with a MNI of seven deer and one mountain sheep in the Early Archaic level. Patterns of tooth eruption and wear on six deer mandibles indicate mid-summer to early fall kills, and the Early Archaic assemblage as a whole is interpreted as a short term hunting camp. The presence of ground stone in both Paleoindian and other Archaic levels indicates to some (Larson et al. 1995) that the site was occupied for a longer period than during the Early Archaic, and a broader diversity of activities were conducted at the site than would be expected from a short term hunting camp. Perhaps the site was occupied on the order of several months at a time during the Late Paleoindian and Late Archaic periods, serving as a base camp from which daily logistical forays were made for floral and faunal resources.

Suggesting that the Early Archaic people using the mountains of northern Wyoming followed a forager lifestyle with shorter, more frequent moves (Larson 1997) is consistent with the Lookingbill data. However, the Lookingbill data are also consistent with a collector orientation in which the site served as a short term field camp during the Early Archaic instead of a base camp as it did in other time periods. The Lookingbill data conform to Loendorf's (1973:52-53) and Metcalf and Black's (1997) prediction that occupations in the lower montane areas for several months in the winter would precede occupations in the upper valleys for summer and fall hunting and gathering. Sites such as Bugas-Holding, Dead Indian Creek, Pagoda Creek, and Yarmony serve as examples of these winter camps. Summer behavior is predicted to involve residential camp occupations of shorter duration than winter camps. These summer residential camps are predicted to be supplemented by field camps used only by certain group members.

In a discussion of Foothill-Mountain Late Paleoindian and Early Archaic subsistence strategies, Frison (1997) does not discuss the forager to collector continuum, but instead he stresses that in a variable environment, hunters and gatherers of northern Wyoming required a diverse set of strategies. Frison (1991:340-345) recognizes food caching as common over-wintering response in the plains, foothills, and mountains during these time periods, and he interprets pits at the Medicine Lodge Creek Site, Schiffer Cave (Frison and Grey 1980), and at Bighorn Canyon Cave sites (Husted 1969) as food caches. Food caching as an over-wintering response is clearly a logistically oriented strategy common to collectors, and although Frison does not use Binford's (1980) terminology, it appears that he is in general agreement with most researchers in the middle Rocky Mountains in considering prehistoric hunter-gatherers of the montane areas as collectors from at least the late fall to early spring.

Perhaps Binford (1980) characterizes the lifestyle best when he proposes that "… in some environments we might see high residential mobility in the summer or during the growing season and reduced mobility during the winter, with accompanying increases in logistical mobility." It seems likely that a collector pattern dominated prehistoric hunter-gatherer activities from the mid-fall to perhaps late spring in the Upper Greybull and surrounding areas, with residentially-based montane foraging in the area from late spring to early fall. This in no way implies that we can then evaluate this model with the archaeological data, because this leads to circularity in reasoning when data produced from the model are used to interpret the model itself (Binford 2001:2). The archaeological data in the Upper Greybull can fruitfully be discussed in terms of the oscillating collector/forager pattern deemed most applicable to the area, but the data do not lend support to either pattern.

CHAPTER 2: ARCHAEOLOGICAL CHRONOLOGY

Lithic cross-dating was used to build a chronology of Upper Greybull prehistory. To approximate the age of surface assemblages from projectile point morphology, the points are qualitatively compared with those documented in radiocarbon-dated stratigraphic contexts of northwestern Wyoming (Figure 2.1). A modified version of the chronological framework developed by Frison (1991:20) is used here for the chronological interpretation of projectile point styles (Figure 2.2). From the oldest to most recent, the major time periods are Early Paleoindian (11,500 to 10,000 RCBP), Late Paleoindian (10,000 to 8000 RCBP), Early Archaic (8000 to 5000 RCBP), Middle Archaic/McKean (5000 to 3200 RCBP), Late Archaic (3200 to 1500 RCBP), Late Prehistoric (1500 to 250 RCBP), and Protohistoric (250 to 75 RCBP). Frison's Archaic chronology included the term "Plains" before "Archaic" (e.g., Late Plains Archaic), but the "Plains" has been dropped because material from the Archaic occurs in most ecological settings of the Northwestern Plains and adjacent montane and intermontane areas.

The Upper Greybull chronology is informative not only for the outline of prehistoric occupation, but also because a number of ambiguous morphologies were identified that deserve further typological attention. For chronological purposes, areas containing unrecognized projectile point types would benefit the most from additional dating methods (e.g., excavation and radiocarbon dating). For example, side-notched Late Prehistoric arrowheads have little morphological overlap with points from other time periods. While using absolute dating techniques on Late Prehistoric sites or artifacts is valuable, it is not as rewarding in terms of the initial stages of chronology building as dating other sites containing projectile points with temporally ambiguous morphologies. Point morphologies within the Archaic exhibit general trends, but apparent temporal overlap in some base morphologies limits the assignment of a time period within the Archaic (e.g., Early, Middle, or Late Archaic). Additional ambiguity is found in small corner-notched points from either the Late Archaic or Late Prehistoric. Absolute dating of these surface scatters, if possible, is more productive for purposes of chronology building than dating sites containing temporally unambiguous points like the small Late Prehistoric side-notched arrowheads.

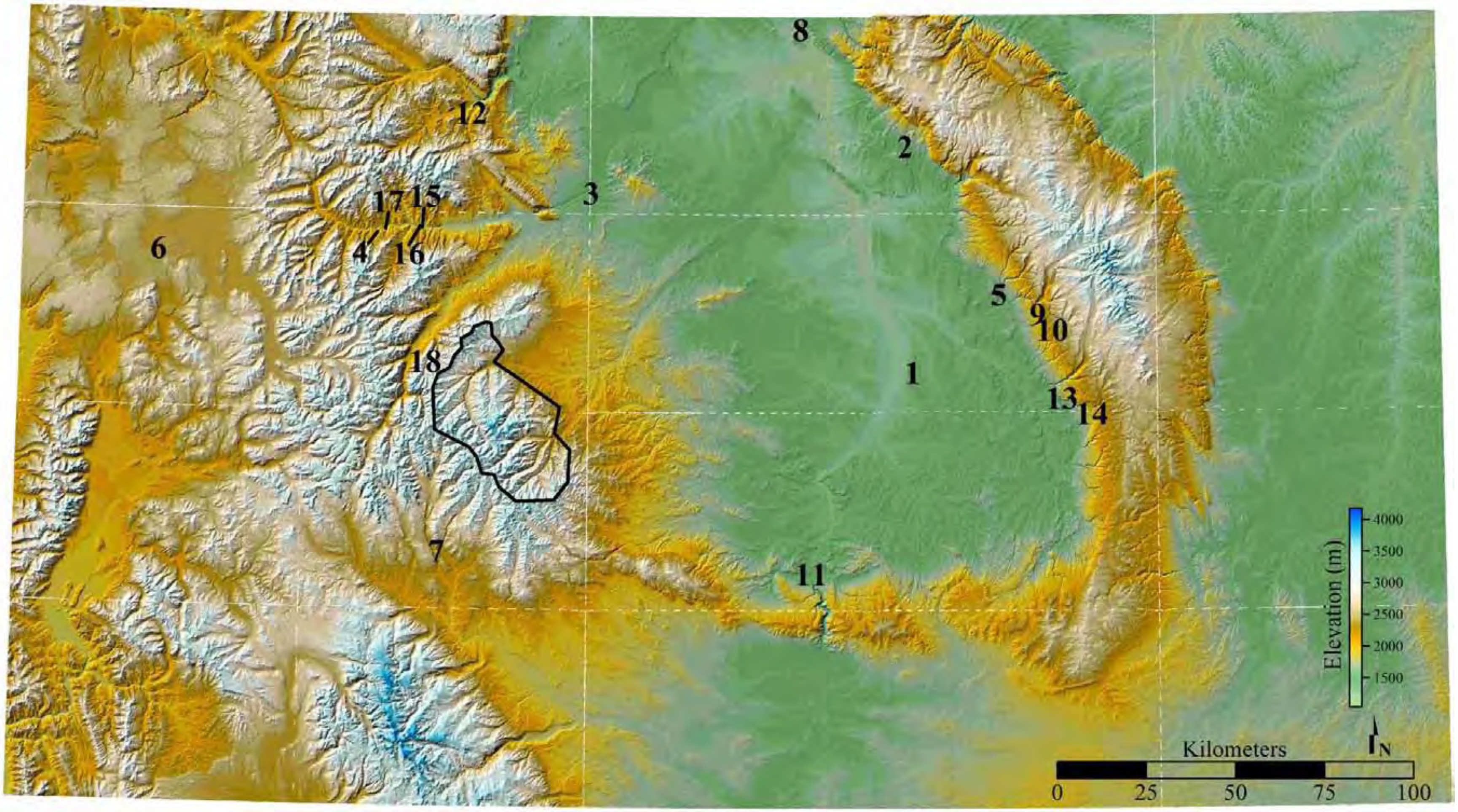


Figure 2.1. Study area in the montane Greybull headwaters (polygon) and selected sites relevant to the Upper Greybull chronology (see text for discussion): 1. Colby; 2. Hanson; 3. Horner; 4. Mummy Cave; 5. Medicine Lodge Creek; 6. Osprey Beach; 7. Lookingbill; 8. Bighorn Canyon Caves, including Bottleneck Cave, Mangus, and Sorenson; 9. Laddie Creek; 10. Southsider Cave; 11. Wedding of the Waters Cave; 12. Dead Indian Creek; 13. Daugherty Cave; 14. Pine Spring Cave; 15. Pagoda Creek; 16. Horse Creek; 17. Moss Creek; 18, Boulder Ridge.

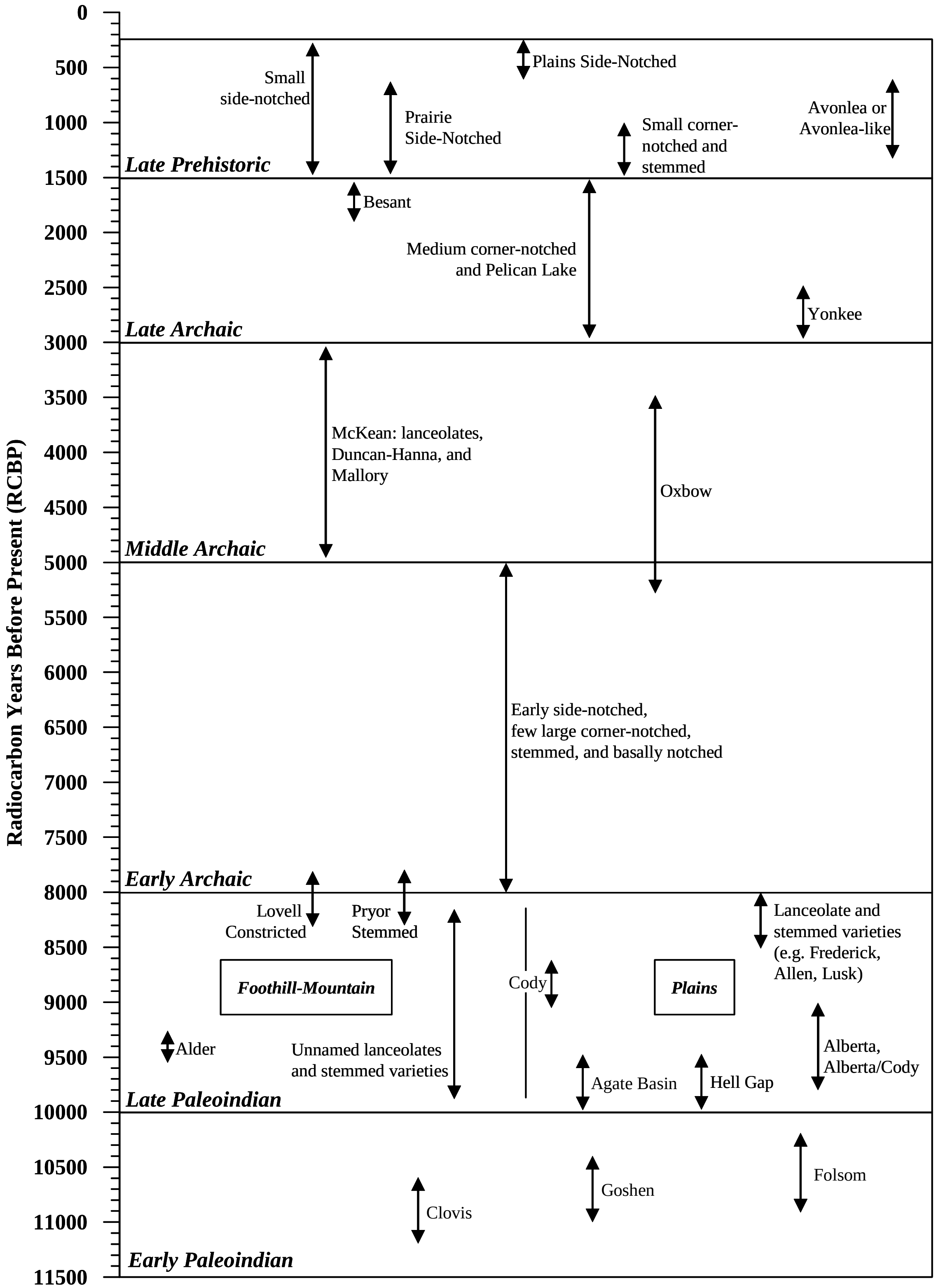


Figure 2.2. Idealized projectile point chronology for the Absarokas and surrounding areas. Data from Frison (1991: Figure 2.4, Tables 2.1 through 2.15), Greiser (1994), Kehoe (1966).

While projectile points are informative for a first estimate of the temporal variability in prehistoric occupation, activities not requiring extensive projectile point use may have caused certain occupations to remain unidentified. For example, a large animal trapping net from the Late Paleoindian time period (8860 ± 170 RCBP) was discovered in a cave on Sheep Mountain near Cody, WY (Frison et al. 1986). Frison and others (1986) suggest that the diameter of the cordage used to construct the net was much larger than what would have been necessary to procure small game, and that it may have been used in hunting larger artiodactyls, most likely mountain sheep (Frison et al. 1986; Frison 1997). This labile artifact would have decomposed long ago on the surfaces of the study area, and the use of trapping nets instead of projectile points would cause these groups to be unidentified in the surface archaeological record. With this caveat, the abundance of projectile points from the different time periods is presumed to roughly reflect the variability land use through time. In this chapter, a regional review of projectile point morphologies and associated sites is provided in tandem with a presentation of the Upper Greybull projectile point sample. This chronology of occupation is discussed from the earliest time period, the Paleoindian, to the latest prehistoric period, the Late Prehistoric.

PALEOINDIAN (CA. 11,500-8000 RCBP, 13,340-8860 cal BP)

The Paleoindian period is divided into two sub-periods: Early Paleoindian (11,500 to 10,000 RCBP or 13,340 to 11,460 cal BP) and Late Paleoindian (10,000 to 8000 RCBP or 11,460 to 8860 cal BP; Figure 2.2). The Early Paleoindian period in northern Wyoming starts with the Clovis complex sometime after 11,500 RCBP and ends with Folsom around 10,200 RCBP (Frison 1991:50). The earliest dated Paleoindian material in the region is at the Colby site in the southeastern Bighorn Basin (Figure 2.1). This Clovis-aged mammoth kill site produced bone collagen radiocarbon dates of 11,200 ± 200 RCBP, 10,864 ± 141 RCBP, and 8719 ± 392 RCBP, although the last date is considered too recent (Frison and Todd 1986:22). The other notable Early Paleoindian locality in the region is the Hanson Site, a Folsom quarry/workshop in the foothills of the Bighorn Mountains (Figure 2.1; Frison and Bradley 1980; Ingbar 1992). This site was radiocarbon dated four times, averaging 10,260 ± 90 RCBP (Haynes et al. 1992). Clovis and Folsom material is commonly found in the high meadows of the Bighorn Mountains at elevations above 2786 masl (Frison 1992) – well within the elevational range of the Upper Greybull project area. But as of 1997 there have been no Clovis, Folsom, Agate Basin, Hell Gap, Alberta, or Cody diagnostics reported from the Absarokas (Frison 1997), and none are in the Upper Greybull assemblage. Only two points from the Paleoindian period were documented in the Upper Greybull project area, and these are interpreted as Late Paleoindian.

Husted (1969; Husted and Edgar 2002:114) was the first to distinguish between Foothill-Mountain and Plains Late Paleoindian groups. Frison (1976, 1983, 1991, 1992, 1997) has also done much work in exploring this dichotomy. Both interpret the archaeological data from the two areas as representing two different types of cultural groups (Plains and Foothill-Mountain people) practicing unique subsistence strategies. This difference is hypothesized to have lasted no more than 2000 years, and only during the Late Paleoindian.

The Plains Late Paleoindian period in Wyoming starts around 10,000 RCBP (Frison 1991:Table 2.2) and is represented by a diversity of unfluted lanceolates, including the Agate Basin type (Irwin-Williams et al. 1973). The Hell Gap type may have developed from Agate Basin (Frison 1991:62). Other recognized plains types include Alberta, Alberta/Cody, and Cody diagnostics. The period ends around 8000 RCBP with what appear to be a number of regional variants of lanceolates and stemmed projectile points. Named terminal Paleoindian point types include Angostura, Allen/Frederick, and Lusk, but some of these styles are believed to be more variants on a theme than discrete typological units (Frison 1997; Sellet 2001).

The Cody Complex is generally included in the Plains group, but Frison (1992:339) suggests that the dichotomy between Foothill-Mountain and Plains groups may have been dissipating by Cody times. The type site of the Cody Complex, the Horner Site (Frison and Todd 1987), is in the Bighorn Basin downstream from Mummy Cave (Figure 2.1), yet at montane Mummy Cave there is no Cody material in the thickly stratified deposits that include sediments of Cody antiquity. Cody diagnostics were found at Medicine Lodge Creek (Figure 2.1), and this site also contained Foothill-Mountain Late Paleoindian diagnostics (Frison 1976). The complex is common to the lower intermontane basins such as the Bighorn Basin and across the Great Plains, but diagnostics have been found in the high meadows of the Bighorn Mountains (Frison 1992), and in the last ten years Cody finds have been reported from Osprey Beach, along the southern end of Yellowstone Lake (Figure 2.1; Cannon et al. 1996; Cannon et al. 1997:345; Shortt 2001). On a similar note but from the Southern Plains, Blackmar (2001) shows that the distribution of Cody projectile points is greater in woodland environments than in either plains or savannah environments. From Montana to Texas, a diversity of Cody Complex lifeways is apparently not at all limited to bison hunting and commonly included hunting and gathering in wooded and montane environments.

Foothill-Mountain Late Paleoindians have traditionally been interpreted as having a broader, more "Archaic" subsistence base than their Plains counterparts (Frison 1976, 1997; Willey and Phillips 1958:104-111). Plant gathering was presumably more important to the subsistence base of foothill-mountain foragers whereas the Plains Late Paleoindians are presumed to have heavier reliance on hunting. Grinding stones were found in association with charred seeds, fire pits, storage pits, and parallel-oblique lanceolates at Medicine Lodge Creek between 8520 ± 230 and 8350 ± 285 RCBP (Frison 1976). As will be seen, grinding stones are common components of assemblages containing Foothill-Mountain Late Paleoindian projectile points. Grinding stones were also found on the plains of eastern Wyoming at the Betty Greene site, which had terminal Plains Late Paleoindian diagnostics (Frison 1991:67). Thus, it seems that grinding stones were not unique to the Foothill-Mountain group, and if the Plains Late Paleoindians really were any different from those using the foothills and mountains, it is likely that they too used grinding stones and procured a diversity of plants and animals.

The Foothill-Mountain Late Paleoindian period starts between 10,000 and 9500 RCBP and begins with various unnamed lanceolates, often with parallel-oblique flaking, and a few stemmed point styles. The proposed Alder Complex (Davis et al. 1988) is the earliest named Foothill-Mountain Late Paleoindian manifestation in the region, and was radiocarbon dated to around 9400 RCBP at Barton Gulch (24MA171) in southwestern Montana (Davis et al. 1988). Lanceolate-bearing Paleoindian strata at Lookingbill have not been adequately radiocarbon dated, but within this assemblage are points described as similar to the Alder complex (Davis et al. 1988 in Frison 1991:Figures 2.40 and 2.41; Kornfeld and Barrows 1995), Hell Gap, and Haskett or Birch Creek B and C varieties (Swanson 1972 in Kornfeld and Barrows 1995).

At Mummy Cave, the Foothill-Mountain Paleoindian lanceolates are associated with ages ranging from 9230 ± 150 RCBP to 8100 ± 130 RCBP, spanning roughly 1100 years (Husted and Edgar 2002:36, 42). Similar points date to 8570 ± 230 RCBP at the Medicine Lodge Creek site (Frison 1991:Table 2.5 and Figure 2.33). Occupation I at the Mangus site in the Bighorn Canyon (Figure 2.1) contained twelve features, six lanceolate and stemmed Foothill-Mountain Paleoindian points, and four grinding stones among other artifacts. Two of the features were radiocarbon dated to 8690 ± 100 RCBP and 8600 ± 100 RCBP (Husted 1969:30), which is in the middle of the Mummy Cave lanceolate sequence. Seven percent of the 336 diagnostic Lookingbill projectile points are Foothill-Mountain Paleoindian lanceolates (Kornfeld and Barrows 1995).

One of two Paleoindian points in the Upper Greybull is interpreted a lanceolate base fragment with constricting lateral margins and a straight, ground base (Figure 2.3a). This artifact is only a basal fragment, and the distal basal morphology is absent. However, the portion that remains appears to be within the range of Late Paleoindian lanceolates and its age could be anywhere between 10,000 and 8000 RCBP. One other Late Paleoindian point was found in the Upper Greybull, and it is considered similar to the Foothill-Mountain fishtail or Lovell Constricted types that have been previously documented in the region (Figure 2.3b). Unlike Lovell Constricted points, the Upper Greybull specimen lacks a constriction above the base. While "Lovell Unconstricted" is tempting, it may be best to refer to it simply as a fishtail point (sensu Kornfeld and Barrows 1995).

Lovell Constricted points were first described by Husted (1969:12-13) from Occupation II of the Sorenson site (24CB202) in the Bighorn Canyon, which was dated to both 7800 ± 250 RCBP and 7560 ± 250 RCBP (Husted 1969:82). The point is described as a medium to large lanceolate with a slight but definite constriction just distal from the base, and with mildly convex blades distal from the constriction. Bases are often concave. Bottleneck Cave in the Bighorn Canyon also has a Lovell Constricted level (Occupation I) that was dated to 8270 ± 180 RCBP and includes two pieces of ground stone (Husted 1969:82). A single Lovell Constricted point was found in Layer 14 at Mummy Cave, which was dated to 7970 ± 210 RCBP (Husted and Edgar 2002:26). This is the youngest diagnostic Paleoindian point found at Mummy Cave. Between 23 and 25 Late Paleoindian fishtail diagnostics have been recovered from deposits at Lookingbill that have been dated to 8980 ± 80, 8880 ± 60, 8525 ± 100, and 7860 ± 90 RCBP, but Foothill-Mountain lanceolates were recovered from these deposits as well (Kornfeld and Barrows 1995). Comparing these dates to those from the Bighorn Canyon and Mummy Cave (above), it seems likely that the earlier two or three dates correspond with the lanceolates, and the latter one or two dates are associated with the Lovell Constricted material.

Figure 2.3. Paleoindian, Early Archaic, and Middle Archaic projectile points from the Upper Greybull: (a) late Paleoindian lanceolate; (b) Foothill-Mountain Late Paleoindian fishtail; (c) Late Foothill-Mountain Paleoindian or Early Archaic lanceolate; (d-i) Early Archaic side-notched; (j) Lovell Constricted or McKean Duncan-Hanna; (k) Late Paleoindian or McKean lanceolate; (l) Early Archaic or McKean Duncan-Hanna, weakly side-notched; (m-r) notched/stemmed Duncan-Hanna; (s-t) McKean lanceolate; (u) McKean lanceolate or Duncan-Hanna. Data are in Appendix B, Table 1.

The Pryor Stemmed point style (Husted 1969:51-52) is two levels above the Lovell Constricted level at Bottleneck Cave (Occupation III), and was dated to 8160 ± 180 and 8040 ± 200 RCBP (Husted 1969:82). Three grinding stones were found in the Pryor Stemmed Level at Bottleneck Cave, and grinding stones are a common component of other Pryor Stemmed assemblages in the Bighorn Mountains and foothills (Frison 1978). Pryor Stemmed is the last of the recognized Foothill-Mountain Paleoindian period points in northern Wyoming and southern Montana, with an approximate date range of 8300 RCBP to perhaps as late as 7800 RCBP (Frison 1991:71; Frison and Grey 1980). These stemmed and bi-beveled points are common to the foothill-mountains of the Bighorn and Pryor Mountains but not in the Absarokas (Edgar, personal communication in Husted 1969:86; Frison and Grey 1980). None were documented among the 336 diagnostics at Lookingbill (Kornfeld and Barrows 1995), and similarly none were found during the 2002-2004 Upper Greybull field research.

Frison (1983, 1997) indicates that Paleoindian surface finds are relatively common in the Wyoming high country, yet there is a low proportion of Paleoindian material on the surface of the Upper Greybull project area. What could cause this anomalous pattern? First, in areas containing Holocene sediment, a higher proportion of Paleoindian artifacts should be buried than those from the following time periods. However, there is no reason to believe that the Absaroka surface exposures are any younger than those in the Bighorn Mountains. Second, the high visibility of large Paleoindian points may have caused increased modern collection rates compared to other time periods. On the other hand, fairly obtrusive points from other time periods are commonly exposed on the surface of the project area and surprisingly close to trails and camping areas. The third possibility is that Paleoindian groups just did not commonly use this high country, or if they did, they didn't lose, abandon, or discard projectile points. For the moment, it is enough to say that surface Paleoindian artifacts are not commonly found in the watersheds of the Upper Greybull, and there is as of yet no definitive evidence of Paleoindian material pre-dating around 8200 RCBP in the Upper Greybull area.

Early Archaic (ca. 8000-5000 RCBP, 8860-5770 cal BP)

The shift from Late Paleoindian to Early Archaic appears to have occurred around 8000 RCBP and is proposed to be coincident with the dry Altithermal (Frison 1997). The diagnostic projectile points of the Early Archaic are large side-notched points with a triangular outline (i.e., "Early Side-

Notched" [Frison 1991:Figure 2.4]), as opposed to the lanceolate and stemmed points of the Late Paleoindian period.

Some researchers have argued that the niche space of some Early Archaic people changed in response to the Altithermal climatic episode (Antevs 1948). Early Archaic artifacts are more common in basin and range areas of Wyoming than they are in the plains, which indicates to some (e.g., Husted 1969; 2002; Mulloy 1958) that these hunter-gatherers did not occupy the plains during this period as they had done previously. Early Archaic components are indeed common to archaeological rockshelters and caves in the foothills and mountains of northwestern Wyoming (Frison 1991:83). The question of Altithermal abandonment of the plains is beyond the focus of this thesis, but continued research in the region has shown that there was no abandonment of the plains or basins (Reeves 1973). It appears that the Early Archaic subsistence base was diverse and that groundstone is a common assemblage component that might reflect predominantly plant processing, but these patterns are no different than several terminal Paleoindian assemblages in the region. What is different from the Late Paleoindian was the widespread use of semi-subterranean pit houses for the first time across the basins of Wyoming (Larson and Francis 1997). These house pits were likely used in the mountains as well, but none are known to exist for the Early Archaic. As previously discussed, Larson (1997) believes the data best support an Early Archaic montane forager strategy and basin collector strategy, but several researchers believe that these people had a predominantly collector orientation supplemented by more classic foraging behavior (short term residential camps) during only the summer months (Bender and Wright 1988; Metcalf and Black 1997).

The Mummy Cave and Lookingbill sites contain extensive radiocarbon-dated Early Archaic deposits (Husted and Edgar 2002; Kornfeld et al. 2001). Early Archaic radiocarbon dates from Mummy Cave range from 7630 ± 170 to 5255 ± 140 RCBP (Husted and Edgar 2002:26). These dates straddle others obtained from sites in the Absarokas and adjacent areas (Frison 1991:32). The Lookingbill site contains four separate Early Archaic levels with dates ranging from 7140 ± 160 to 6460 ± 90 RCBP (Kornfeld et al. 2001). An Early Archaic level (Occupation IV) at the Sorenson Site in the Bighorn Canyon was the most productive of all Holocene levels at this site. Charcoal from a fire pit in this level was dated to 5475 ± 190 RCBP (Husted 1969:15). The next Early Archaic level (Occupation V) at Sorenson was dated to 4900 ± 250 RCBP. Early Archaic sediments at Medicine Lodge Creek were not well-preserved, due either to a period of Altithermal deflation or subsequent erosion (Frison 1976). Still, Early Archaic diagnostics were found in a Medicine Lodge Creek stratum.

Large corner-notched and stemmed points have been documented in stratigraphic context at Laddie Creek (Frison 1991:Figure 2.45; Larson 1990), Medicine Lodge Creek (Frison 1991:Figure 2.46), Sorenson (Husted 1969:Plate 9), Southsider Cave (Frison 1991:Figure 2.45), Wedding of the Waters Cave (Frison 1962) and Mummy Cave (Husted and Edgar 2002:Plate 13), but still these are rare compared to the side notched varieties. Some of the unspecified Archaic points from the Upper Greybull could be Early Archaic corner-notched varieties (Figure 2.5).

Six diagnostic Early Archaic points are recognized from the Upper Greybull project area (Figure 2.3:e-l), contributing only 4.1 percent of the 147 diagnostic points (Figure 2.8). These are all medium to large side-notched points and are typical of specimens documented throughout montane northern Wyoming, including those from Mummy Cave (Husted and Edgar 2002:Plates 13-15) and Lookingbill (Frison 1983; Kornfeld and Barrows 1995) in the Absarokas and Medicine Lodge Creek (Frison 1976), Laddie Creek, and Southsider Cave (Frison 1991:Figure 2.45) in the Bighorn Mountains.

One peculiar point (Figure 2.3c) is either a Late Paleoindian or Early Archaic lanceolate. It weakly resembles the Late Paleoindian Haskett point (Butler 1965), but it is smaller, more symmetrical, and its base is more pointed than is typical of Haskett points. It is weakly similar to Cascade points (Drager and Ireland 1986:598), but this type is smaller and more teardrop-shaped than this Upper Greybull point. This artifact does not have a ground base and is presumed to be either Late Paleoindian or Early Archaic, but no solidly analogous points are known to exist.

Middle Archaic/McKean (ca. 5000-3000 RCBP, 5770-3200 cal BP)

McKean immediately followed the Early Archaic (Frison and Walker 1984). Sites from this time period are common across the central and northern plains and intermontane basins. Husted and Edgar (2002:101-105) suggest that McKean material is common from North Dakota to Nevada, California, and British Columbia, but the focus here is on the northwestern Plains and central Rocky Mountains. The type site of the McKean complex is the McKean site in the western foothills of the Black Hills (Mulloy 1954; Kornfeld and Frison 1985). Forbis (1985) suggested that evidence from Signal Butte I in western Nebraska, McKean in northeastern Wyoming, and Pictograph Cave in central Montana all have McKean components representative of a hunting-focused economy as opposed to representing "archaic" broad spectrum foragers. Reher and others (1985) showed that the Cordero Mine bison processing site (48CA75) in the Powder River Basin was similarly hunting-focused and that fire pits, boiling depressions, and boiling stones were likely used in meat processing. Similarly, the Scoggin kill and butchery site (48CR304) shows a McKean bison hunting focus in south-central Wyoming (Lobdell 1974). Throughout the 2000 years or so of the Middle Archaic (ca. 5000-3000 RCBP) in the northwestern plains, mountains, and intermontane basins, it seems likely that these people were avid hunters that gathered an unspecified amount of flora, but there is no unambiguous evidence of intensive plant processing in the Absarokas or the adjacent mountains. Frison and Walker (1984) suggest that the presence of grinding tools in McKean sites increases to the south in the central and northern plains McKean study area.

The three McKean projectile point styles are the McKean lanceolate, stemmed/notched Duncan-Hanna, and Mallory types (Davis and Keyser 1999). McKean lanceolates and Duncan-Hanna points co-occur in most assemblages (Davis and Keyser 1999; Frison and Walker 1984). Both of these styles typically have indented or notched bases. The same groups may have used the different point styles contemporaneously for different purposes (Davis and Keyser 1999). Davis and Keyser (1999) use morphological and breakage data to suggest that the lanceolates were used on thrusting spears and the Duncan-Hanna varieties were atlatl dart points. Duncan and Hanna varieties were originally considered typologically distinct (Wheeler 1954) but Davis and Keyser (1999) have shown that there is morphological overlap between these varieties and that Duncan points are likely resharpened Hanna points. Thus, the two varieties have been compressed into the Duncan-Hanna type. Assuming that this functional dichotomy between the lanceolate and Duncan-Hanna points is correct, it appears that both thrusting spears and atlatl darts were commonly employed in McKean hunting strategies.

The other major Middle Archaic projectile point style common to the north of the Absarokas is Oxbow, named from the Oxbow Dam site in Saskatchewan (Nero and McCorquodale 1958). Most of the Oxbow material appears to be in the northern plains of Saskatchewan and Alberta. The Sun River site provides well-documented evidence of Oxbow in northern Montana (Greiser et al. 1985). Oxbow material was excavated from Layer 30 at Mummy Cave, and is intermingled with McKean Lanceolates and Duncan-Hanna varieties. An Oxbow point was also found at the Edgar Site in the Oregon Basin of the Bighorn

Basin, southeast of Cody, Wyoming. It was exposed on a palimpsest surface that contained everything from Folsom to Late Archaic and possibly Late Prehistoric (Coe 1959). Breckenridge (1974) found an Oxbow point on the southern end of the Upper Greybull project area, off of a tributary of the North Fork of the Wood River (Cascade Creek). A date of 4450 ± 125 RCBP from the Powers-Yonkee Bison Trap in the Powder River Basin (Bentzen 1962) gave early indications that Yonkee was part of the McKean complex, but other radiocarbon assays from this and several other Yonkee sites indicates that Yonkee is solidly a Late Archaic manifestation (see Todd et al. 2001 for a list of Yonkee radiocarbon dates).

The two radiocarbon-dated Middle Archaic sites of the Absarokas are Mummy Cave (Husted and Edgar 2002) and Dead Indian Creek (Frison and Walker 1984). McKean Lanceolate, Duncan-Hanna, and Oxbow points are found in the Layer 30 at Mummy Cave, and both McKean Lanceolate and Duncan-Hanna points are found at Bottleneck Cave and Dead Indian Creek. The four radiocarbon dates from Layer 30 at Mummy Cave range from 4420 ± 150 to 4090 ± 140 RCBP (Husted and Edgar 2002:26). Three radiocarbon dates from Dead Indian Creek range from 4430 ± 250 to 3800 ± 110 RCBP (Frison and Walker 1984). A similar date of 3820 ± 220 RCBP was returned from a McKean level at Bottleneck Cave (Husted 1969:82), and a hearth at the multicomponent Platt site in Cody, Wyoming (48PA848) produced a date of 3400 ± 310 RCBP (WYSHPO 2004) that may be associated with two Duncan-Hanna points collected from the site surface (Platt and Hughes 1986). Middle Archaic/McKean artifacts are present at the Lookingbill site, with several Duncan-Hanna points collected from the site surface (Frison 1983). The buried Middle Archaic deposits at Lookingbill have apparently been heavily bioturbated and redeposited by rodents (Kornfeld et al. 2001). Frison (1983) reports that a surface lithic scatter about one kilometer north of Lookingbill at an elevation of 2865 masl contains Duncan-Hanna points, grinding tools, and fire pits.

McKean artifact diversity is extraordinarily rich at Mummy Cave, with a variety of intact labile organic remains, including hair, hide, cordage, basketry, wood, and bone (Husted and Edgar 2002:59-70). As for the breadth of diet expressed in the Mummy Cave data, there is one striated grinding stone (metate), a possible lightly-used mano, a digging stick, and several pieces of coiled basketry presumed to relate to plant processing. Some of the cordage in Layer 30 could have been used as an animal trapping net as has been documented from earlier times (e.g., Frison et al. 1986). The basketry recovered may also have functioned in plant procurement, but there is no direct evidence of this. At Mummy Cave, just as at the McKean sites mentioned above, there is evidence of a hunting focus with supplementary plant processing.

Dead Indian Creek is located in the Sunlight Basin of the northern Absaroka Range at an elevation of 1859 masl (Figure 2.1). This site yielded data regarding McKean montane subsistence (Frison and Walker 1984). Included at Dead Indian Creek are the remains of a pit house and a possibly ceremonial low rock wall and associated pile of six large mule deer frontals and antlers (Simpson et al. 1984). Dentition studies of fauna in the lower level at the site indicate that the occupation spanned several winter months (Frison and Walker 1984). A total of 43 manos and metates were recovered (Simpson et al. 1984). Other groundstone specimens include a pendant, a steatite pipe, five hammerstones, and two sandstone abraders. Just as at Mummy Cave, bone tubes were found in the Dead Indian Creek McKean component. Dead Indian Creek has numerous projectile points (n = 566), mainly from the McKean complex with a few Late Archaic Pelican Lake points included. While the number of groundstone implements seems large in comparison with other radiocarbon-dated McKean sites in Wyoming, the ratio of projectile points to groundstone is still quite high, which indicates a hunting focus supplemented by casual plant processing. Frison and Walker (1984) suggest that the artifact diversity in the Dead Indian Creek McKean component is representative of broad spectrum “archaic” foragers as opposed to that of hunting specialists.

Mule deer were the most numerous archaeofauna at Dead Indian Creek, represented by a MNI of 50 mandibles (Fisher 1984; Scott and Wilson 1984). Other fauna include mountain sheep (MNI = 16 for the distal left humerus), bison (MNI = 4 for the distal left tibia), elk (MNI = 2 for the right astragalus), pronghorn (MNI = 3 for the right mandible), and black bear (MNI = 1). Additionally, several lesser fauna are represented but with ambiguous association to the human occupation of the site (Fisher 1984; Scott and Wilson 1984). Based on patterns of tooth eruption from the mule deer assemblage, occupation occurred between October and March (Simpson 1984).

In the Upper Greybull project area, between nine and twelve McKean points were found (Figure 2.3: j-u). Of the 146 points assigned to a definitive time period, the nine McKean points represent 6.1 percent of the diagnostic projectile point assemblage. At least two are McKean lanceolates (Figure 2.3: s, t), and at least six are Duncan-Hanna (Figure 2.3: m-r). If the lanceolates are from thrusting spears and the Duncan-Hanna points from dart points, as has been suggested by Davis and Keyser (1999), then it appears that dart technologies resulted in more broken and discarded projectile points than those discarded from spear use. Causes of this higher number of dart points could include higher proportionate use or higher proportionate breakage of the dart tips versus the spear tips. No Mallory or Oxbow points were documented by CSU, but Breckenridge (1974:23) documented an Oxbow point on the southern end of the project area.

As a whole, the diagnostic McKean/Middle Archaic record in the project area is sparse (Figure 2.8). Occasional Middle Archaic use of this part of the Absarokas has been unambiguously demonstrated, but with only nine documented Middle Archaic points there is currently no evidence of sustained Middle Archaic use of the Upper Greybull.

Late Archaic (ca. 3000-1500 RCBP, 3200-1380 cal BP)

After reviewing 220 Late Archaic sites in the northwestern Plains that were believed to contain Pelican Lake diagnostics (Wettlaufer 1955), Foor (1982:97) emphasized the region-wide emphasis on large artiodactyl hunting, particularly for bison. The assemblages of his sample were found in several plant communities but were often in proximity to freshwater. Foor (1982:98) separated these sites into two broad categories: kill sites (i.e., locations or special use areas) and base camps, while separating the latter into the equivalent of temporary residential sites (Foor 1982:123) and field camps. An emphasis was made on the reliance of Pelican Lake communities on bison kills as major contributions to their diet (Foor 1982:98-122). While this hunting-focused economy certainly appears to have been widely practiced during the Late Archaic, a diversity of other subsistence strategies were likely employed in Wyoming.

Evidence of Late Archaic pit houses has emerged from the Wyoming Basin (Frison 1991:105), and although they have not been found in the mountains or foothills, they are most likely present there as well. These could be indicative of a collector strategy with less residential movement than would be anticipated in a hunting-focused economy. It is possible that a more nomadic hunting strategy was employed on the plains, while a more semi-sedentary broad spectrum foraging strategy with warm season mobile residences was common in the basins and ranges (Frison 1991:107). Plant processing was common in Late Archaic intermontane subsistence in Wyoming, as indicated by ground stone found in Late Archaic components at Bottleneck Cave (Husted 1969:62), Daugherty Cave (Frison 1968), Spring Creek Cave

(Frison 1965), and Wedding of the Waters Cave (Frison 1962). Digging sticks and basketry are occasionally present in these assemblages, and these too are indicative of plant processing.

The Late Archaic pattern from Mummy Cave is different from the Bighorn Basin and Bighorn Foothill-Mountain assemblages. At Mummy Cave, two Late Archaic levels are sandwiched between McKean and Late Prehistoric Rose Spring levels that both contain basketry and groundstone. These Late Archaic components include small amounts of grass cordage, but they demonstrate no evidence of plant processing for subsistence needs (Husted and Edgar 2002:70-73). No groundstone was found in an extensive excavation of a Late Archaic component at Pagoda Creek (48PA853), which is located less than 14 km downstream from Mummy Cave (Figure 2.1). Tooth eruption and wear patterns of 13 mountain sheep at this site indicate winter kills, and the site is interpreted as a short-term hunting camp (Eakin 1993:356). The faunal elements are highly fragmented, and among tens of thousands of artifacts removed from this site, the only other artifact class at Pagoda Creek is flaked stone. No groundstone or fire-cracked rock was found. This same general pattern is evident in data from the Horse Creek Site (48PA852). The thousands of artifacts consisted of highly crushed bone and flaked stone but no groundstone (Eakin 1986). Moss Creek (48PA919), also along the North Fork and only 2.6 km from Mummy Cave (Figure 2.1), has buried Middle and Late Archaic horizons in addition to a Late Prehistoric surface component (Eakin 1999). Again, no ground stone is associated with the hearths and thousands of pieces of highly fragmented bone and flaked stone. Because these are buried open air sites, labile artifacts such as cordage or basketry are not expected to have been preserved, if present. They need not be present, however, to infer from the lack of any lithic plant processing tools that these were not broad spectrum foraging residential bases, and were instead hunting camps. Data from the North Fork of the Shoshone River, in comparison with the Foothill-Mountain Bighorn data, indicate that subsistence strategies in the Absarokas were likely more hunting focused than those in and around the Bighorns.

The morphological theme of Late Archaic projectile points is medium to large corner-notched or weakly stemmed projectile points with random flaking and base shapes including eared, concave, straight, and convex proximal ends (Figure 2.4). Although not found in the Upper Greybull, the Late Archaic Besant point trends toward side-notched. Archaeologists subsume much of the morphological variability of the corner-notched points under the “Pelican Lake” style first identified at the from the Mortlach site in

Figure 2.4 (page 1 of 3). Late Archaic projectile points: (a-f) concave base, sharp barbs and tangs; (g-m) narrow-notched concave to straight-based with pointed tangs; (n) pointed tang with a slightly concave base and an ambiguous notch; (o-q) slightly stemmed corner-notched with pointed tangs and barbs; (r) possibly resharpened, corner-notched; (s-ac) straight base with rounded tangs and sharp barbs (when present). Data are in Appendix B, Table 1.

Figure 2.4 (page 2 of 3). Late Archaic projectile points, continued: (ad-ak) weakly stemmed points with wide corner-notches, straight to slightly expanding stems, and straight to slightly convex bases; (al-ap) medium to large weakly stemmed points with wide corner-notches and expanding, convex bases with pointed barbs and tangs; (aq-as) medium-large weakly stemmed points with corner-notching and convex bases with rounded tangs; (at-bc) medium corner-notched points with narrow notches, convex to nearly straight bases and pointed barbs and tangs. Data are in Appendix B, Table 1.

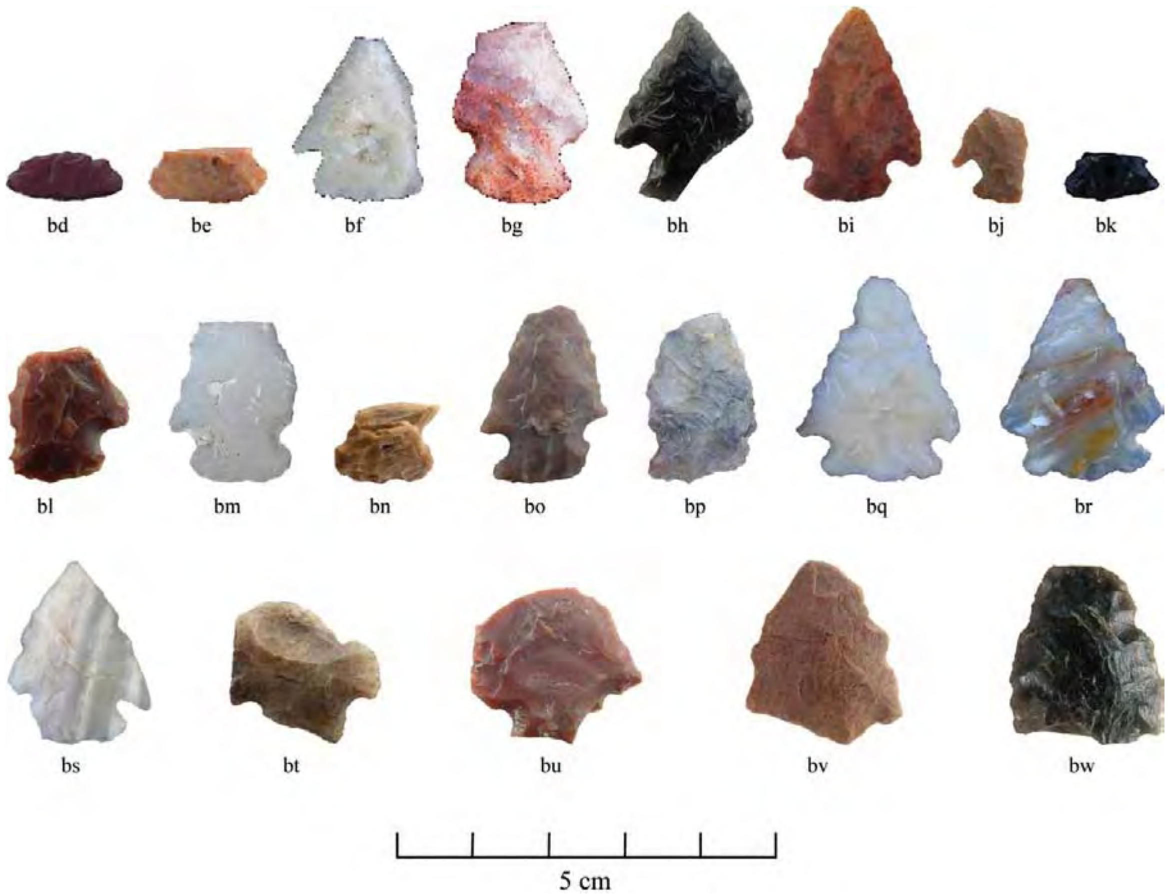


Figure 2.4 (3 of 3). Late Archaic corner-notched projectile points, continued: (bd-bk) narrow notches, pointed to slightly rounded tangs, and convex bases; (bl-bp) narrow notches, rounded to slightly rounded tangs, and slightly convex bases; (bq-bs) narrow notches, slightly convex base with lightly-rounded tangs and two shallow basal notches; (bt-bw) miscellaneous corner-notched point fragments with fragmentary or missing bases. Data are in Appendix B, Table 1.

Saskatchewan (Wettlaufer 1955). The Upper Greybull is along the western boundary of what has been defined as Pelican Lake country in Wyoming (Foor 1982:30, Figure 4). Several of the Upper Greybull Late Archaic projectile points fit within the range of variation of Pelican Lake projectile points, but the range of variation in Pelican Lake styles has not been adequately defined to date. Seventeen of the Upper Greybull Late Archaic projectile points fit well within the variation of what others have defined as Pelican Lake morphology (Figure 2.4a-q; Frison 1991:Figure 2.59p-t, 1998:Figure5.6; Wettlaufer 1955). The two other notable point styles within the Late Archaic of the northwestern plains are the Yonkee and Besant points, although neither of these styles has been documented in the Upper Greybull. Yonkee points have small eared bases and are found most often in the Powder River Basin (Bentzen 1962) to the east of the Bighorn Mountains. Besant is a large side- and corner-notched point easily confused with those of the Early

Archaic. Besant is also found in the Powder River Basin (e.g., the Ruby Bison Pound [Frison 1971]), but has a wider range mostly to the north (Wettlaufer 1955). Besant is a terminal Late Archaic dart point style that may have coexisted with people using Avonlea arrow points in the Late Prehistoric period, after approximately 1500 RCBP (Frison 1991:111).

Unspecified Archaic (ca. 8000-1500 RCBP, 8860-1380 cal BP)

Archaic projectile point typologies include similar point styles for different periods and different point styles for the same periods. For example, side- and corner-notched points are found both in the Early and Late Archaic, although side-notched is more common than corner-notched in the Early Archaic, and vice versa. Lanceolate, stemmed, corner-notched, and base-notched points were common during the Middle Archaic, but Late Paleoindian lanceolates can be similar to McKean lanceolates. Medium to large corner-notched points can be found in Mummy Cave levels dating anywhere between 7630 ± 170 and 2050 ± 150 RCBP (Levels 16, 28, 32, and 34), spanning the entire Archaic period (Husted and Edgar 2002:45, 54, 70, 72). Given these ambiguities, the "unspecified Archaic" category is used to refer to points whose age could be anywhere between 8000-1500 RCBP (Figure 2.5). Forty-four of the Upper Greybull points are from the Unspecified Archaic time period, comprising 21 percent of the projectile point sample (n = 204), excluding those points that are completely nondiagnostic (see Appendix B, Table B.1).

One series of unspecified Archaic points (Figure 2.5m-r) has been a common discovery in the Upper Greybull. These stemmed points have wide, obtuse notches, convex bases, and in our sample they exhibit asymmetry in the notch angles. A scouring of the regional radiocarbon dated sites and associated projectile points has produced no analogues to this series, and for the unspecified Archaic period this is the point style that would benefit the most from attempts at absolute dating of associated debris. Excavation will be necessary for this, and the site most likely to produce intact subsurface deposits from this time period is site 48PA2776.

Late Prehistoric (ca. 1500-200 RCBP, 1380-250 cal BP)

The Late Prehistoric period is defined by the use of bow and arrow technology and is associated with changes in projectile point morphology. The most notable change is the reduction in neck or haft width (Figure 2.9). Just as in the Archaic period, there was likely a diversity of subsistence strategies

Figure 2.5 (1 of 2). Unspecified Archaic projectile points: (a-c) stemmed with wide-angled notches, sharp to slightly rounded tangs, slightly rounded barbs, straight to slightly convex bases; (d) stemmed with a ground, slightly expanding base with rounded tangs and right-angled barbs; (e, f) large corner-notched points with convex bases and rounded barbs; (g, h) narrow stemmed/corner-notched points with rounded tangs and a slightly convex base; (i) corner- and basally-notched point of Middle or Early Archaic age; (j-l) side-notched points with straight and convex bases; (m-s) stemmed, open-notched points with rounded barbs and tangs and convex bases. Data are in Appendix B, Table 1.

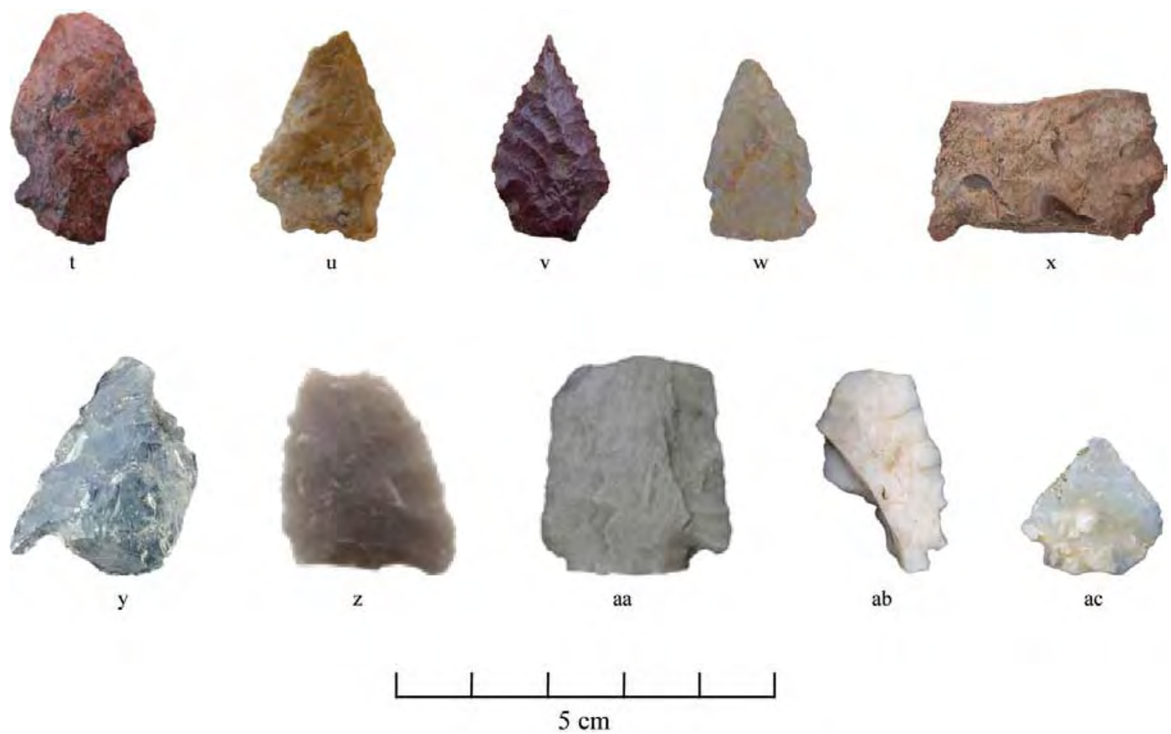


Figure 2.5 (2 of 2). Unspecified Archaic projectile points, continued: (t) side-notched point with a shallow basal notch just below tang and a highly convex base; (u-v) stemmed points with constricting bases; (w) shallow side-notched point with a convex base and notches just above the base; (x-aa) large corner-notched point fragments lacking bases; (ab-ac) medium-sized corner-notched points lacking bases. Data are in Appendix B, Table 1.

practiced throughout the northwestern plains and adjacent areas, where there existed more of a hunting focus in the plains and a more "Archaic" broad-spectrum subsistence in the basin and range settings. Ceramics became common during the Late Prehistoric, and in the mountains of northwestern Wyoming, the most common type, although still rare, is termed Intermountain Pottery Tradition and has been proposed to be of Shoshonean origin (Mulloy 1958:196-200).

The first arrow points in northwestern Wyoming are morphologically similar to larger corner-notched dart points (Greiser 1994), thus making the age of a few small corner-notched points ambiguous (Figure 2.6). The early corner-notched arrow points have been documented under an Avonlea level at the Hastings Site in Montana (Greiser 1994). Evidence of pre-Avonlea bow and arrow points have been found in stratigraphic context in the northwestern plains (Davis 1988), and these strata indicate that the people who made Late Archaic dart points began also using arrow points within the last 2000 years (Davis 1988).

In addition to these Late Archaic or Late Prehistoric points, corner-notched arrow points identified as Late Prehistoric are possible early arrow morphologies (Figure 2.7as-aw).

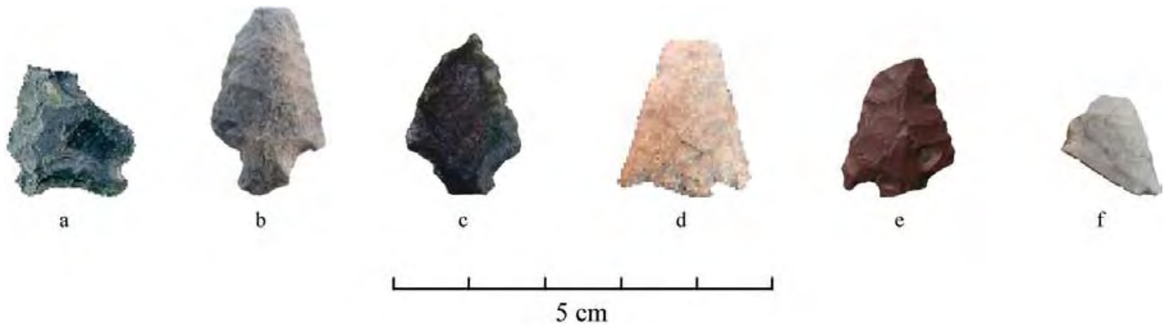


Figure 2.6. Late Archaic or Late Prehistoric corner-notched and stemmed projectile points. Data are in Appendix B, Table 1.

One Late Prehistoric Rose Spring-like corner-notched/stemmed point was documented in the Upper Greybull area (Figure 2.7a). Husted and Edgar (2002:106-110) cite evidence of this point type occurring in Wyoming, Colorado, Utah, southern Idaho, and throughout the Great Basin (Husted and Edgar 2002:106-110). Mummy Cave Layer 36 contains several of these points and dates to 1230 ± 110 RCBP. Frison (1991:114-116) cautions against using this name for the point style, because the idea of a cultural relationship between Wyoming and the type site in California (Lanning 1963) goes far beyond the data. The designation is used here for morphological description and to note its similarity with those found in the extensive Level 36 at Mummy Cave (Husted and Edgar 2002:Plate 36).

Avonlea is the first of the small side-notched arrow points (Kehoe 1966; Kehoe and McCorquodale 1961), and was used across the northern plains and adjacent areas from approximately 2000 to 700 RCBP (Morlan 1988). In Wyoming, however, the material is more recent (ca. 1500-800 RCBP [Frison 1988]). The Avonlea-like Wyoming material has been termed “Beehive” and “Benson’s Butte-Beehive Complex” from points documented at the Beehive and Benson Butte sites (Fredlund 1988; Frison 1988; Morlan 1988). The Wardell Bison Trap in the Green River Basin has similar points (Frison 1983), as does Occupation III of the Mangus Site in the Bighorn Canyon (Husted 1969:36). No definitive Avonlea or Avonlea-like diagnostics were located in the Upper Greybull, although a few of the side-notched varieties fit within the range of variation of Avonlea-like points (e.g., Figure 2.7 [b-d]).

Figure 2.7. Late Prehistoric projectile points: (a) Rose-Spring; (b-e) early Late Prehistoric; (f-i) Prairie Side-Notched; (j-ag) Plains Side-Notched; (ah, ai) tri-notched fox-eared (Shoshone); (aj, ak) small side-notched; (al-ao) Plains Side-Notched point fragments lacking basal morphology; (ap) possible concave-based Plains Side-Notched preform or unnotched arrow point; (aq, ar) unnotched arrow points with concave bases; (as-av) small corner-notched points believed to be Late Prehistoric in age; (aw) Late Prehistoric point lacking basal morphology. Data are in Appendix B, Table 1.

Prairie Side-Notched and Plains Side-Notched have been offered as two types of Late Prehistoric non-Avonlea point styles (Kehoe 1966; MacNeish 1954:39-40 in Kehoe 1966 and in Peck and Ives 2001), and several names have been proposed for essentially the same points across much North America. Because the documented Upper Greybull Late Prehistoric points are not in dateable or stratigraphic context, it is not fruitful to split this group up into several supposed variants indicative of temporal change. The one distinction that is useful for these non-Avonlea side-notched points is that of the Plains Side-Notched point, because they often date to less than 650 RCBP and are not morphologically similar to earlier arrow points (Kehoe 1966; Peck and Ives 2001). These points could become similar in appearance to earlier points,however, given raw material constraints and morphological changes resulting from refurbishing broken points. For the Upper Greybull sample, when the points were clearly Plains Side-Notched (i.e., sharp angles at base and/or and notches [Kehoe 1966]), then this was noted, but there was no attempt to definitively identify the earlier styles of side-notched arrow points. During the terminal prehistoric period, tri-notched points were common across the plains, and are associated with either Crow or Shoshone occupations. Five tri-notched points have been found in the Upper Greybull (Figure 2.7ae-ai). One (Figure 2.7ah) is fire-damaged and is on the edge of a dense, extremely fragmented and burned bone scatter from a diminutive artiodactyl (mountain sheep or mule deer; Site 48PA2772).

As this chronological overview has shown, the amount of land use in the Upper Greybull appears to have dramatically increased during the late Holocene. While excavations and a more comprehensive surface survey will be necessary to evaluate the potential that most of the earlier material is absent from the sample as a result of sediment aggradation, this chronology of land use derived from the projectile points is not viewed as definitive but rather a useful starting point for future investigations. A direct comparison of the Upper Greybull projectile points is presented in the next section for purposes of describing their variability in abundance, location, and morphology.

COMPARISONS

The quantity of projectile points found from the different time periods is highly variable (Figure 2.8). Late Archaic dart points dominate the diagnostic assemblage, while Late Prehistoric points are also relatively numerous compared to those from earlier Archaic and Paleoindian time periods. This pattern of Late Archaic dominance is the same in Yellowstone National Park to the west and northwest of the project area and Glacier National Park in Montana (Johnson 2001). From these large assemblages, it appears that Late Archaic material dominates the surfaces and near surfaces of the Wyoming and Montana Rockies.

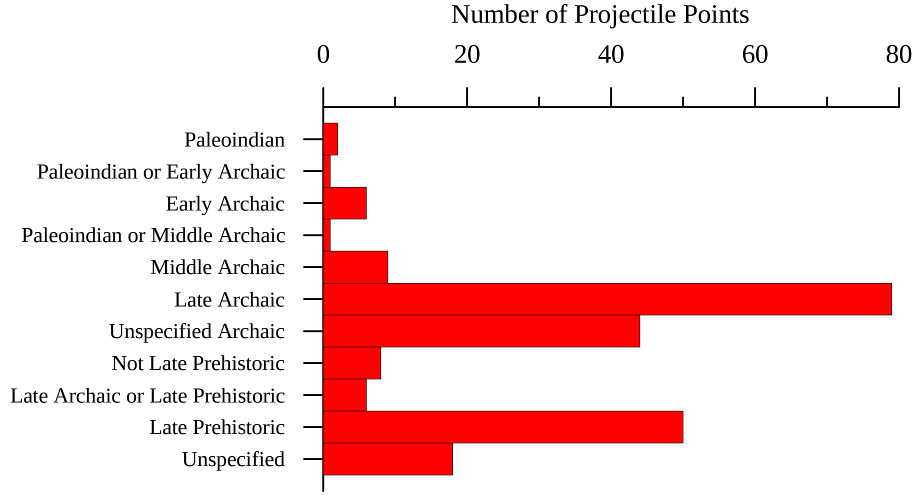


Figure 2.8. Number of projectile points per time period in the complete projectile point sample (n = 224), including those from general and unspecified time periods.

Because of sample size limitations prior to the Late Archaic period, it is unclear if use of the higher and lower montane elevations was more or less common through time (Figure 2.9). It is evident, however, that projectile points were deposited above 2900 masl but not as often as below 2900 masl. Finding these points in such diverse settings is indicative of the diversity of ecological communities used by the people of the Late Archaic. Given the data from the Upper Greybull, Yellowstone, and Glacier National Park it appears equally likely that montane land use intensified during the Late Archaic to a level unprecedented in prehistory.

Most of the documented projectile points retain basal morphology (Table 2.1), and neck width data are available for 70 percent of the projectile point assemblage (Appendix B, Table B.2). The neck (i.e., haft) widths of Early Archaic side-notched points tends to be larger than the smaller side-notched arrow points of the Late Prehistoric, although they overlap with those of the Late Archaic (Figure 2.10). The broader neck width of the Early Archaic could indicate that they were designed for low speed/high mass impact kills, as opposed to the narrower Late Archaic dart that were more advantageous in high speed deliveries (Hughes 1998). The overlap in basal morphology between the dart points of the Archaic causes some difficulty in assigning them to a time period within the archaic, which is why “unspecified Archaic” is a useful category.

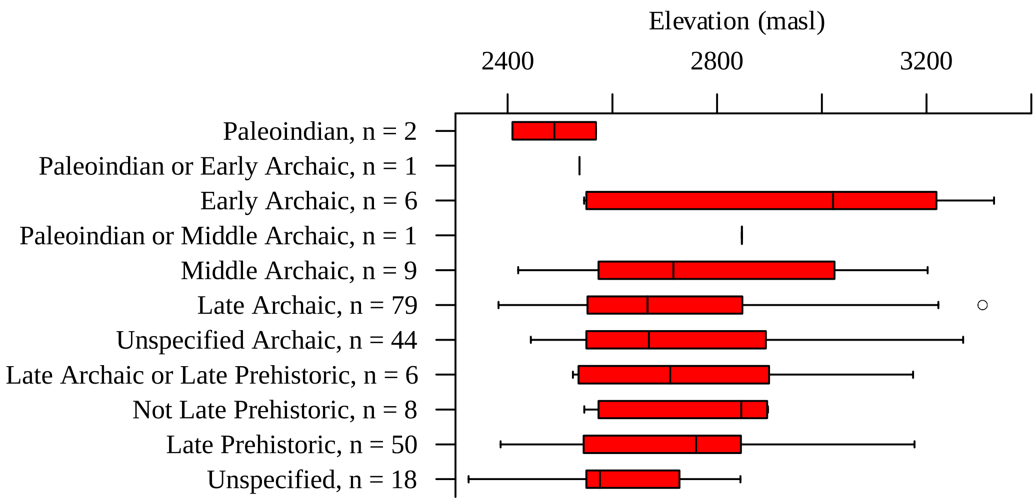


Figure 2.9. Box and whisker plot of the elevational variability in the projectile point assemblage (n = 224). The shaded area is the interquartile range (IQR) and is between the first and third quartiles (medians of the upper and lower halves). The median (i.e., second quartile) is within the IQR, and outliers exceed the maximum whisker length, which is 1.5 times the IQR.

Table 2.1. Projectile point completeness data. See Appendix B, Table B.2 for the dataset.

Portion	n	%
Complete	41	18.3
Distal (tip)	22	9.8
Distal and neck	2	0.9
Fragment	1	0.4
Lateral	2	0.9
Medial	25	11.2
Proximal (base)	44	19.6
Proximal and blade portion	87	38.8

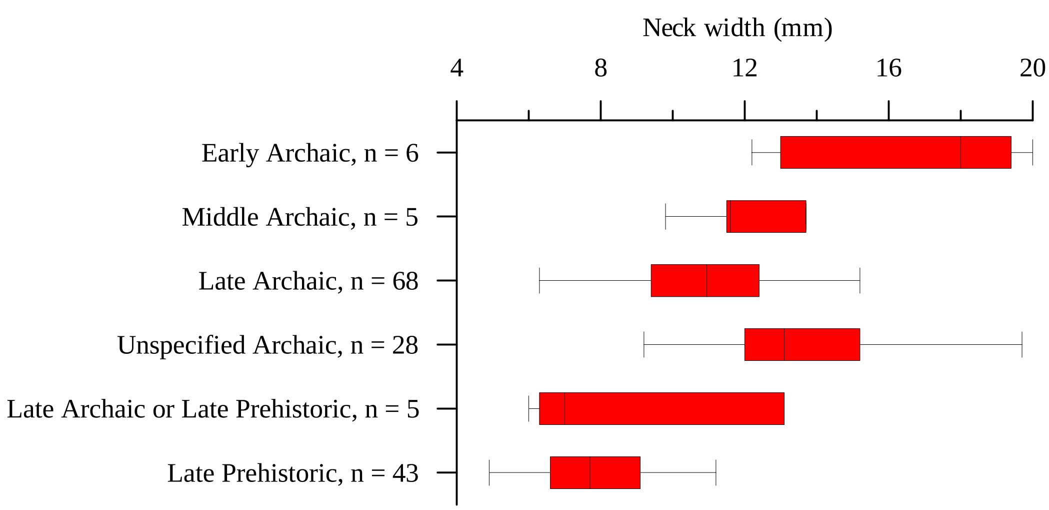


Figure 2.10. Neck width distributions per time period. See Figure 2.9 for a description of the box and whisker plot.

The Bighorn Basin and surrounding environs have been used prehistorically from around 11,200 RCBP (13,131 cal BP) to European contact. The amount of prehistoric people using the Upper Greybull changed through time, and there is evidence of a dramatic increase in the number of occupations after 3000 RCBP (3200 cal BP) marked by the corner-notched points of the Late Archaic period. This same pattern has been noted in Yellowstone and Glacier national parks (Johnson 2001), indicating that this was a regional phenomenon.

Throughout the prehistoric occupation of the region, the continental climate has been markedly seasonal. Warm summer temperatures are replaced with frigid winter temperatures accompanied by deep snows in the high country. Reducing mobility and biotic resource availability in the high country, the cold season caused an incongruence between resource availability and mobility structure. This elicited a collector pattern of land use (Binford 1980), marked by long-term winter residences in the foothills and lower montane elevations with little to no residential mobility and increased mobility and high elevation land use during the warm season. Food caches were necessary to accommodate the reduction in winter mobility, and this requirement promoted bulk food procurement and processing near the end of the warm season. A foraging pattern represented by increased residential mobility and frequent moves was used during the summer months, but by the fall the winter surpluses were procured and the hunter-gatherers shifted again toward the collector part of the forager/collector continuum.

The archaeological pattern of discarded broken projectile points mostly in the middle montane elevations indicates that resource procurement in the Upper Greybull commonly involved camping in the middle montane elevations (ca. 2600 – 2900 masl). During this camping, broken projectile points were occasionally discarded in the course of toolkit maintenance. From these middle montane camps, the higher montane elevations were used for task-specific procurement activities (e.g., hunting, gathering, and toolstone procurement). To provide a more colorful picture of the activities performed across the Upper Greybull and the surrounding region, artifact assemblages need to be analyzed, rather than only the projectile points. Deriving and analyzing variability in Upper Greybull artifact clusters will provide the basis for more detailed interpretations of prehistoric land use than is offered by the diagnostic artifacts themselves.

Chapter 3: The Clusters

Traditionally, one of the methodological limitations of an off-site or artifact-based approach to archaeological documentation has been the lack of spatial control over artifacts documented in the course of mobile field work. Detailed spatial control over "sites" was traditionally easier than for entire landscapes because mapping around a stationary site-specific datum was much easier than mapping across large areas with only topographic references as datums. This changed with two major methodological advances: modern GPS and GIS technology. It is now relatively easy and affordable to record the locations of individual artifacts to the nearest five meters or less across landscapes of any size. In the Upper Greybull, individual artifacts were most commonly provenienced using uncorrected handheld GPS receivers (Garmin© 12XL® in 2002 and Wide Area Augmentation System (WAAS)-enabled Garmin® Rino 110 and 120 in 2003 and 2004). Artifacts were occasionally provenienced using a sub-centimeter GPS (Sokkia© Locus®) or an EDM (electromagnetic distance measurement) total station (Sokkia© Set 4B®). The provenience data are easily manipulated in GIS, making this technology the second major methodological advance for an individual artifact-based approach to in-field archaeological documentation.

In addition to provenience data, individual artifacts were described in a spreadsheet to varying levels of detail (see Chapter 1, Figure 1.3, and Appendix A, Tables A.2 and A.3). Handheld computers (Compaq/HP© iPAQ®) were used to enter the data real-time into Microsoft© Pocket Excel® spreadsheets. When these computers were unavailable, data were entered into fieldbooks and later entered into a computer. Every artifact description included an artifact number received from the GPS receiver. This waypoint, the person's GPS initials, and the date of recording were used to merge the artifact data with the GPS data. After the data were in one file, they could be "cleaned" of errors, described, and analyzed on multiple scales. The scale chosen for this thesis is defined by the distance between artifacts. In this case, a distance of under five meters between artifacts was considered sufficient for grouping the artifacts into assemblages, or clusters, and this was easily done using GIS (ESRI© ArcView® GIS 3.2).

TESTING GPS ACCURACY

In a test of our handheld GPS accuracy, 537 artifacts at one site (48PA2721) were provenienced with both WAAS-enabled uncorrected handheld GPS (Garmin© Rino® 110) and the sub-centimeter EDM. The coordinates were mapped with the same projection (WGS84), but the handheld coordinates were downloaded and exported into a spreadsheet and the EDM coordinates were transcribed by hand and subsequently typed into a digital spreadsheet. The crew members performing the tasks were not given any special instruction during this test, and as a result they may not have waited until the GPS units had the maximum amount of accuracy possible before taking a provenience. This method has the advantage over more controlled, deliberate research into GPS accuracy because the data reflect the behaviors of college-aged students attempting to record artifacts at 3330 masl elevation in the cold wind, snow, and sleet. In other words, these methods mimic real world scenarios.

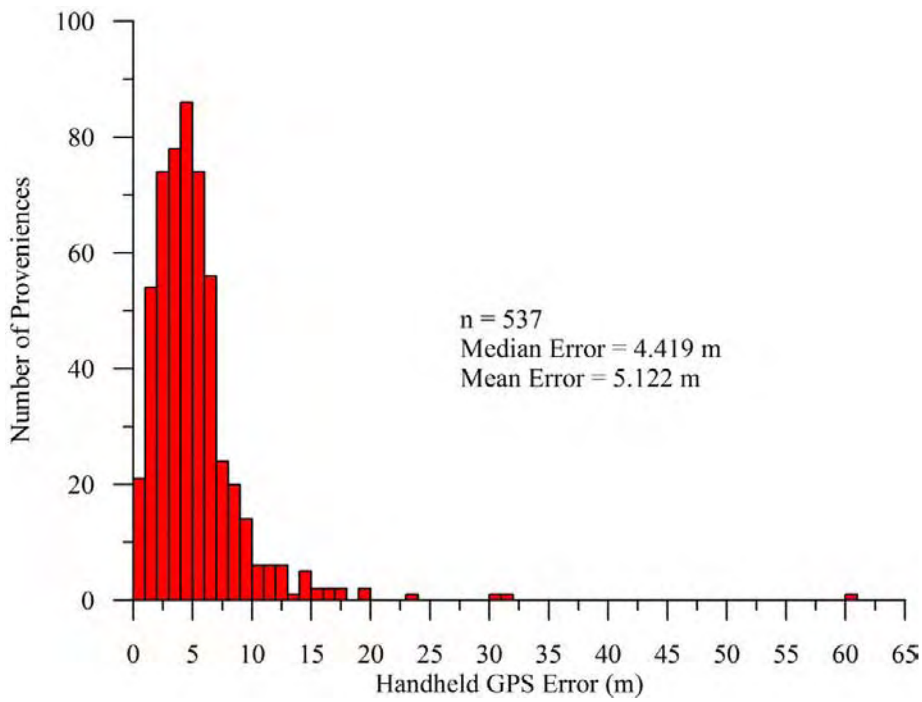


Figure 3.1. WAAS-enabled, uncorrected handheld GPS provenience deviations from sub-centimeter EDM proveniences in an alpine cirque at 3330 masl.

Results show that the handheld GPS has a median and average x-y error of around 5 m (Figure 3.1). However, GPS accuracy varies throughout the day and this sampling was only conducted between late morning and early evening. Still, these results are consistent with more controlled tests of accuracy with similar Garmin devices (Londe n.d.). Elevation error is only slightly greater than the x-y error, with a median error of 5.097 m and a mean error of 5.597. Assemblage elevations were derived by averaging the elevation data per assemblage. This small study shows that it is inappropriate to interpret spatial relationships between artifacts provenienced with uncorrected handheld GPS on a scale of less than five meters in the x-y plane. The results are pertinent to GIS-based artifact clustering because the spatial relationship between artifacts is the determining variable for cluster inclusion.

Clustering Method

Buffer and clip functions available in ArcView® GIS 3.2 were used to create and extract artifact concentrations, or clusters, from the Upper Greybull flaked stone database. This "proximity buffering" method requires that two parameters be defined before the GIS can extract clusters from the database. First, a minimum number of artifacts per cluster is specified. If the minimum number is too small, there can be too many clusters with small sample sizes. On the other hand, if the cluster requirement is too large, then a large amount of data will not be included in the clusters and there would be too few clusters for comparison. A minimum of five artifacts is required for a cluster in this study, although a minimum of 20 is used when statistical estimations need a larger sample size. The five artifact minimum was tailored to suit the density of artifacts within this particular study area.

The second of the two parameters necessary for this GIS-based clustering technique is the minimum spatial distance required for cluster inclusion, or buffer radius. This distance must meet two objectives. First, it must be large enough to minimize clustering error brought about by the provenience error inherent in uncorrected handheld GPS (Figure 3.1). A minimum distance of one meter between artifacts would poorly group the data because artifacts situated on top of each other in reality can show up as 5 or 10 m apart in the handheld GPS data. On the other hand, a large minimum distance (e.g., 30 m) between artifacts can cause too few clusters for comparison and produces too many multicomponent clusters (Figure 3.2). A maximum distance of 5 m was chosen for this project, primarily because 5 m is the mean error in the handheld GPS provenience data. Once the two cluster parameters were set, a GIS (ESRI© ArcView® GIS 3.2®) was used to extract the cluster data.

To extract the clusters, the artifact data were first projected as a theme in the GIS program. Then, a 2.5 m buffer was set around every artifact (using the "Create Buffers…" function (ESRI 1999), and these buffers were set to merge if they overlapped. This created bubbles around groups of artifacts that were no more than 5 m apart from each other (Figure 3.2). If these aggregates contained at least five artifacts, they were considered a cluster. The individual artifact data were extracted for each cluster from the complete database using the "clip one theme based upon another" geoprocessing function in ArcView®. The database was clipped based upon the cluster boundaries, and the clipped data from each cluster were exported from ArcView® to spreadsheets. A cluster identification column was added to each of these datasets and the separate files were merged back together into a single file that contains the flaked stone data from all of the clusters. This process created 269 clusters with anywhere between 5 and 5164 artifacts per cluster (Appendix C).

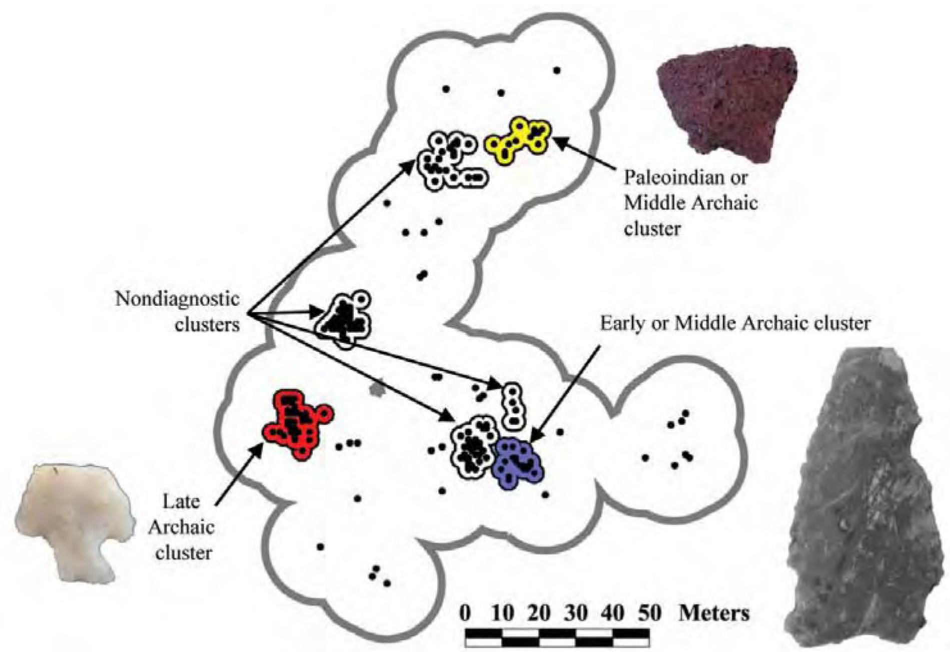


Figure 3.2. Example of clusters made with the proximity buffering function in ArcView® GIS 3.2 (ESRI 1999). The 15 m buffer radius is a useful site boundary, and the 2.5 m buffer radius delineates artifact clusters within the site (Site 48PA2775).

From a chronological perspective, four types of clusters were created by this technique: diagnostic, somewhat diagnostic, nondiagnostic, and multicomponent clusters. The diagnostic clusters are those containing projectile points whose morphology can only be attributed to one time period (Table 3.2). Because the temporal scale of behavioral interpretation used here is on the order of time periods spanning several hundred years, to qualify as multicomponent, a cluster must contain diagnostic debris from more than one time period, and not just more than one occupation from the same time period. For example, a cluster with a Late Archaic and a Late Prehistoric point is considered to be multicomponent, but a cluster with a Late Prehistoric Prairie Side-Notched point and a Late Prehistoric tri-notched point is not. The nondiagnostic clusters do not have projectile points whose age can be estimated. Using the methods described above, 38 diagnostic, 19 somewhat diagnostic, 204 nondiagnostic, and 8 multicomponent clusters were produced (Appendix C). Before the variability of these clusters is described, the issue of GPS accuracy and cluster association is addressed.

Cluster Accuracy

The accuracy of uncorrected GPS receivers not only affects the proveniences of individual artifacts as discussed above, but it also influences the spatial relatedness of sets of artifacts in clusters. Given their accuracy limitations it is easy to imagine a scenario in which clusters that are in reality discrete are blurred into more homogenous groups from the GPS proveniences. The GPS accuracy test showed that artifacts can easily be in reality on top of one another yet in the GPS data appear around five meters apart from each other. Given that the 2.5 m buffer radius does group artifacts that are over five meters apart, it is likely that some artifacts that should be included in clusters are being missed as a result of the GPS accuracy limitations. But to what extent does this provenience error affect the clusters?

To estimate the amount of cluster dilution that occurs as a result of the provenience error inherent in uncorrected GPS data, clusters are derived from both the uncorrected GPS provenience data and the sub-centimeter EDM data described above (Table 3.1; Figure 3.3). The clusters made from the sub-centimeter proveniences are considered the controls, and the test clusters are those compiled from the handheld GPS receivers. A few examples will show how the accuracy of the test clusters was approximated (Table 3.1). If a test cluster contains exactly the same artifacts as the control, then, for purposes of artifact association within a cluster, the handheld cluster would be 100 percent accurate. If a sub-centimeter cluster contained 100 artifacts but the handheld cluster only had 99 and these were the same 99 as were in the control, then the handheld cluster is considered 99 percent accurate. If the test cluster had 100 and the control also had 100, but one of the test cluster artifacts was different from those in the control, then the cluster is 98% accurate, with one percentage point subtracted for the missing artifact and another subtracted for the incorrectly included artifact. The data from site 48PA2721 indicate that handheld GPS cluster accuracy is positively correlated with assemblage size, with small clusters being more ephemeral in the dataset than the larger ones (Table 3.1; Figure 3.2). No clusters were blurred together in this small test, and the artifact population in the handheld clusters is surprisingly similar to that of the control clusters. In conclusion, the clusters created from the handheld GPS closely approximate the clusters that would have been derived from sub-centimeter proveniences.

Table 3.1. Number of artifacts in 2.5 m buffer radius clusters derived from "test" WAAS-enabled, uncorrected handheld GPS receivers (Garmin© Rino 110®) and a "control" sub-centimeter EDM (Sokkia© Set 4B®).

Cluster	Test	Control	In Test, Not in Control	% Accuracy of Test
1	30	31	0	97
2	462	465	3	98
3	8	8	1	75
4	0	6	0	0
5	21	21	1	90

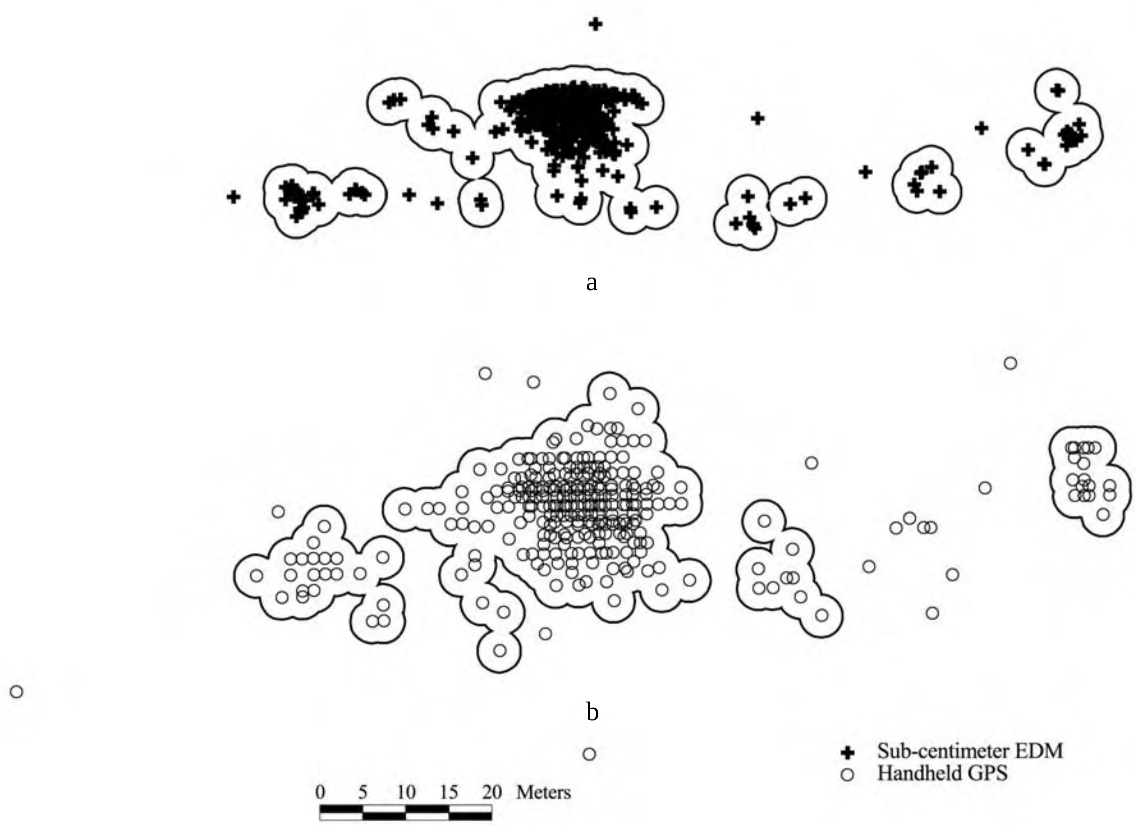


Figure 3.3. Comparison of sub-centimeter EDM (a) and uncorrected handheld GPS (b) proveniences (n = 537) and derived clusters. Note the spreading of the handheld proveniences compared to the sub-centimeter group.

Cluster Variability

This overview of the diversity in Upper Greybull flaked stone cluster attributes has three foci: assemblage sizes (number of artifacts), toolstone, and artifact types. For each topic, background information is provided first and is followed by an interpretation of the diversity apparent in the Upper Greybull clusters across space and through time. The diagnostic clusters (Table 3.2) provide assemblage data on individual time periods, but the high variability of sample sizes limits the statistical relevance of cluster comparisons from different time periods.

Table 3.2. Cluster types and numbers.

Time Period	Number of Clusters
Diagnostic Clusters	*38*
Early Archaic	3
Middle Archaic	1
Late Archaic	27
Late Prehistoric	7
Somewhat Diagnostic Clusters	*19*
Not Late Prehistoric	2
Paleoindian or Middle Archaic	1
Unspecified Archaic	16
Multicomponent Clusters	*8*
Paleoindian and Late Archaic	1
Paleoindian and Late Prehistoric	1
Early Archaic, Late Archaic, Unspecified Archaic, and Late Prehistoric	1
Middle Archaic, Late Archaic, Late Archaic or Late Prehistoric, and Late Paleoindian or Middle Archaic	1
Late Archaic and Late Prehistoric	4
Nondiagnostic Clusters	*204*

Assemblage Size Variability

Cluster artifact tallies are used to analyze the variability of assemblage size in the Upper Greybull (Appendix C, Table C.1). Cluster area (m^2) is not analyzed because the spreading effect of the handheld GPS proveniences exaggerates the sizes of larger clusters disproportionately to the smaller ones (Figure 3.3), and as a result the area calculations would not be a reflection of actual archaeological patterning.

Cluster sizes (i.e., artifact totals) are not normally distributed, but have a right skew with a strong mode at the small cluster sizes (Figure 3.4). Interestingly, the median assemblage size of all multicomponent clusters is vastly greater (median = 368) than that of the entire cluster population (median = 15). The median size of diagnostic and somewhat diagnostic clusters is 52. Multicomponent clusters are the products of several knapping episodes, and the differences in assemblage size reflect this repeated use.

If single component clusters were actually multicomponent but only lacked projectile points from the other time periods, then this large difference in assemblage size would not be anticipated.

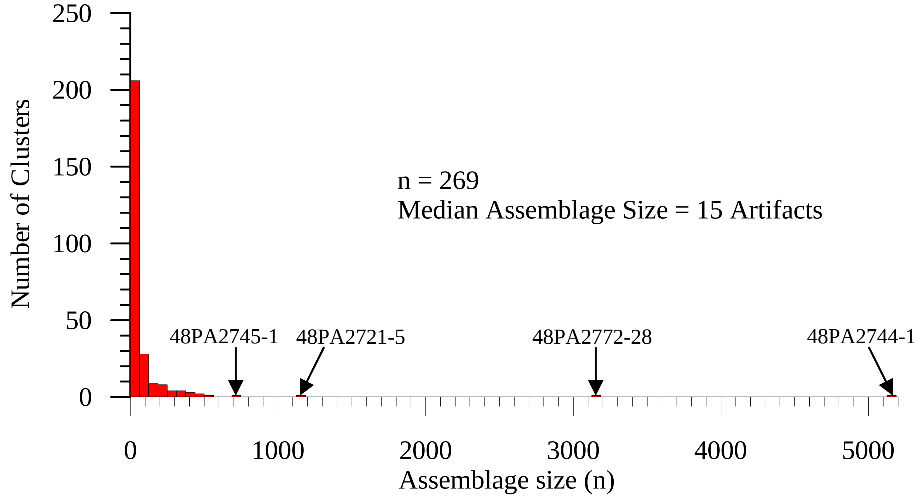


Figure 3.4. Assemblage size variability among the 269 documented flaked stone clusters in the Upper Greybull. Very large clusters are labeled.

Although the lower montane elevations (ca. 2200 to 2400 masl) have only been minimally sampled, all cluster sizes are found at all elevations (Figure 3.5). There is a tendency for the largest clusters to be in the middle montane elevations, between 2600 and 2800 masl. These represent repreated-use seasonal residential camping areas. The upper outliers of the large clusters (Figure 3.5) are the high-altitude workshops adjacent to the Dollar Mountain toolstone source (Reitze 2004) and are not presumed to be the result of residential camping but more likely represent repeated episodes of toolstone procurement.

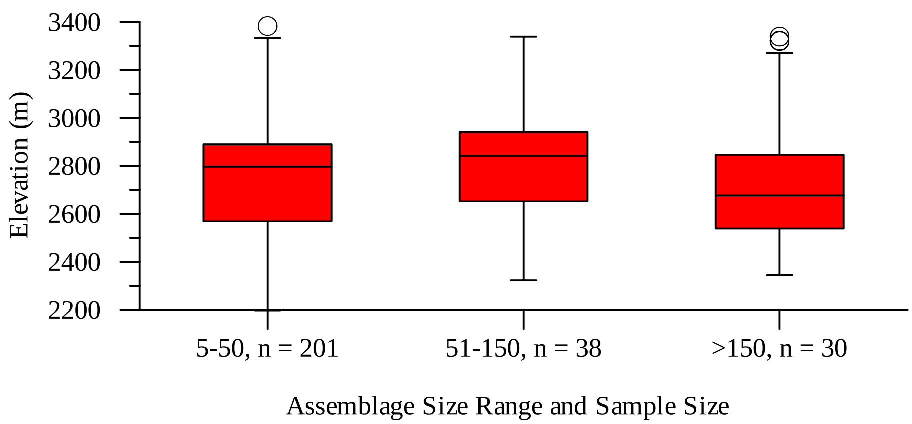


Figure 3.5. Range of elevations per cluster assemblage size (in number of artifacts per cluster). Arbitrarily defined small clusters have 50 or fewer artifacts, with medium clusters having between 51 and 150 artifacts and large clusters having over 150 artifacts. See Figure 2.9 for a description of the box and whisker plot.

Comparing the elevation and size range of different cluster types (Figure 3.6), it is apparent that the only two clusters with more than 1127 artifacts are multicomponent. Additionally, the smallest multicomponent cluster is medium-sized, consisting of 80 items. There are no small (i.e., under 50 artifacts) multicomponent clusters, and as a result, clusters with less than 50 artifacts are most likely the result of behavior during only one time period. Small diagnostic clusters, as expected, are relatively common. While the size of diagnostic clusters overlaps closest with that of the nondiagnostic clusters (Figure 3.6), diagnostic clusters tend to have 1127 artifacts or less. Located at the Dollar Mountain toolstone workshop (Site 48PA2721, Cluster 5), this largest diagnostic cluster contains only one diagnostic (an Early Archaic point) but likely contains debris from multiple time periods. Few discarded points are found at this site because it is not a residential camp where retooling activities are commonly performed in conjunction with other flaking behaviors. Excluding this cluster from the diagnostic assemblage leaves only one diagnostic cluster with over 400 artifacts (695 at Site 48PA2745, Cluster 1).

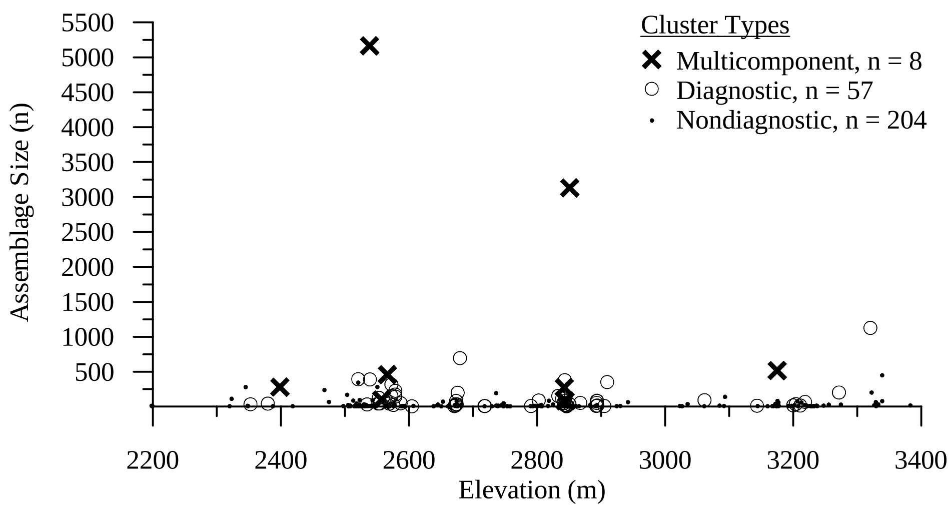


Figure 3.6. Assemblage size variability of the multicomponent, diagnostic (including somewhat diagnostic) and nondiagnostic clusters as a function of elevation.

Of the 201 nondiagnostic clusters, the largest contains only 450 artifacts. From this and the data on multicomponent and diagnostic cluster sizes, clusters with over approximately 400 artifacts are likely not only to contain projectile points but to contain points from more than one time period. Not only are assemblage sizes highly variable, but so are other aspects of these assemblages, such as toolstone and artifact type proportions.

Toolstone Variability

Upper Greybull toolstone sources are a combination of igneous and sedimentary materials, and several materials were imported into the watershed from distant sources. Variability in toolstone use is largely determined by a combination of resource availability, land use patterns, and anticipated need (Bamforth 1986; Binford 1979; Kelly 1988; Nelson 1991). Detailed lithic source information does not exist for the Absarokas, but a few patterns emerge that are informative of prehistoric behavior. Several types of raw material are locally available, and materials diagnostic of nonlocal outcrops (mostly obsidian) are also evident. "Local" toolstone sources are defined as those within the watersheds of the project area (i.e., Upper Greybull and Wood Rivers and their tributaries). Diagnostic nonlocal modified toolstone in the Absarokas is limited to obsidian and a small amount of Morrison Formation Quartzite/Siltstone.

Table 3.3. Toolstone types, codes, and quantities of all flaked stone artifacts documented in the Upper Greybull (n = 26,478).

Toolstone	Code	n	%*
Locally Available		*7351*	*33.1*
Basalt	BS	116	0.5
Chalcedony	CL	1175	5.3
Dollar Mountain Chert	DMC	2542	11.5
Dollar Mountain Quartzite	DMQ	4	0.0
Irish Rock Chert	IR	97	0.4
Madison Formation Chert	MAD	66	0.3
Metamorphosed shale	MS	6	0.0
Silicified wood	PWD	887	4.0
Quartz crystal	QTC	1	0.0
Silicified sediment	SLS	2401	10.8
Unspecified igneous	VO	56	0.3
Intermediate Source Distance		*1745*	*7.9*
Quartzite	QT	1745	7.9
Not Locally Available		*1330*	*6.0*
Obsidian	OB	1266	5.7
Morrison Formation Quartzite/Siltstone	QTM	64	0.3
Unspecified Source Distance		*11,759**	*53.0*
Chert	CH	11,759	53.0
Unspecified	US	4292	--
Not Dollar Mountain Chert	NDMC	1	0.0

* not including unspecified toolstone

Volcanic tuff deposited atop the aggrading Absarokas provided silica (SiO_2) that lithified a variety of Eocene material, including sediments, trees, pores, and cracks, producing a variety of toolstones in the

Absaroka Volcanic Province that were used throughout prehistory. Most of these appear to be chemical precipitates of silica (i.e., quartz) that transformed a host material into conchoidally-fracturing stone (Andrefsky 1998:50-51). The source of this silica is presumably volcanic ash that blanketed sediments and vegetation periodically during the formation of the range. Locally available toolstones all have a formational association with wet Eocene environments. Bogs, swamps, and marshes produced anoxic conditions necessary for the lignitization of wood (partial carbonization), which is a precursor to wood opalization or silicification (Wieland 1932). Although no silicified wood deposits comparable to those from Specimen Ridge in Yellowstone National Park (Knowlton 1899) have been documented in the Upper Greybull, smaller patches outcrop in the study area. Silicified sediments originated largely from fluvial deposits along Eocene streams of the aggrading Absaroka Plateau and are available in small patches throughout the Absarokas. The relatively large flake sizes of silicified wood and several other local sources (Table 3.4, Figure 3.7) are presumably the result of early stage reduction and the relatively large flakes derived from this material is indicative of source proximity. With a few exceptions, there is a tendency for the local materials to be represented by larger flakes than the nonlocal obsidian, which is represented by small flakes. This correlation of source distance and flake size is not new (e.g., Feder 1980:200; Jeffries 1982:108; Newman 1994), but the Upper Greybull data show that local materials (e.g., chalcedony, Irish Rock Chert, and Madison Chert), can also be represented by small flake sizes characteristic of toolstone from distant resources. The nonlocal Morrison Formation Quartzite/Siltstone is not smaller than local materials, with the population of flakes similar in size to quartzite and silicified wood (Table 3.4).

Table 3.4. Flake length descriptive statistics for all documented toolstone (n = 17,892). See table 3.3 for toolstone code descriptions.

Statistic	BS	CL	DMC	DMQ	IR	MAD	MS	PWD	QTC	SLS	VO	QT	CH	OB	QTM
Number of values	98	969	1042	2	77	50	3	720	1	2021	37	1553	10185	1070	55
Minimum	5.2	0.8	2.6	7.2	2.0	4.3	26.5	3.8	8.5	1.6	6.3	2.2	0.4	1.0	3.9
Maximum	89.9	47.1	87.5	8.1	41.8	36.3	32.6	53.8	--	99.4	80.3	90.8	80.7	86.2	35.8
Mean	24.6	10.8	18.5	7.7	11.7	11.7	29.8	14.8	--	16.7	19.0	15.1	11.6	9.4	15.5
Median	20.4	9.2	15.7	7.7	10.4	9.8	30.3	12.8	--	14.2	14.9	12.5	10.0	8.0	15.1
Standard error	1.6	0.2	0.3	--	0.8	0.9	--	0.3	--	0.2	2.3	0.3	0.1	0.2	1.1
95% CI	3.1	0.4	0.7	--	1.5	1.7	--	0.6	--	0.4	4.7	0.5	0.1	0.3	2.2
Variance	243.9	38.0	121.3	--	44.3	37.3	--	61.0	--	98.7	196.6	100.7	40.8	30.8	68.0
SD	15.6	6.2	11.0	--	6.7	6.1	--	7.8	--	9.9	14.0	10.0	6.4	5.6	8.2
CV	0.6	0.6	0.6	--	0.6	0.5	--	0.5	--	0.6	0.7	0.7	0.6	0.6	0.5

Judging from the archaeological abundance of the modified toolstone (Table 3.3), fine-grained silicified sediment was the most common local material used in toolstone production. Also common are silicified woods, and chalcedonies. Relatively small amounts of basalt, metamorphosed shale, and unspecified igneous material, presumably of local origin, were also knapped in the Upper Greybull (Appendix A:Table A.4).

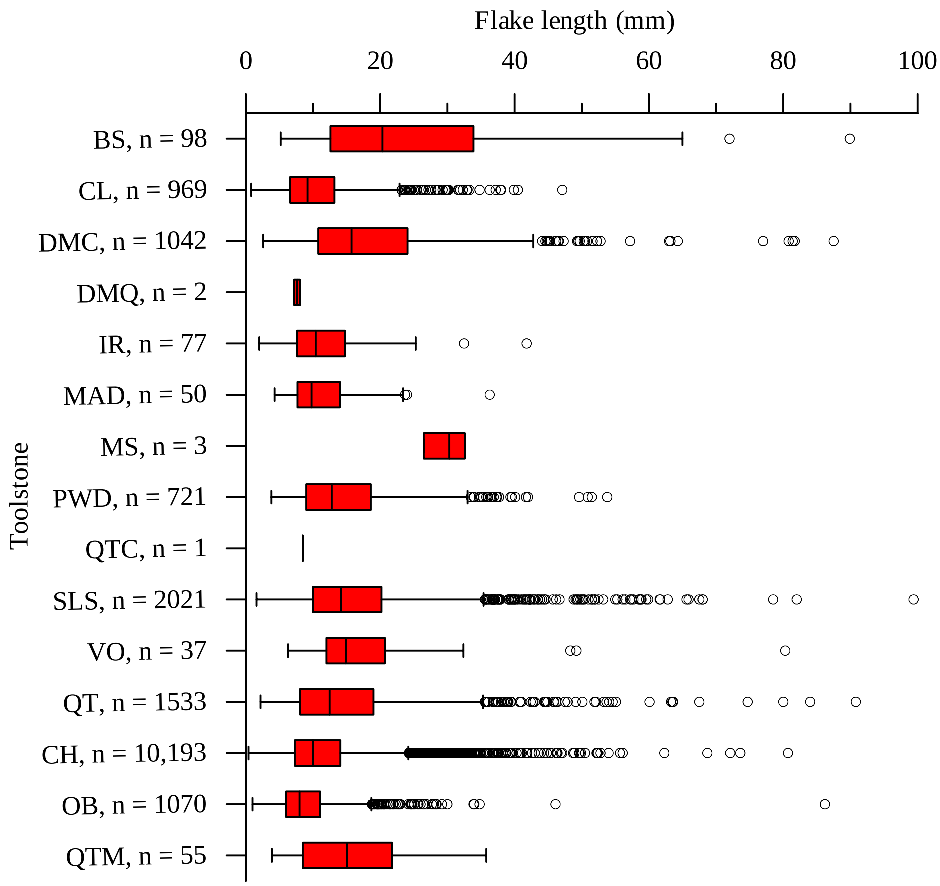


Figure 3.7. Flake lengths, including flake fragments, per material type (n = 17,892). See Table 3.3 for code descriptions. Note that nonlocal obsidian flakes tend to be the smallest, while local materials (see Table 3.3) are the largest. Nodule size limitations are hypothesized to have caused the local chalcedony (CL) flakes to be much smaller than other local materials.

One local green chert grades from opaque to translucent and has been coined “Irish Rock Chert” after an outcrop of the material on Irish Rock, which is located between the Greybull and Jack Creek montane watersheds. Rare Irish Rock Chert nodules in the Upper Greybull grade into hues of caramel and red. From the toolstone tallies (Table 3.3) this chert does not appear to be locally abundant. Although the material likely outcrops sporadically throughout the Absarokas in various colors, quality, and thickness, the name “Irish Rock Chert” is fitting for its dominantly green color. A Cody knife made of this or a similar material was found at the Osprey Beach Site on the southern shores of Yellowstone Lake (Shortt 2001), and this vitreous green chert is one of the more enigmatic toolstones for archaeologists of the Absarokas.

Given the size range of documented Irish Rock Chert flakes (Figure 3.7; Table 3.4), raw material veins or beds probably produce small workable toolstone nodules comparable to chalcedony. In addition to low overall quantity of available Irish Rock Chert, the small nodules may be a contributing factor to its low proportions in the toolstone sample (Table 3.3).

Dollar Mountain is a large chert source in the study area (Reitze 2004). The top of the mountain contains an isolated Paleozoic block of sedimentary chert-bearing limestones containing strata analogous to outcrops along the western edge of the Big Horn Range. Because the source contains large amounts of chert and is completely surrounded by Eocene igneous material, it offers a unique toolstone source that is relatively easy to identify in the upper montane basins surrounding this source. However, the macroscopic diversity of Dollar Mountain toolstone overlaps with that of the western slopes of the Bighorn Mountains (see Francis 1983) and possibly sources in the southern Absarokas (Love 1939:Figure 2). While it is reasonable to expect that most of the chert diversity adjacent to the outcrop is representative of the diversity of chert within the outcrop, the association becomes blurred with increasing distance (Table 3.5).

Table 3.5. Changing proportion of modified Dollar Mountain toolstone with increasing straight-line distance from the source. Only data with raw material descriptions and proveniences were used.

Distance (km)	Dollar Mountain Material (%)	Dollar Mountain Material (n)	Total Raw Material Data (n)
0-5	94	2100	2234
5-10	18	201	1098
10-15	1	3	234
15-20	1	49	9050
20-25	1	104	7767
25-30	0	1	536
30-35	1	6	691
Total	11	2464	21,610

In addition to the "Dollar Mountain Chert" material identified at this source area, Madison Chert was also identified in low quantities at the Dollar Mountain sites. Diagnostic features of Madison Chert are black dendritic (manganese oxide) inclusions. Reitze (2004:81) correctly states that the Madison limestone at Dollar Mountain "is not reported to contain any chert." However, the presence of this material in the Dollar Mountain workshops and the known occurrence of Madison limestone in the Dollar Mountain strata indicate that the presence of chert in this stratum is likely.

Unmodified quartzite nodules were noted in colluvium and alluvium that originated in the sedimentary Dollar Mountain strata, but the very low quantity (n = 6 of 1712 or .35 percent) of this material at a Dollar Mountain site (48PA2721) indicates that it was not intensively quarried. From these data, it is apparent that the majority of the documented quartzite spread across the project area was procured at the next nearest of sources: the base of the Absarokas immediately east of the project area.

Quartzite outcrops at the base of the Absarokas, and across the Bighorn Basin it is found relatively ubiquitously as rounded cobbles that mantle deflated Eocene surfaces and more recent terraces. Quartzite and chert outcrop in the southern Absarokas as well (e.g., at the Lookingbill site [Frison 1983]), but the greater distance to their sources probably limits their quantity in the Upper Greybull.

Unspecified chert accounts for 53 percent of the 22,186 flaked stone artifacts with toolstone data (Table 3.3). As a result, chert sourcing is the biggest problem in Absaroka toolstone research. Unfortunately, there is no foreseeable way to properly source most cherts in the field in the Absarokas, unlike the Bighorn Mountains where the majority of cherts are macroscopically identifiable to the formation (e.g., Francis 1983; Frison and Bradley 1983; Ingbar 1992).

Obsidian is unique from the most of the modified toolstone documented in the Upper Greybull because it not known to outcrop in the Absarokas. Given this limited availability, it surprisingly still contributes 5.7 percent to the documented toolstone assemblage (Table 3.3). The obsidian was most likely imported from the west, but a sourcing project is underway (Bohn et al. 2004) that will greatly clarify the degree to which the obsidian sources were utilized. The presence of obsidian indicates that groups traversed the Absarokas, probably in the course of a year, and in their travels acquired obsidian to the west and subsequently distributed it across the Absaroka landscapes, mostly as small waste flakes (Figure 3.7; Table 3.4). The presence of obsidian indicates that people did not simply move from the Bighorn or adjacent basins and into the Absarokas and back again in a pattern of seasonal transhumance, but instead worked across the mountains of northwest Wyoming and other ranges in the region that yield workable obsidian.

Morrison Formation Quartzite/Siltstone is the second diagnostic nonlocal toolstone identified in the project area. The size range of these flakes are quite large for a presumably nonlocal source (Figure 3.7; Table 3.4), and are of a size comparable to silicified wood and quartzite. Because of these large flake sizes and coincident wasteful lithic reduction, it is likely that this material dropped from the active toolkits of the hunter-gatherers in the Absarokas at a faster rate than did obsidian and chert, in which small flake sizes indicate obsidian and chert use was more conservative. Francis (1983:Table 38) came to the same conclusion after analyzing the use-life of Morrison Formation Quartzite/Siltstone in the Bighorn Basin and Bighorn Mountains.

Reviewing these trends in lithic raw material use, chert from unspecified sources dominates the lithic assemblage, however several local sources were also used. Dollar Mountain is the only large local toolstone source that has been identified, but large amounts of local silicified sediment indicate that it was extensively used in the area if not also extensively quarried from some as of yet unknown source. The proportion of obsidian present in the sample (5.7 percent) is not extensive but given its source distance, the presence of this raw material is indicative of intermontane land use. The nearest obsidian source is Obsidian Cliff, located 130 km (straight line) northwest of the northwestern Upper Greybull area.

Toolstone Variability Index (TVI)

Across the entire project area, 22,186 observations of toolstone type were made. The variability of this entire assemblage (Table 3.3) provides a baseline for assessing the variability of the toolstone composition in the artifact clusters. Comparing the observed toolstone variability per cluster to these baseline data through a simple equation facilitates an intercluster comparison:

$$V = (t_o - t_e)$$

$$TV = \Sigma|V|$$

$$TVI = (TV/TV_{max}) \times 100$$

where V = variability;
t_o = observed toolstone percentage (from the individual cluster data).
t_e = expected toolstone percentage (from the percent column in Table 3.3);
TV = toolstone variability;
TVI = toolstone variability index; and
TV_{max} = maximum TV value.

The V (variability) value is toolstone and cluster-specific, while the TV and TVI values are combinations of all toolstone V values for each cluster. V values are useful because they indicate the type of toolstone that is present in atypical proportions and to what degree (Appendix C, Table C.3). Instead of the five artifact minimum for cluster sizes, a 20 artifact minimum was used in computing the TVI values to minimize the effects of small sample sizes. TV values in the Upper Greybull sample range from 24 to 184.2 for the 106 clusters with at least 20 lines of toolstone data. Dividing the TV values by the largest TV value (TV_{max} = 184.2) and multiplying this value by 100 allows assemblage comparison on a 0-100 scale.

The toolstone variability index (TVI) provides a rough estimate of the uniqueness of the toolstone assemblages, and the individual V (i.e., variability) values indicate the toolstone type(s) that cause(s) the high TVI. With this index, the cluster with the most unique assemblage composition has a TVI of 100 (48PA2720-1), and the cluster whose toolstone composition is completely average receives a value of 0. The most average toolstone assemblage (smallest TVI) in the Upper Greybull is from cluster 48PA2799-6, with a TVI of 15, while the most atypical clusters are those completely dominated by only one material type (e.g., 100 percent quartzite in cluster 48PA2720-1, TVI = 100). Although all elevations have not been equally sampled, high TVI values are clearly found across all elevations (Figure 3.8a). Most of the high TVI values are found in the southern end of the project area (Figure 3.8b). These atypical clusters are largely the result from the high proportion of Dollar Mountain Chert around its source area. Such clusters are analogous to Binford's (1980) "locations," where extractive events were the focus of activities.

The hypothesis posed earlier, that most of the quartzite in the project area originated to the east in the Bighorn Basin, is supported by the atypical dominance of quartzite in the eastern portion of the project area (Figure 3.8c). Other local toolstones such as silicified sediment, chalcedony, basalt, and silicified wood dominate assemblages in the middle montane altitudes (Figure 3.8a), and these reduction areas are likely representative of initial toolstone reduction. However, these middle montane assemblages are not homogenous groups of single material types as is found around Dollar Mountain. Occurring at lower elevations than Dollar Mountain, it is likely that these reductive events occurred not at quarries and workshops (i.e., locations) but instead were performed at residential or field camps where several other raw material types were reduced in the same location.

Toolstone clusters with no diagnostic projectile points exhibit by far the most variability in TVI values (Figure 3.8d). This correlation was expected, because behaviors leading to the deposition of homogenous toolstone clusters (i.e., clusters with only one material type represented) are the result of limited behavioral events that are not presumed to include projectile point discard. Point discard is presumed to occur most commonly in residential settings, where broken artifacts are retooled after a day's procurement activities. Because residential areas commonly include several workable raw material types, point discard most commonly occurs in clusters characterized by a diversity of raw material types (low TVI values). The only exception is the rare point (n = 3) associated with Dollar Mountain workshop clusters

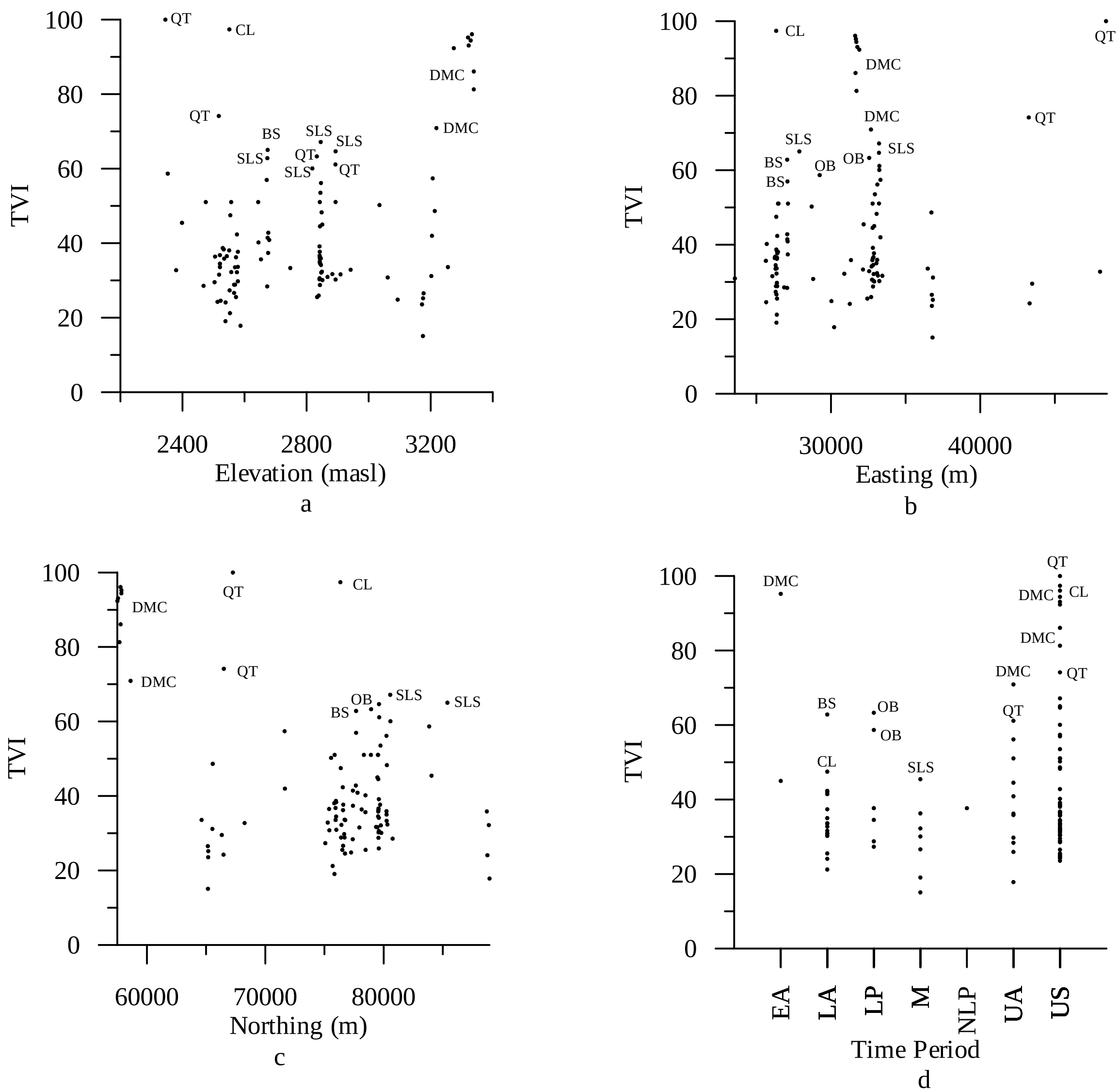


Figure 3.8. Four dimensions of toolstone TVI variability, showing gradients of elevation (a), easting (b), northing (c), and across the major prehistoric time periods. Selected toolstone with the highest V values in each cluster are labeled. See Appendix C, Table C.3 for toolstone V values per cluster.

(Figure 3.8d). Obsidian has the highest V value in only five clusters. Two are from unspecified time periods (48PA2772-13 and -30), another is a Late Archaic cluster (48PA2811-1), and the last two are Late Prehistoric clusters (48PA523-1 and 48PA2769-1). These data indicate that obsidian use in the Upper Greybull increased through the Holocene. Small sample sizes from other time periods precludes a test of statistical significance of this pattern, but Kornfeld et al. (2001) also noted an increase in late Holocene obsidian use at the multicomponent Lookingbill site, providing further evidence that intermontane mobility and associated obsidian deposition was more common in the late Holocene than earlier time periods.

Artifact Type Variability Index (AVI)

A total of 23,498 observations of flaked stone artifact type were made during the 2002-2004 field seasons (Table 3.6). As expected, the vast majority of documented items are unmodified flakes (87 percent). Of the modified flaked stone artifacts, edge-damaged flakes are the most common, followed by worked flakes, projectile points, bifaces, and cores (Table 3.6). The proportions of these artifact types per cluster is used here as a proxy of the behavioral diversity that led to the initial cluster deposition. For example, where a wide range of activities were carried out (e.g., residential or field camp), it is hypothesized that the artifact type diversity will be greater than in areas where the behavioral diversity was lower (e.g., locations such as procurement sites). Just as in the toolstone analysis presented above, the complete sample of artifact types from the project area (Table 3.6) provides a baseline for assessing the variability in individual clusters.

To assess the artifact type diversity of each cluster, a numerical estimate of artifact type diversity was created and is known as the AVI, or Artifact Variability Index. The AVI equation is similar to that of the TVI presented above, except that artifact type data are used instead of toolstone type:

$$V = (t_o - t_e)$$

$$AV = \Sigma|V|$$

$$AVI = (AV/AV_{max}) \text{ x } 100$$

where V = variability;
t_o = observed modified lithic percentage (from the individual cluster data).
t_e = expected modified lithic percentage (from Table 3.6);
AV = artifact type variability;
AVI = artifact variability index; and
AV_{max} = maximum AV value.

Debitage is excluded from this equation because its quantity tends to be much greater than the quantity of modified lithics, and AVI values including debitage are primarily driven by the variability in debitage content rather than by the variability of other artifact types. Clusters consisting only of debitage were still included in the AVI calculation, but only their zero values for modified lithics were incorporated into the AVI equation. Clusters with no modified lithics have an AVI of 52, which reflects the deviation in percentages of the modified lithics from the expected values (Figure 3.8). This mid-level AVI for samples with only debitage reflects that it is relatively unusual to have samples consisting entirely of debitage but

Table 3.6. Artifact types, numbers, and percentages for all flaked stone artifacts documented in the Upper Greybull (n = 23,498), not including unspecified artifact types (n = 2980).

Artifact Type	n	%	Modified Lithics %
Angular debris	938	4.0	--
Modified angular debris	18	0.1	0.9
Biface	215	0.9	10.9
Amorphous core	90	0.4	4.6
Flake	20,572	87.5	--
Edge-damaged flake	1002	4.3	51.0
Worked flake	329	1.4	16.8
Modified nodule	37	0.2	1.9
Other formal tool, including gravers and unifaces	14	0.1	0.7
Potlid	24	0.1	--
Projectile point	224	1.0	11.4
Scraper	35	0.1	1.8
Total	23,498	100.0	100.0

that the assemblage composition of clusters can deviate far beyond this pattern. For example, if clusters consisting entirely of debitage were the most atypical of the clusters, then the AVI would be 100, but this is clearly not the case.

The most average assemblage would have artifact proportions equal to those in Table 3.6. In the Upper Greybull, this cluster, 48PA2792-1, consists of 279 artifacts including a Late Paleoindian fishtail spear point (Figure 2.3b) and a Late Prehistoric side-notched arrow point (Figure 2.7d). The four most atypical assemblages (AVI = 100) have atypically large percentages of amorphous cores relative to the rest of the modified lithic assemblage (Appendix C, Table C.5). Amorphous cores comprise only 0.4 percent of the entire Upper Greybull flaked-stone sample (Table 3.6), and even one core in an assemblage with less than about 200 pieces of flaked stone is unusual. Atypically large numbers of bifaces and projectile points also make several large AVI values, but these values are not as large as those with the cores because cores are found only half as often as bifaces (Table 3.6). The V value of cores is larger than that of bifaces when one is present in an assemblage, and this causes higher AVI values for clusters with the same amount of artifact types but that include a core instead of a biface.

Comparing the AVI and artifact type V values across space and time (Figure 3.9), it is immediately apparent that both average and atypical artifact type assemblages are found across all elevations. Additionally, it is evident that the quantities of amorphous cores, bifaces, and projectile points drive most of the variability. Slightly more of the average and atypical assemblages are found in the northwest portion of the project area and at mid-elevations (ca. 2500 to 2900 masl). In this area, large projectile point V values are often the cause of the high AVI values (Figure 3.9). These are situated amongst a large number of low AVI clusters. Projectile point retooling involving point discard is presumably more often conducted at residential and field camps than at limited use locations, and the cluster data show that these camps are located at the mid-elevations and are concentrated in the northwestern portion of the project area, although this is the area most intensively sampled.

AVI variability with respect to time period shows that most diagnostic clusters consist of a relatively average artifact type population (Figure 3.9a), although a few have aberrantly large amounts of projectile points. Still, the variability in the artifact type population of the diagnostic assemblage is nothing like that of the clusters with no diagnostics. This temporal comparison shows that the diagnostic clusters mostly contain the "average" assemblages, while those that are not diagnostic contain a wider range of artifact proportions. Many of the unspecified clusters with high AVI values are interpreted as resulting from limited activities (i.e., locations) that produce idiosyncratic assemblages, while the unspecified clusters with low AVIs are most likely the result of behaviors similar to those that produced the diagnostic clusters but without the deposition of a diagnostic artifact. This AVI analysis is informative on the scale of assemblage-sized patterning, but comparison of a few artifact types, such as bifaces and cores, also has utility and is not possible with the AVI values.

Bifaces are documented about twice as often as cores in the Upper Greybull (Table 3.6). The biface to core ratio has been cited as roughly indicative of prehistoric mobility patterns (Cowan 1999; Kelly 1988; Larson 1990:202;). Cowan (1999) shows significant differences between combined site assemblages from four prehistoric time periods in New York and notes that the differences were largely driven by the relative amounts of cores and bifaces. He interprets the dominance of bifaces as the product of highly mobile task-specific logistical groups, whereas the dominance of amorphous cores indicates long-term base camps where all toolkits were not necessarily mobile. In the Upper Greybull bifaces are more common than cores, but neither is abundant (1 in 109 and 1 in 261 artifacts, respectively).

Larson (1990:Table 20) reports biface to core ratios for selected basin and foothill/mountain Early Archaic sites in northern Wyoming that are completely dissimilar to those found in the Upper Greybull. For example, Laddie Creek has a biface to core ratio of 61:11, or 5.5. The Folsom Hanson Site has a ratio of 56:10 (5.6), while the lower basin sites had lower ratios (Split Rock = 30:9 or 3.33, Sweetwater Creek =

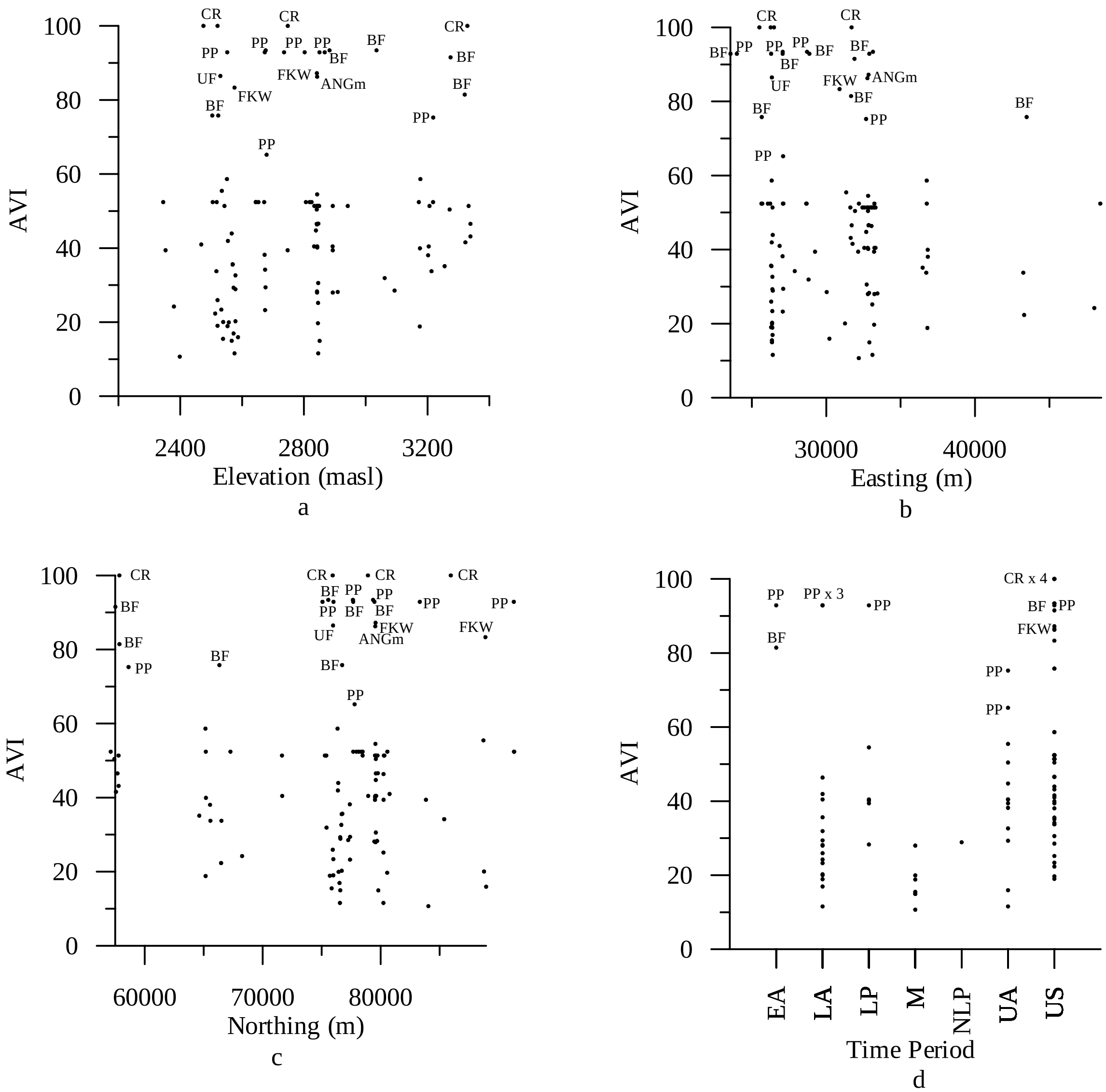


Figure 3.9. Four dimensions of artifact type variability (AVI), showing gradients of elevation (a), easting (b), northing (c), and across the major prehistoric time periods. The faint line of points with an AVI of 52 are those clusters consisting entirely of debitage. Selected toolstone with the highest V values in each cluster are labeled. See Appendix C, Table C.5 for artifact type V values per cluster.

5:6 or .83). The biface to core ratio is part of Larson’s (1990:202; 1997) interpretation of a highly mobile foraging lifestyle during the Early Archaic in the Bighorn Mountains and foothills compared to a more logistically oriented strategy practiced in the Wyoming intermontane basins. The current Upper Greybull biface to core ratio is 215:90, or 2.4. According to Larson’s presented data (1990:Table 20), the Greybull biface to core ratios conform more to patterns in basin sites, rather than to her two foothill/mountain sites.

Mid-elevation Upper Greybull clusters commonly contain a wide diversity of artifacts, including cores and bifaces. These assemblages are presumably field or residential camps and the majority of assemblages that are above 3000 m elevation likely the result of limited use activities (i.e., locations). Binford (1980) suggests that both highly mobile foraging strategies and semi-sedentary logistical orientations were likely to produce camps and locations. He asserts that logistically oriented hunter gatherers would also use caches and stations (e.g., lookout sites), but no unambiguous archaeological pattern in the Upper Greybull have yet been detected. Sites with phenomenal viewsheds have been documented, but no indication exists that they are the result of any specific settlement strategy. Given the ease of travel and availability of high mountain resources, the highest of the high country, including the tundra, was most likely used only in the summer months; however, the lower and middle montane elevations might have been habitable for much of the year and as a result were prime camping areas.

Looking at the variability in the biface to core ratio through time in the Upper Greybull, interesting patterns emerge (Table 3.7). The ratio is high for the Early Archaic and Late Archaic, but is low for the Middle Archaic and other less diagnostic clusters. While the Early Archaic pattern conforms nicely to the data presented by Larson (1990:Table 20) for other Early Archaic foothill/mountain sites, the large ratio was derived from the artifacts recorded at the Dollar Mountain workshop site (48PA2721). Although only an Early Archaic point was found in this cluster, the cluster is on a deflated surface with an extremely high density of surface artifacts that were very likely produced during several occupations rather than only during the Early Archaic time period. It is likely that bifaces were manufactured, broken, and discarded through several time periods on this site. While this behavior in toolstone reduction is informative, it should not be interpreted as unique to the Early Archaic. The Middle Archaic sample size includes only 88 artifacts and as a result the biface to core ratio for this time period is not informative. The Late Archaic clusters, on the other hand, are numerous and are associated with a high biface to core ratio. There is no easy explanation for this pattern and it is one that deserves further attention. It is possible that several of the bifaces were early in stage and not at all part of a curated toolkit geared for long distance transport.

The most fascinating aspect of the biface to core ratios of the Upper Greybull is not these tallies per time period but rather the relationship between the biface to core ratios of diagnostic and other clusters. For example, the Early and Late Archaic assemblages both have high biface to core ratios, but the unspecified Archaic ratio is very low. Multicomponent sites also have a low ratio, as do the "unspecified" clusters with no diagnostics at all (Table 3.7). There appears to be a tendency for a high biface to core ratio to be correlated with diagnostic artifacts, while the clusters with no diagnostics tend to have a low ratio. Comparisons of biface to core ratios among sites across a region (e.g., Larson 1990:Table 20) do not generally incorporate the difference between diagnostic and nondiagnostic clusters into the equation, but the Upper Greybull data indicate that biface to core ratios may be highly variable within different site types of the same time period, with sites involving projectile point discard tending to have a higher biface to core ratio than those without diagnostics.

Table 3.7. Number of bifaces and cores per time period. The biface to core ratio was derived by dividing the number of bifaces by the number of cores and modified nodules.

Time Period	Number of Bifaces	Number of Cores	Number of Modified Nodules	Biface:Core
Early Archaic	5	0	0	5.0
Middle Archaic	1	0	0	1.0
Late Archaic	31	2	3	6.2
Late Prehistoric	4	0	1	4.0
Not Late Prehistoric	1	0	0	1.0
Unspecified Archaic	9	12	1	0.7
Multicomponent	71	14	18	2.2
Unspecified	53	43	5	1.1

TVI versus AVI

If methods of assemblage comparison are to be used, it is best if they are both easy and replicable. The TVI and AVI equations could easily be applied to contract archaeological data where often little more exists than toolstone and artifact type tallies. Because these are the only variables required for calculating the TVI and AVI, the equations are applicable to existing and ever-increasing datasets. The office time necessary to prepare these values is minimal, especially if artifact tallies are systematically entered into project-specific databases. The V, TV, and TVI equations are easily copied across a spreadsheet to produce nearly automated results. Conclusions regarding assemblage level variability are often either lacking or minimal in grey literature, and these simple equations expedite this process while illuminating potentially unanticipated dimensions of variability.

One final way of interpreting the TVI and AVI data is to array them against each other (Figure 3.10). The cluster of points with the lowest TVI and AVI values are the most average in terms of toolstone and artifact variability, while those in with the highest values (Figure 3.10 upper right) are the most atypical with respect to these two dimensions of variability. There is no statistically significant relationship between TVI and AVI, but the distribution is informative in showing the range of variability in these attributes without diluting the data into arbitrary categories such as diverse or not diverse. High TVI values from Dollar Mountain Chert reduction areas are the result of being proximal to the source location, and assuming that TVI values tend to be high near sources, it follows that unknown sources can be identified by the variability in TVI of nearby assemblages. The highest V values in these assemblages are hypothetically the nearest source material.

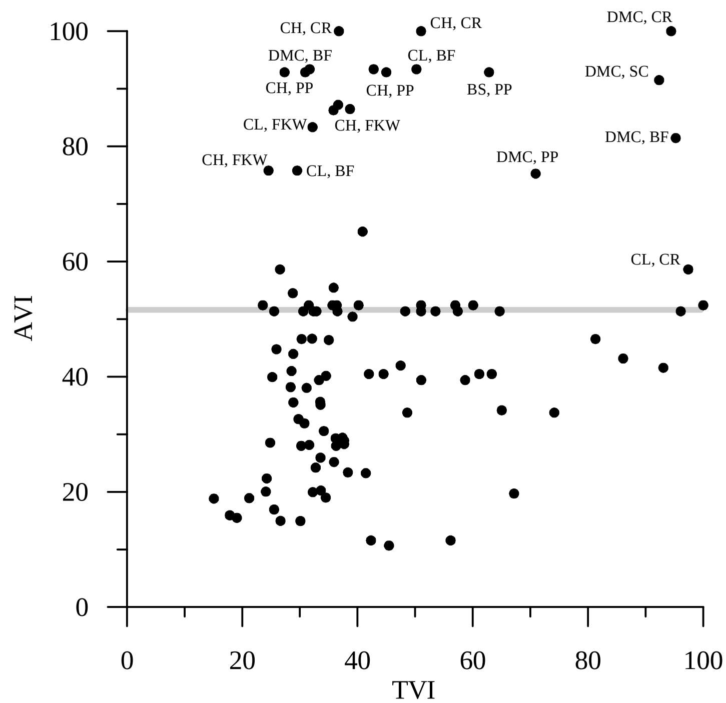


Figure 3.10. Comparison of Toolstone and Artifact Variability Indices (TVI and AVI) of the 104 clusters with at least 20 artifacts as well as toolstone and artifact type data. The gray line indicates an AVI of 52, which is the value of assemblages with only flakes present. Selected values are labeled with the toolstone and artifact type that contributes the most positive V values (See Appendix A, Table A.3 for code descriptions and Appendix C, Tables C.3 and C.5 for TVI and AVI data).

Considering the variability of these derived indices, it must be remembered that one odd artifact type is enough to give the assemblage a high AVI as long as that artifact is not accompanied by an average suite of other modified debris. For example, the most deviant cluster in terms of AVI and TVI does not appear atypical when the artifact list is described: one core and 64 flakes. Lacking edge-damaged and worked flakes was enough to cause the AVI to soar. With only subtle variation driving such variability in AVI, it is all the more surprising that most of the cluster assemblages have low AVI and TVI values

(Figure 3.10, lower left). The outliers are interesting for identifying abnormalities in the dataset, but the artifact and toolstone assemblages in the Upper Greybull really do cluster around a norm that is approximated by the toolstone and artifact type tallies of the entire Upper Greybull lithic dataset (Table 3.3; Table 3.6).

Mostly situated in the middle montane elevations and occasionally as multicomponent clusters, these low diversity areas are interpreted as repetitively used residential camping areas that served as temporary hubs for mostly warm season hunting, gathering, and toolstone extraction in the adjacent uplands. These behaviors occasionally produced short term upland field camps represented by broken projectile points and associated debris discarded during retooling episodes. Unique assemblages produced at limited-use locations such as the Dollar Mountain workshops mark areas of small group activities away from the residential hubs. Thus, the behavioral roots of surface lithic scatters in the Upper Greybull are beginning to be exposed, and it is now possible to scale up from this Upper Greybull pattern to regional interpretations of land use.

Chapter 4: Conclusions

Surface lithic scatters receive the most person-hours in archaeological documentation in the western United States, but they are not commonly the focus of in-depth interpretation. This thesis uses three aspects of cluster variability to provide an overview of the surface lithic scatters in the Upper Greybull: assemblage size, toolstone proportions, and morphological artifact type proportions. These attributes are highly variable across the project area and through time, and their variability is used to interpret the range of behaviors that produced them. After reviewing these attributes and some behavioral implications of the observed patterns, the diachronic variability in occupations both in the Upper Greybull and in the region are explored. Following this temporal assessment of hunter-gatherer behavior in and around the Upper Greybull, suggestions for future research are offered that will advance the interpretations derived from this research in particular and interpretations of regional prehistoric behavior in general.

While easy and replicable, the method for clustering artifact proveniences derived from recreational GPS receivers has limited utility because every individual artifact is rarely point-plotted during the course of surveys. When proveniencing every artifact is not an option, artifact concentrations should be defined based upon artifact proximity observed in the field. Concentrations should be recorded separately from the remainder of the site matrices. When possible, the following attributes should be recorded for every documented artifact: morphological artifact type, material type and color, and artifact size, and data from concentrations should be recorded separately from the rest of the site materials.

A five meter maximum distance between artifacts is a useful measure for cluster inclusion because it approximates the accuracy of the recreational GPS receivers commonly used during survey. If the maximum distance between artifacts is reduced for other recording methods, then clusters created from these GPS receiver data may not be comparable to those derived from smaller maximum distances. Recording these clusters systematically across landscapes will allow for comparisons of landscapes to regions. For example, data from a sample of archaeological clusters in the adjacent Bighorn Basin could be productively compared to the cluster sample from the Absarokas, and patterns between the two assemblages could be used to interpret the structure of basin and range mobility patterns.

ASSEMBLAGE VARIABILITY

Small, medium, and large clusters are found at all elevations, but small clusters are by far the most common. Multicomponent clusters tend to be larger than single component clusters, reflecting the accumulation of debris from multiple occupational episodes. Short-term camps, lookout stations, and food procurement activities (i.e., locations) are likely to produce these small clusters. The larger clusters, on the other hand, are more likely the result of behaviors involving extensive lithic reduction. Site types produced by this behavior are hypothesized to be either residential camps or lithic quarry workshops (e.g., Dollar Mountain primary reduction areas).

In addition to the Dollar Mountain chert source, other types of toolstone outcrop in the Upper Greybull. Chalcedony, silicified sediment, silicified wood and Irish Rock Chert outcrop in the middle montane elevations (ca. 2600 to 2900 masl), and basalt might outcrop in the middle montane elevations, although it is over-represented in only one cluster and useable material apparently does not outcrop in any significant quantities. Obsidian is occasionally present in clusters in large amounts, but rather than representing an Upper Greybull obsidian source, this material was imported from the west (Hughes 2004).

Large numbers of projectile points and cores are more common in the mid-elevations, between 2600 and 2900 masl. Large numbers of broken bifaces are over-represented in samples from the higher elevations (above 2900 masl). In models of lithic technological organization (e.g., Cowan 1999; Kelly 1988; Nelson 1989; Larson 1990:202), bifaces are often associated with high rates of mobility while amorphous cores are heavier and more difficult to move in highly mobile situations. The abundance of cores and broken projectile points in the lower elevations is interpreted as resulting from residential and field camping episodes, while the bifaces in the higher elevations represent a need for lighter toolkits that are not as bulky as one including amorphous cores. Lower elevations serve as base camps for forays into the higher elevations, and the AVI and artifact type V values reflect this pattern. Several of the broken bifaces are located in the Dollar Mountain primary reduction area at a high elevation unlikely to serve as a residential camp. Toolstone available in the middle montane area is associated with clusters that have more cores than is common. Could elevation (masl) be positively correlated with biface to core ratios around primary reduction areas in the region? If true, toolkit composition could be determined largely by the landscape of raw material availability and not by regional mobility patterns.

While the biface to core ratio is commonly employed as a marker of mobility (e.g., Cowan 1999; Kelly 1988; Larson 1990), the biface to core ratio of artifacts in nondiagnostic clusters is relatively low and quite lower than the most populous temporally-specific sample (Late Archaic). Behaviors that lead to the deposition of projectile points, which make clusters diagnostic, may also often include behaviors that lead to the deposition of bifaces. When these same groups perform lithic manipulation that does not involve point discard, it is possible that they also commonly leave fewer bifaces.

Assemblage variability of Upper Greybull clusters is not unambiguously reflective of either forager or collector orientations (Binford 1980), but a collector strategy with seasonally-partitioned mobility regimes seems most likely. There is evidence of long-term foothill-mountain winter camps in the region (e.g., Bugas-Holding [Rapson 1990], Dead Indian Creek [Frison and Walker 1984], and Pagoda Creek [Eakin 1993:356]). These were occupied for a longer duration than summer camps because of mobility limitations. Limited mobility causes food storage and bulk procurement behavior, and these are hallmarks of the collector pattern (Binford 1980:10). The numerous small lithic clusters in the high country above ca. 2900 masl were presumably produced during warm season resource procurement, because deep snow would have limited access to the summer months. The lower elevations (below ca. 2900 masl) might have been habitable year-round, and the large low-elevation clusters could have been produced at any time of the year. Could the low elevations in the Upper Greybull have been used for winter residential camps? Were the high elevations only used the summer/early fall? A general pattern of prehistoric Upper Greybull land use has now been defined, but answers to these questions are currently unavailable. Having modeled general hunter-gatherer land use patterns in the Upper Greybull, the apparent diachronic changes in this land use are summarized.

Diachronic Changes in Land Use

To assess temporal change in land use from surface assemblages, artifacts need to be clustered in a way that provides assemblages representative of the material deposited during each prehistoric time period. However, the absence of material from time periods is also informative, indicating that the area was minimally used during that period (e.g., Paleoindian). Assemblage size, toolstone proportions, and artifact type proportions are not constant through time, and the structure of their variability has led to a series of hypotheses regarding the range of behaviors that produced these patterns. Research ideas geared toward evaluating these hypotheses are presented after this assessment of diachronic variability.

Paleoindian

Early Paleoindians are hypothesized to have been highly mobile (Kelly and Todd 1988), but there is no evidence of regular intermontane travel through the Greater Yellowstone Ecosystem. Early Paleoindian (ca. 11,500 to 10,000 RCBP) material has not been documented in the Upper Greybull. Occurring during the Temple Lake glaciation, the mountains were much colder than they were during the Late Paleoindian period (Figure 1.3). Early Paleoindian mobility in the mountains may have been hampered by this glacial period, and this is hypothesized to have caused the lack of Early Paleoindian diagnostics in the Upper Greybull. One Clovis point was found near Yellowstone in Gardiner, MT, but no Clovis, Folsom, or Goshen points have been documented in Yellowstone National Park (Janetski 2002:23). While likely highly mobile, Early Paleoindians appear to have preferred the foothills, basins, and plains, and not the mountains. Were the Early Paleoindians highly mobile but only in the intermontane basins and plains? Were the Late Paleoindians the first to regularly include the high elevations of mountain ranges in their annual rounds in a pattern of transhumance very different from the Early Paleoindians?

Numerous Late Paleoindian (ca. 10,000 to 8,000 RCBP) point styles have been documented in the basins and ranges of northwestern Wyoming, and their low quantities in the Upper Greybull is striking. Although the climate had warmed significantly since the Early Paleoindian (Figure 1.3), there is only evidence of sporadic occupation in the Upper Greybull during the Late Paleoindian period. Did the Paleoindian groups just not commonly use the Upper Greybull, or did they commonly use the area while leaving only a few diagnostics remaining on the ground surface today?

The Temple Lake glaciation during the Early Paleoindian is hypothesized to have prevented intermontane travel between the Upper Greybull and obsidian sources on the western side of the Greater Yellowstone Ecosystem, but tight distributions of Late Paleoindian projectile point styles lend support to the hypothesis that Late Paleoindian mobility was restricted to a simple up-down pattern of basin and range transhumance (Figure 4.1; Benedict 1992). The archetypal case of this limited distribution of point styles is Pryor Stemmed, which is limited to areas in and adjacent to the Bighorn Mountains. Although there are

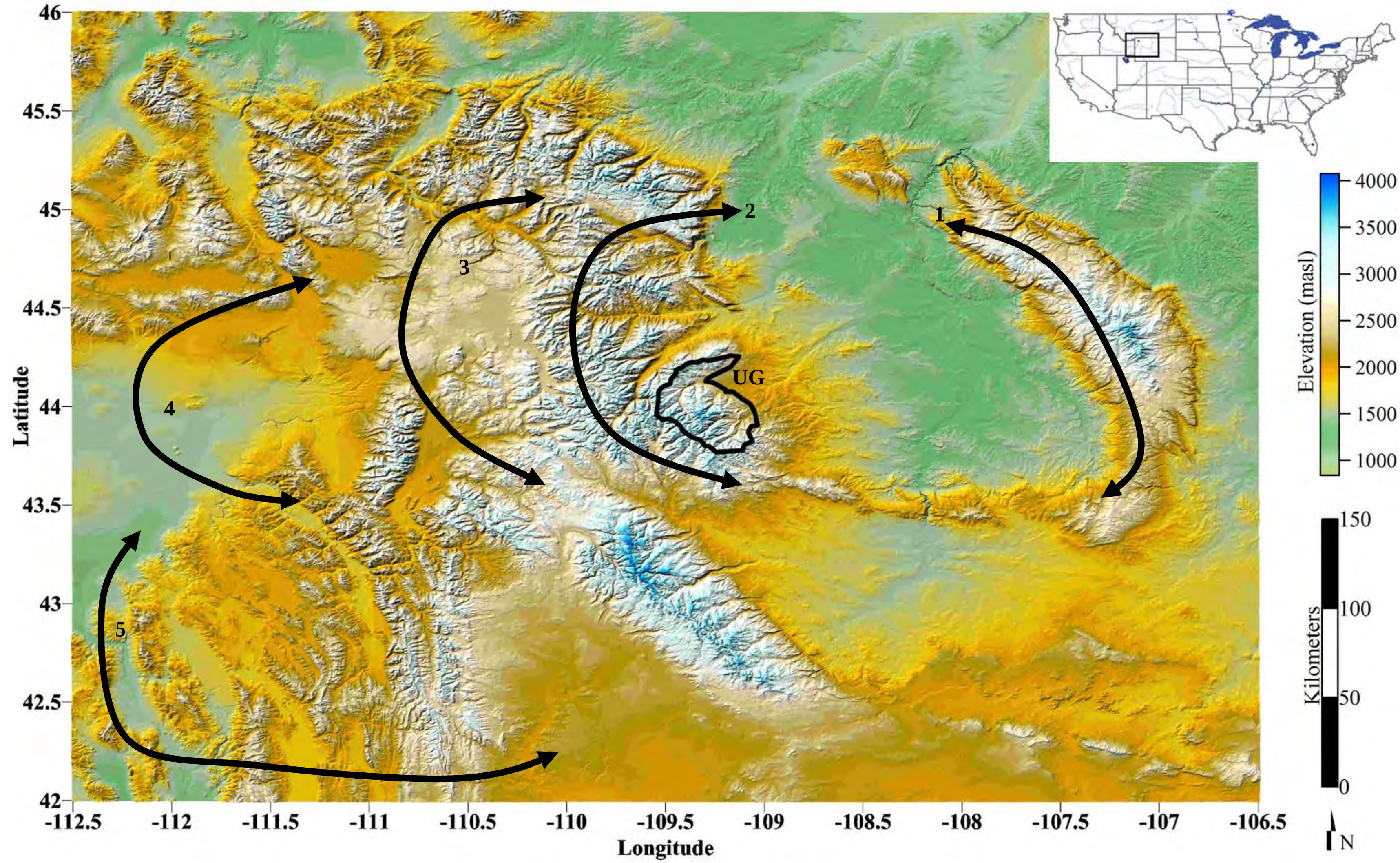


Figure 4.1. Upper Greybull (UG) changes in prehistoric annual transhumance as interpreted from obsidian use. Before 5000 RCBP, the 1-2 pattern was most common (no obsidian in UG). After 5000 RCBP, the 1-3 pattern (involving Obsidian Cliff [3]) gained prominence and was occasionally supplemented by 1-4 (Bear Gulch obsidian [4]) and 1-5 (Malad obsidian [5]) routes. Arrows show trends and not exact routes.

currently no isolated Paleoindian clusters in the Upper Greybull, when they are documented there is anticipated to be little to no obsidian present if this up-down hypothesis is correct. This up-down pattern is hypothesized to have continued into the Early Archaic. Did the cold climate keep Early Paleoindians out of the Greybull? With a much warmer climate during the Late Paleoindian, why have there been so few diagnostics documented from this time period? Was Late Paleoindian transhumance in the region a simple up-down basin and range pattern contrasting with a highly mobile basin and plains pattern of the Early Paleoindian period? The Upper Greybull toolstone data indicate that up-down basin and range transhumance was common following the Paleoindian period.

Early Archaic

Early Archaic material is not extremely common in the Upper Greybull, but from the projectile point tallies (Figure 2.8) and elevational distributions (Figure 2.9) the Early Archaic is most likely the earliest period of upper montane land use that involved all elevations in the Upper Greybull. The latter end of this period correlates with the Altithermal (Antevs 1948), a time when the glaciers of the Wind River Range were stagnant or in retreat and when pollen data across North America indicate warm and dry conditions (Figure 1.3). Were the foothills and mountains used more commonly than the adjacent lowlands as a response to Altithermal conditions (Husted 2002; Mulloy 1958)? There appears to be more Early Archaic material than Paleoindian material in the Absarokas, which is consistent with this hypothesis. While this pattern of increased projectile point deposition during the Early Archaic is intriguing, the quantity of diagnostics from this time period still pales in comparison to the amount of late Holocene diagnostics.

Of 1,181 Early Archaic artifacts (as derived by the clustering technique), not one piece of obsidian was documented. Is this pattern the result of a simple up-down pattern of basin and range transhumance? An intermontane mobility regime that regularly connected the Greybull to the western GYE (Figure 4.1) should cause some Early Archaic clusters in the Upper Greybull to contain obsidian. There is still a data gap in the Early Archaic assemblages, however, and further research may show connections with the western GYE through obsidian analysis, should it be encountered in association with Early Archaic diagnostics. One of the Early Archaic clusters is located at the Dollar Mountain primary reduction area, and it consists of 1127 artifacts (of 1181 total Early Archaic artifacts), and 1117 of the artifacts are composed of the immediately local Dollar Mountain chert. Thus, more Early Archaic toolstone data are needed to evaluate the hypothesis of up-down basin and range transhumance during the Early Archaic. Was there a change in mobility and land use patterns from the Early Archaic to the Middle Archaic?

Middle Archaic

The Middle Archaic period (ca. 5000 to 3000 RCBP) overlaps with neoglaciation across North America (Viau et al. 2002). Represented locally by the Alice Lake glaciation in the Wind River Range (Dahms 2002), glaciation during this period was marked but not intense. While the exact age range of this Wind River episode is unclear, during some period of the Middle Archaic it was colder than it had been during the Early Archaic. Could cold temperatures have shortened the productive seasons in the high country, keeping the intensity of land use relatively low until the recession of the Alice Lake glaciers at the beginning of the Late Archaic?

Middle Archaic toolstone variability in the Upper Greybull is not well understood due to the small amount of toolstone data. These clusters need to be documented, especially for toolstone and artifact type data. Accompanied with obsidian sourcing efforts (Bohn et al. 2004), these clusters will add much needed information for interpretations of diachronic variability in regional mobility. Of nine Middle Archaic point bases, two are obsidian (Figure 2.3n, u). This indicates that obsidian is present in some quantity during this period. Was the Middle Archaic the first period of intermontane GYE mobility (Figure 4.1)?

A sourcing program is underway for obsidian (Bohn et al. 2004; Hughes 2004), and the results will be informative with regard to patterns of regional mobility. However, because most obsidian is currently associated with the Late Archaic and Late Prehistoric clusters, this information is currently more applicable for the period after 3000 RCBP and less so for the earlier time periods. While the obsidian sourcing results are presented elsewhere (Bohn et al. 2004), it is clear that the majority of the obsidian deposited in the Upper Greybull is from Obsidian Cliff in Yellowstone National Park. Obsidian also was transported from to a range of Idaho sources, including the Bear Gulch and Malad sources (Figure 4.1; Hughes 2004). Single artifacts were also sourced to a range of other obsidian outcrops in the region, including Teton Pass, Wyoming, Packsaddle Creek and Timber Butte, Idaho. One obsidian artifact was sourced to the more distant Wild Horse Canyon source in Utah (Hughes 2004).

Late Archaic

Twenty-seven Late Archaic clusters provide 2745 toolstone records and 2838 artifact type records. Given the overall abundance of Late Archaic material, land use in the Upper Greybull is hypothesized to have been most common during this period. Furthermore, the Late Archaic toolstone assemblage consists of 6 percent obsidian. This forms the basis for hypothesizing that intermontane mobility patterns were common as well (Figure 4.1). Did a mountain-focused cultural identity similar to the Sheepeater Shoshone (Hughes 2000) develop during the Late Archaic?

The Black Joe glacial alloformation in the Wind River sequence (Dahms 2002) dates to the terminal Late Archaic and is associated with cool conditions across North America (Viau et al. 2002). Did the associated cooler temperatures limit high country productivity and resource density, lowering the number of high country occupations at the end of the Late Archaic period (ca. 2000 to 1500 RCBP)? The chronology of occupation in the Upper Greybull is currently based upon projectile point morphologies, and these do not provide the temporal resolution needed to evaluate this possibility.

Late Prehistoric

After the Black Joe glaciation in the Wind River Range came a warm period between approximately 1500 and 600 RCBP, which is followed by the Gannett Peak neoglaciation of the last 600 years that is associated with global cooling known commonly as the Little Ice Age (Dahms 2002). Correlating increased montane land use during the Late Archaic with the warm period between the Alice Lake and Black Joe glaciations is an intriguing hypothesis. But, more intriguing is the fact that most of the Late Prehistoric projectile points are what Kehoe (1966) has termed “Plains Side-Notched,” and these points are not common in the northwestern plains until approximately 650 RCBP. This date coincides with the onset of the Gannett Peak glaciation and regional and global cooling. Thus, while warmth is positively correlated with the intensity of occupation in the Late Archaic, it is negatively correlated with the intensity of occupation during the Late Prehistoric. Was there a higher proportion of people using the mountains instead of the plains and basins after 650 RCBP than between 1500 and 650 RCBP? Or, did regional population packing after 650 RCBP cause there to be more people using all environments of the region?

Compared to the proportion of obsidian in the Late Archaic clusters (6 percent), the proportion of obsidian in Late Prehistoric clusters jumps sharply to 19 percent (of 626 artifacts). Data from the

Lookingbill site indicate a similar pattern of increased late Holocene obsidian manipulation (Kornfeld et al. 2001). Did intermontane mobility dramatically increase during the Late Prehistoric period? Increased obsidian content during the late Holocene nicely correlates with the large biface to core ratio during the Late Archaic and Late Prehistoric (Table 3.7). Higher biface to core ratios during the late Holocene could indicate increased group mobility during the late Holocene. However, considering the variability in the biface to core ratio between diagnostic, nondiagnostic, and multicomponent clusters, it is evident that the proportion of bifaces and cores discarded by individual groups was not constant (Table 3.7). In light of these findings, interpreting mobility on the basis of biface to core ratios (Cowan 1999; Kelly 1988; Larson 1990:202) appears to be theoretically tenuous.

Directions for Future Research

Archaeological research began in the Upper Greybull from the ground up, with no preexisting information regarding archaeological patterns in the area. The Upper Greybull flaked stone dataset has been used to inductively derive a series of models describing prehistoric land use in the central Absarokas. Now that data from the area have been synthesized and models describing the behavioral causes of these patterns have been derived, future research will most productively proceed by evaluating these models and testing the hypotheses raised in this thesis. Seven major foci for future research have been identified that will be useful in guiding deductively-based research: (1) diachronic changes in archaeological documents; (2) projectile point typology; (3) chert sourcing; (4) identifying and describing local lithic procurement areas; (5) diachronic changes in ecosystem structure and resource capture; (6) diachronic changes in land use intensity; and (7) diachronic changes in regional mobility patterns. Following a problem statement or hypothesis, a framework for future research is presented.

Diachronic Changes in Archaeological Documents

Accuracy limitations of recreational GPS receivers (Figures 3.1 and 3.3 and Table 3.1) will cause surface lithic scatters to have different spatial properties each time the sample is documented. GPS accuracy is not influenced by weather, but it is influenced by GPS hardware and software precision, satellite geometry, and the number of satellites in contact with the receivers. These factors will cause the same archaeological material to have different spatial properties with every sampling, and this could cause cluster inclusion to vary. The degree to which this would vary is currently unknown, and would be a useful avenue for future research.

Identifying clusters with deviant artifact type assemblages using the AVI equation has raised additional questions regarding the artifact type composition of various assemblages. For example, clusters with only debitage and projectile points have been documented, but edge-damaged flakes should occur about four times as often as projectile points and their absence is notable. It will be beneficial to resample clusters with over 20 pieces of flaked stone and high AVI values to determine if the clusters really are unusual, or if the high AVI values are a result of observer error (i.e., failed to identify edge-damaged and/or worked flakes).

Projectile Point Typology

Hypotheses regarding the number of occupations in the Upper Greybull and the surrounding region have been based upon projectile point typologies. As a result, projectile point typology is an important avenue for future research. The current projectile point typology for the Upper Greybull was derived by qualitative lithic cross-dating of the points documented in the Upper Greybull with those documented in radiocarbon-dated stratigraphic contexts. Because of the morphological changes that a projectile point can undergo through the course of its use-life (Flenniken and Raymond 1986), time-ordering projectile points based on their morphology is difficult and can lead to erroneous results. However, the majority of the projectile points documented in the Upper Greybull have temporally-specific morphologies.

The most important problem facing the Upper Greybull projectile point morphology is the Unspecified Archaic category. A total of 44 points are assigned to this category, and determining the ages of these points would dramatically increase the amount of diagnostic clusters. The ages of these projectile points will not easily be approximated by lithic cross-dating with regional samples, as this has already been attempted.

There are two methods proposed for approximating the ages of these points. First, finding them in a stratigraphic context with dateable materials (e.g., charcoal or bone) would allow the stratigraphy to be radiocarbon-dated, and this would provide an age estimate. The second method, which is more likely to yield rapid but less accurate results, is to target already documented Unspecified Archaic surface clusters containing obsidian (Table 4.1) for obsidian hydration dating (Friedman and Long 1976; Michels 1967; Ridings 1996; Stevenson et al. 1989). Hypotheses regarding the light Early and Middle Archaic occupation compared to the heavy Late Archaic occupation could be changed if several of these Unspecified Archaic points are determined to be from the Early or Middle Archaic period. Neck width data (Figure 2.10) indicate that this may indeed be the case.

Table 4.1. Obsidian content of clusters with Unspecified Archaic projectile points.

Site	Cluster	n Obsidian
48PA2740	6	17
48PA2741	3	1
48PA2745	2	2
48PA2751	6	4
48PA2770	1	1
48PA2772	19	2
48PA2772	24	6
48PA2775	3	1
48PA2815	3	2

Significant variables influencing hydration rates include hydration rind thickness, intrinsic water content, geochemical composition, relative humidity, and temperature. Relative humidity and temperature must be determined from field observations, but can be approximated using weather station data (Friedman and Long; 1976). In the Upper Greybull, HOBO® temperature data loggers have already been used to approximate the thermal variability of surfaces (Derr et al. 2004). These data, as well as additional HOBO® deployments placed near obsidian samples will provide the surface temperature data needed for estimating the Effective Hydration Temperature of the surface, but more sophisticated data loggers will be necessary for estimating relative humidity.

The most important factor to consider in estimating the age of Unspecified Archaic from obsidian hydration is the effect that fire has on EHT (Friedman and Trembour 1983). Fire first deepens the hydration layer, followed by the water being released from the hydration rind from excessive temperatures. In this way, fires can restart the hydration time signature, thus providing an age of the last fire rather than an age of the archaeological debris. Because of this, obsidian should not be sampled from artifact clusters where macroscopic fire damage is observable on adjacent artifacts. Obsidian hydration dating should be used to approximate the ages of clusters in the Upper Greybull, but the task will clearly be more complicated than just submitting samples for analysis.

Chert Sourcing

Chert sourcing is the most important problem in toolstone sourcing within the region; however it is the most difficult to address. Exposed along the Bighorn Mountains are toolstone-bearing strata similar to those that outcrop in the southern Absarokas and at Dollar Mountain. Assigning the toolstone to one source or another is not only tenuous but it could lead to dramatically different interpretations of mobility patterns. Approximately half of the raw material identified in the project area is unspecified chert, and such data are not informative with respect to mobility patterns. Identifying the sources of the cherts used in the Upper Greybull would greatly aid in evaluating hypotheses of diachronic changes in mobility patterns. For example, chert could easily come from the southern Absarokas and the Bighorn Mountains. Upper Greybull chert sourced to the southern Absarokas would be indicative of travel through the mountain ranges, while chert sourced to the Bighorns would indicate basin and range travel, since the Bighorn Basin would be traversed between the source area and the Upper Greybull.

A geochemical analysis of regional toolstones is the first step in solving this chert problem (e.g., Hoard et al. 1993; Leudtke 1979). Neutron-activation analysis must be performed on the Dollar Mountain toolstones, and these results should be compared with similar strata outcropping in the southern Absarokas (Love 1939) and in the Bighorn Mountains (Francis 1983). After the geochemical signatures of these sources are defined, a sampling strategy can be devised to sample chert from Upper Greybull clusters for sourcing. The most productive approach is to sample chert from diagnostic clusters. Then, diachronic variability in chert use can be researched and prehistoric mobility patterns can be further understood.

Identifying and Describing Local Lithic Procurement Areas

Understanding the nature of local toolstone availability is important for interpretations of prehistoric land use, because proximity to sources is anticipated to affect the toolstone composition of assemblages (Newman 1994). A useful first step in identifying and describing local lithic procurement areas is to analyze the variability in toolstone proportions in each small watershed of the Upper Greybull (Ollie et al. 2004). As the TVI data have shown (Figure 3.8), proportions of toolstone vary throughout the project area, and this variability is hypothesized to be heavily influenced by source proximity.

Toolstone V values indicate areas of atypical percentages of material types, and these provide a useful starting point for sourcing the local Absaroka toolstones. For example, silicified wood might outcrop in one unique but as of yet unidentified area, and the proportions of this material should be greater as source distance decreases. Cobbles of silicified wood have been identified in Venus Creek and Upper Greybull alluvium, and high silicified wood V values are concentrated in the Greybull and Upper Jack and Meadow Creeks.

Similarly, silicified sediment workshop locations are identifiable by toolstone V values (Appendix C, Table C.3) in clusters with high TVI values around Jack and Warhouse Creeks (Figure 1.1). The toolstone variability in clusters around the Dollar Mountain Chert source confirms this tendency for high V values to correlate with outcrop locations, but nonlocal materials such as quartzite and obsidian have been documented with high V values. As a result, the patterning across several clusters will be more informative as to local source areas than the V values of individual clusters.

Archaeological reconnaissance geared toward the identification and description of the Absaroka toolstones is the second step in solving this local toolstone problem. The numerous small lithic sources are difficult to study because they are not discernable by geologic map unit or stratum (with the exception of Dollar Mountain toolstones). A diversity of raw materials outcrop throughout the thick breccias and conglomerates blanketing the Absarokas. Igneous intrusives exposed in patches across the central Absarokas commonly yield basalt, but the distribution of basalts quarried prehistorically is unknown. Finding a pattern to the toolstone availability in these formations will inform the analysis of toolstone percentages across the central Absarokas, and this will be informative with regard to patterns of mobility in the Upper Greybull in particular and in the region in general. Furthermore, hypotheses regarding elevationally mediated differences in toolkit composition (e.g., biface to core ratio) can be evaluated when the toolstone source proveniences are known.

Diachronic Changes in Ecosystem Structure and Hunting Strategies

Because of the semi-arid climate in the Upper Greybull, plant communities are responsive to subtle shifts in effective moisture. This results in diachronic reorganizations of plant communities. Several patches of dead tree stands in the Upper Greybull are examples of a moister climate in the past than at present (Figure 4.2). Tree communities most likely expanded during the Little Ice Age (Figure 1.3), and then contracted as mean annual temperatures increased after this global cold period (Reider et al. 1988; Romme and Turner 1991). Periods of warmer temperatures can cause the upper and lower timberlines to rise, while cooler temperatures have the same effect. Increased precipitation over several years causes tree communities to expand, and lower precipitation causes them to contract.

Figure 4.2. Dead spruce-fir stand in the Jack Creek watershed. Photograph taken by L. C. Todd.

Tree communities likely expanded concordantly with the glaciations documented in the Wind River Range (Figure 1.3; Dahms 2002; Reider et al. 1988; Romme and Turner 1991). This oscillating canopy cover may have influenced several facets of prehistoric life in the Upper Greybull, possibly influencing site placement (in or out of trees) and game density (via changes in forage production). Defining the diachronic changes in ecosystem state factors will allow the hypotheses regarding temporal changes in the number of occupations to be evaluated. For example, it has been hypothesized that the Late Archaic period is correlated with long seasons of productivity in the mountains of the region, but there are no data on the temporal changes in plant communities in the Upper Greybull to correlate with these data. Conversely, the regional paleoclimate data indicate that the climate during the Late Paleoindian period should have been amenable to regular montane land use, but there is only evidence of sporadic use of the Upper Greybull. Paleoclimatic data from the Upper Greybull may indicate that local conditions were cooler than indicated by the regional data.

A record of plant community shifts might be found in pond sediments (macrobotannicals and pollen) and in sediments adjacent to modern plant community boundaries (carbon isotope ratios). Soil sampling between modern tree stands might show chemical variability indicative of prehistoric tree stands (Reider et al. 1988), and the modern temperature and moisture properties of these sampled surfaces could be modeled across the landscape to derive interpretations of diachronic plant community reorganization. Such a model could be used to predict diachronic changes in forage production and would aid in understanding prehistoric site placement decisions. For example, a site recorded today in an open grassland setting might have been forested at the time of occupation. As a result, interpreting land use patterns in the Upper Greybull would greatly benefit from research into the diachronic changes in ecosystem structure.

As ecosystem structure changes, methods of hunting strategies may have also changed. Conversely, methods of hunting may have been only weakly influenced by ecosystem changes. For example, the Late Paleoindian trapping net found near Cody, WY (Frison et al. 1986) is an example of one hunting strategy that may have been newly employed in the mountains during the Late Paleoindian period following the Temple Lake glaciation. While the end of this glaciation did not necessarily cause Paleoindians to develop net technology, it may have caused them to use these nets in higher country than would have been possible during the glaciation.

Hunting aided by stone features (e.g., drive lines, hunting blinds, and stone enclosures) may have become more common through time in the region. The Boulder Ridge trap (48PA781) consists of stone drive lines most likely of Late Prehistoric or proto-historic in age given the presence of wood in the drive lines and associated diagnostics (Finley et al. 2004; Frison and Walker 1982). While there is some indication that drive lines were more popularly used in the Late Prehistoric and Protohistoric time periods in Wyoming (Finley et al. 2004; Frison 1991:250), the temporal variability in stone structure use as aids in resource capture in the Absarokas is not well understood. Benedict (1992) notes that game drives were used in the Colorado high country since Paleoindian times. The Upper Greybull has three sites with stone structures (48PA2795, 48PA2820, 48PA2838; Kinneer et al. 2004), and attempts should be made to age these structures so that they can be compared to the paleoclimatic record and the ages of other stone structures in the region. If the Upper Greybull stone structures can be aged, it would be useful to interpret the structure of the surrounding plant communities when the structures were used, because the viewsheds and natural obstructions present today may have been much different than when the sites were used in the past.

Diachronic Changes in Land Use Intensity

Excavations are required to test the hypothesis of increased late Holocene montane land use following light early Holocene use of the area. Localities deemed likely to have high early Holocene subsurface archaeological potential should be identified, and selected high potential areas should be targeted for excavations. It would be particularly informative to excavate in high potential sites with only late Holocene (Late Archaic or Late Prehistoric) surface components, because finding earlier components under the late Holocene material would show the influence of sedimentation on projectile point abundance from different time periods.

One of the most intriguing unknowns of Upper Greybull prehistory is the seasonality of land use. Hypotheses regarding winter use of the lower montane elevations of the Upper Greybull and summer/early fall use of the higher elevations can be evaluated with seasonality data from archaeological sites from a range of elevations. Summaries of seasonal uses are currently common-sense approximations that tundra elevations were not commonly used in the deep snow months because of mobility limitations and harsh weather. To produce seasonality data, excavations should target areas interpreted as having a high potential of yielding subsurface faunal elements. Should dentition be recovered, analysis of tooth eruption and wear patterns could indicate a season of death, and by association, a season of prehistoric human occupation (Frison et al. 1976; Reher and Frison 1980). Butchered archaeofaunal elements have been documented on the surfaces of a few sites in the lower montane elevations (e.g., two small green bone shaft fragments with cutmarks at 48PA2744 and a dense bone scatter of a diminutive ungulate including burned bone at 48PA2772). Additionally, buried archaeofaunal elements were documented at Site 48PA2811. These sites would be useful starting points for seasonality and prey choice research. They are situated low enough in the montane elevations that the seasonality data could potentially indicate occupation during several seasons. Not knowing the range of seasons in which these sites were produced is a major hindrance to our understanding of prehistoric behavior in the project area.

Diachronic Changes in Regional Mobility Patterns

There is no evidence of Early Paleoindian use of the Upper Greybull or in Yellowstone National Park (Janetski 2002:23), but there is evidence of them using the Bighorn Mountains and adjacent basins (Frison 1992; Frison and Bradley 1980; Frison and Todd 1986). While Early Paleoindians are interpreted as highly mobile (Kelly and Todd 1988), it appears that this mobility excluded the montane GYE. Two regional mobility patterns have been proposed for the hunter-gatherers that used the Upper Greybull ecosystem. The first is a simple up-down basin and range transhumance (Benedict 1992) that is hypothesized to have been the dominant pattern of regional mobility during the first half of the Holocene (Late Paleoindian and Early Archaic periods). The second is a more complex intermontane pattern of transhumance. This pattern is evident after 5000 RCBP in the Upper Greybull by the presence of obsidian in samples of Middle Archaic, Late Archaic, and Late Prehistoric ages. A comprehensive regional comparison of toolstone assemblage content in dated assemblages would be the most useful way to evaluate this hypothesis. Comparing sourced obsidian from sites in and around the GYE will inform interpretations of transhumance through the region, and may indicate multiple routes of patterned transhumance, as opposed to the routes indicated from one landscape (e.g., the Upper Greybull).

Land use in the central Absarokas was clearly highly variable through time. The hypotheses of prehistoric behavior presented in this thesis are not end-all statements about prehistoric lifeways but rather heuristics to guide further research into the prehistory of the central Absarokas in particular and the Greater Yellowstone Ecosystem in general. Using a method of in-field, individual artifact-based documentation is clearly a viable strategy for archaeological documentation. This method allows us to research prehistory while leaving the artifacts in place for future generations to observe and study. Sampling an archaeological landscape on an artifact level instead of focusing on one specific site or locality provides a seamless dataset with multiple uses, not the least of which is adding interpretive value to those ephemeral lithic scatters so ubiquitously spread across western North America.

APPENDIX A: PROJECT DATA AND CODING STRUCTURE

Table A.1. Prehistoric sites (n = 133) and isolates (n = 27) with flaked stone data in the Upper Greybull project area. This list does not include prehistoric sites that were identified but have no associated data. The "n" column indicates the amount of documented flaked stone per site (26,478 total).

Site	n	Site	n	Site	n	Site	n
48PA48*	156	48PA2742	259	48PA2776	330	48PA2811	487
48PA249	16	48PA2743	978	48PA2777	25	48PA2812	6
48PA250	19	48PA2744	5636	48PA2778	358	48PA2813	35
48PA303*	140	48PA2745	713	48PA2779	21	48PA2814	20
48PA522*	47	48PA2746	207	48PA2780	21	48PA2815	113
48PA523*	154	48PA2747	71	48PA2781	27	48PA2816	20
48PA659	369	48PA2748	14	48PA2782	121	48PA2817	157
48PA875	13	48PA2749	10	48PA2783	32	48PA2818	98
48PA876	7	48PA2750	20	48PA2784	11	48PA2819	75
48PA998*	10	48PA2751	338	48PA2785	2	48PA2821	32
48PA2717	5	48PA2752	182	48PA2786	64	48PA2822	16
48PA2718	7	48PA2753	244	48PA2787	69	48PA2823	4
48PA2719	62	48PA2754	9	48PA2788	68	48PA2824	84
48PA2720	281	48PA2755	53	48PA2789	349	48PA2825	5
48PA2721	1722	48PA2756	3	48PA2790	3	48PA2826	1
48PA2722	59	48PA2757	116	48PA2791	4	48PA2827	2
48PA2723	122	48PA2758	15	48PA2792	311	48PA2828	24
48PA2724	224	48PA2759	125	48PA2793	10	48PA2829	108
48PA2725	59	48PA2760	156	48PA2794	13	48PA2830	6
48PA2726	214	48PA2761	54	48PA2796	44	48PA2831	2
48PA2727	1	48PA2762	105	48PA2797	50	48PA2832	2
48PA2728	26	48PA2763	53	48PA2798	52	48PA2833	39
48PA2729	22	48PA2764	127	48PA2799	794	48PA2834	3
48PA2730	2	48PA2765	26	48PA2800	2	48PA2835	173
48PA2731	31	48PA2766	36	48PA2801	5	48PA2836	8
48PA2732	5	48PA2767	124	48PA2802	26	48PA2837	34
48PA2733	23	48PA2768	5	48PA2803	46	ISO-DC**	4
48PA2734	6	48PA2769	58	48PA2804	9	ISO-DM**	5
48PA2735	259	48PA2770	131	48PA2805	121	ISO-EL**	2
48PA2736	1	48PA2771	14	48PA2806	17	ISO-GR**	9
48PA2737	22	48PA2772	5486	48PA2807	11	ISO-JC**	3
48PA2738	4	48PA2773	39	48PA2808	14	ISO-MC**	3
48PA2739	12	48PA2774	388	48PA2809	27	ISO-WAR**	1
48PA2740	517	48PA2775	271	48PA2810	8	Unspecified	3
48PA2741	1146						

* Previously recorded prehistoric component

** Isolate totals from various Upper Greybull watersheds

Table A.2. Smithsonian site numbers, temporary site numbers, and short site descriptions of sites that include a flaked stone component.

Smithsonian Site Number	Temporary Site Number	Description	Other Name
48PA48		Multicomponent, prehistoric lithic scatter and historic debris	
48PA249		Multicomponent, prehistoric lithic scatter and historic cabin and debris	Amelia's Cabin
48PA250	VIC002	Multicomponent, prehistoric lithic scatter and historic cabin and debris	Anderson Lodge
48PA303		Prehistoric lithic scatter	Jack Creek Trailhead
48PA522		Prehistoric lithic scatter	
48PA523	JC001	Prehistoric lithic scatter and hearth	
48PA659	WR003	Multicomponent, prehistoric lithic scatter and historic mining district	Kirwin
48PA875	JC-CHICO	Multicomponent, prehistoric lithic scatter and historic cabin and debris	Chico's Cabin
48PA876	WR004	Multicomponent, prehistoric lithic scatter and historic cabin and debris	Venus Cabin
48PA998	WR004	Prehistoric lithic scatter	Bon Jovi
48PA2717	AND001	Prehistoric lithic scatter	
48PA2718	DC001	Prehistoric lithic scatter	
48PA2719	DC002	Prehistoric lithic scatter	
48PA2720	DC003	Prehistoric lithic scatter	
48PA2721	DM001	Prehistoric lithic scatter	
48PA2722	DM002	Multicomponent, prehistoric lithic and historic debris scatter	
48PA2723	DM003	Prehistoric lithic scatter	
48PA2724	DM004	Prehistoric lithic scatter	
48PA2725	DM005	Prehistoric lithic scatter	
48PA2726	DM006	Prehistoric lithic scatter	
48PA2727	DM007	Prehistoric lithic scatter	
48PA2728	DM009	Prehistoric lithic scatter	
48PA2729	DM010	multicomponent, prehistoric lithic scatter and historic wood post	
48PA2730	DM013	Prehistoric lithic scatter	
48PA2731	DM014	Prehistoric lithic scatter	
48PA2732	DM016	Prehistoric lithic scatter	
48PA2733	EL001	Prehistoric lithic scatter	
48PA2734	EL002	Prehistoric lithic scatter	
48PA2735	EL003	Prehistoric lithic scatter	
48PA2736	EL004	Prehistoric lithic scatter	
48PA2737	EL005	Prehistoric lithic scatter	
48PA2738	EL006	Prehistoric lithic scatter	
48PA2739	GR001	Prehistoric lithic scatter	
48PA2740	GR002	Prehistoric lithic scatter	
48PA2741	GR003	Prehistoric lithic scatter	
48PA2742	GR004	Prehistoric lithic scatter	
48PA2743	GR005	Multicomponent, prehistoric lithic and historic debris scatter	
48PA2744	GR006	Multicomponent, prehistoric lithic and historic debris scatter	
48PA2745	GR007	Prehistoric lithic scatter	
48PA2746	GR008	Prehistoric lithic scatter	
48PA2747	GR009	Prehistoric lithic scatter	
48PA2748	GR010	Multicomponent, prehistoric lithic scatter and historic cabin and debris	Haymaker Cabin

Table A.2, continued.

Smithsonian Site Number	Temporary Site Number	Description	Other Name
48PA2749	GR011	Prehistoric lithic scatter	Ol' Big
48PA2750	GR013	Prehistoric lithic scatter	
48PA2751	GR014	Multicomponent, prehistoric lithic and historic debris scatter	
48PA2752	GR016	Prehistoric lithic scatter	
48PA2753	GR017	Prehistoric lithic scatter	
48PA2754	GR018	Prehistoric lithic scatter	
48PA2755	GR019	Multicomponent, prehistoric lithic scatter and historic camp	
48PA2756	GR020	Prehistoric lithic scatter	
48PA2757	GR021	Prehistoric lithic scatter	
48PA2758	GR022	Multicomponent, prehistoric lithic scatter and historic camp	
48PA2759	GR023	Multicomponent, prehistoric lithic and historic debris scatter	
48PA2760	GR024	Prehistoric lithic scatter	
48PA2761	GR025	Prehistoric lithic scatter	
48PA2762	GR026	Prehistoric lithic scatter	
48PA2763	GR027	Prehistoric lithic scatter	
48PA2764	GR028	Prehistoric lithic scatter	
48PA2765	GR029	Prehistoric lithic scatter	
48PA2766	GR030	Prehistoric lithic scatter	
48PA2767	GR031	Multicomponent, prehistoric lithic scatter and historic camp	
48PA2768	GR032	Prehistoric lithic scatter	
48PA2769	GR033	Prehistoric lithic scatter	
48PA2770	HC001	Prehistoric lithic scatter	
48PA2771	HC002	Multicomponent, prehistoric lithic and historic debris scatter	
48PA2772	JC002	Multicomponent, prehistoric lithic and historic debris scatter	
48PA2773	JC006	Prehistoric lithic scatter	
48PA2774	JC008	Prehistoric lithic scatter	
48PA2775	JC010	Prehistoric lithic scatter	
48PA2776	JC014	Multicomponent, prehistoric lithic and historic debris scatter	
48PA2777	JC015	Prehistoric lithic scatter	
48PA2778	JC016	Prehistoric lithic scatter	
48PA2779	JC017	Multicomponent, prehistoric lithic scatter and historic cabin and debris	
48PA2780	JC018	Prehistoric lithic scatter	
48PA2781	JC019	Prehistoric lithic scatter	
48PA2782	JC020	Prehistoric lithic scatter	
48PA2783	JC021	Prehistoric lithic scatter	
48PA2784	JC023	Prehistoric lithic scatter	
48PA2785	JC024	Prehistoric lithic scatter	
48PA2786	JC026	Prehistoric lithic scatter	
48PA2787	JC032	Prehistoric lithic scatter	
48PA2788	JC033	Prehistoric lithic scatter	
48PA2789	JC034	Prehistoric lithic scatter	
48PA2790	JC035	Prehistoric lithic scatter	
48PA2791	JC036	Prehistoric lithic scatter	

Table A.2, continued.

Smithsonian Site Number	Temporary Site Number	Description	Other Name
48PA2792	JC037	Prehistoric lithic scatter	
48PA2793	JC040	Prehistoric lithic scatter	
48PA2794	JC041	Prehistoric lithic scatter	
48PA2796	JC043	Prehistoric lithic scatter	
48PA2797	JC044	Prehistoric lithic scatter	
48PA2798	MC001	Prehistoric lithic scatter	
48PA2799	MC002	Multicomponent, prehistoric lithic scatter and Webster Cabin	
48PA2800	MC003	Multicomponent, prehistoric lithic scatter and historic cabin and debris	
48PA2801	MC004	Prehistoric lithic scatter	
48PA2802	MC005	Prehistoric lithic scatter	
48PA2803	MC006	Prehistoric lithic scatter	
48PA2804	MC009	Prehistoric lithic scatter	
48PA2805	MC011	Prehistoric lithic scatter	
48PA2806	MC012	Prehistoric lithic scatter	
48PA2807	MC013	Prehistoric lithic scatter	
48PA2808	MC015	Prehistoric lithic scatter	
48PA2809	MC016	Prehistoric lithic scatter	
48PA2810	PC001	Prehistoric lithic scatter	
48PA2811	PC002	Multicomponent, prehistoric lithic scatter and hearth and historic debris scatter	
48PA2812	PC003	Prehistoric lithic scatter	
48PA2813	PC004	Prehistoric lithic scatter	
48PA2814	PC005	Prehistoric lithic scatter	
48PA2815	PC006	Multicomponent, prehistoric lithic and historic debris scatter	
48PA2816	PC007	Prehistoric lithic scatter	
48PA2817	PC008	Prehistoric lithic scatter	
48PA2818	PC009	Prehistoric lithic scatter	
48PA2819	PC011	Prehistoric lithic scatter	
48PA2821	VIC001	Prehistoric lithic scatter	
48PA2822	WAR001	Prehistoric lithic scatter	
48PA2823	WAR002	Prehistoric lithic scatter	
48PA2824	WAR003	Prehistoric lithic scatter	
48PA2825	WAR004	Prehistoric lithic scatter	
48PA2826	WAR005	Prehistoric lithic scatter	
48PA2827	WAR006	Prehistoric lithic scatter	
48PA2828	WAR007	Prehistoric lithic scatter	
48PA2829	WAR008	Multicomponent, prehistoric lithic scatter and historic camp	
48PA2830	WAR009	Prehistoric lithic scatter	
48PA2831	WAR010	Prehistoric lithic scatter	
48PA2832	WAR011	Prehistoric lithic scatter	
48PA2833	WC001	Multicomponent, prehistoric lithic and historic debris scatter	
48PA2834	WC002	Prehistoric lithic scatter	
48PA2835	WR002	Prehistoric lithic scatter	
48PA2836	WR005	Prehistoric lithic scatter	
48PA2837	WR006	Prehistoric lithic scatter	

Table A.3. Codes and descriptions for the 2002-2004 Upper Greybull flaked stone artifact database. The number of times the attribute was observed for flaked stone is indicated in the right column, with only one entry for artifacts recorded multiple times. File names are embedded with data on the initials of the person using the handheld computer, the date, and the site or location of work. For example, HTH062504HC002.xls indicates initials = HTH, date = 06/25/04, and temporary site number = HC002. These data were added to the spreadsheets as the files were merged.

Column Heading	Description	Uses
Em.000	East NAD83/WGS84 rounded to nearest meter	25,884
Nm.000	North NAD83/WGS84 rounded to nearest meter	25,884
EAST83	East NAD83/WGS84 including decimal points (if applicable)	25,884
NORTH83	North NAD83/WGS84 including decimal points (if applicable)	25,884
ELEV	Elevation in meters above sea level	22,812
INI**	Initials of person or GPS/EDM name	26,478
NAME**	GPS waypoint name	26,478
DATE	Waypoint date	26,478
SITE/IF	Site, isolated find, or other name	26,478
SURVEY	Sampling method	26,478
GPS COMMENTS	Comments entered into GPS or other comments	7709
iPAQ	Name of iPAQ (handheld computer)	4868
SUBPT	Modified-Whittaker plot or subplot	701
FLG	Flag color	1966
DOT	Presence of a marker dot on the artifact (from prev. recording)	27,178
UP	Side of artifact facing skyward	3373
CON*	Micro-scale environmental context of artifacts	16,037
CL*	Artifact class or category - most general description	31,480
EL**	Artifact element or type	22,313
POR*	Artifact portion or completeness	14,594
MAT**	Artifact material type	22,186
CLR1**	Dominant color and opacity	19,641
CLR2*	Secondary color and opacity	7,442
INCL*	Inclusions color and opacity	6,298
HT**	Heat modifications	10,931
C/T*	Clast or technological measurements?	20,807
MLEN**	Maximum length (mm)	20,807
MWID*	Maximum width (mm)	15,497
MTHK*	Maximum thickness (mm)	15,490
PTW*	Platform width (mm)	4708
PTT*	Platform thickness (mm)	4722
SCR	Scar count	3365
CTX*	Cortex values	18,310
COMMENTS**	Additional artifact comments	7110
PHOTO1*	Photo log number 1	561
PHOTO2*	Photo log number 2	282
PHOTO3*	Photo log number 3	50
AXLEN†	Axial or midline length	156
BLL1†	Blade length 1	41
BLL2†	Blade length 2	27
ND1†	Notch depth 1	131
ND2†	Notch depth 2	58
NW†	Neck or haft width	159
NH†	Neck or haft height	130
BH†	Base height - from proximal to widest point on base	141
BW†	Base width	117
TIME†	Time period	206

* Typical column in spreadsheet for full recording

** Typical column in spreadsheet for rapid (DAMN) recording

† Column in spreadsheet for projectile points only

Table A.4. Code possibilities for flaked stone, with the exception of the "CL" codes where all used codes are listed. The number of times the code was used for flaked stone (with the exception of the "CL" and DOT = Y values) is listed in the column on the right, with only one entry per artifact for those recorded multiple times. See Table A.2 for a description of the column headings.

Column Heading	Codes	Description	Uses	Column Heading	Codes	Description	Uses
INI	A	Sub-centimeter provenience	821	CON	ATR	Animal trail	63
	ABH	Alisa Hjermstad	193		CEX	Cultural (human) exposure	834
	ACM	Andrew Mueller	177		ERD	Eroded surface	204
	ADB	Allison Bohn	608		RBB	Rodent burrow backdirt pile	629
	ADR	Anthony Robinson	1701		RK	Rock	9
	AER	Audry Rudolph	720		SDP	Sediment (bare ground) patch	13,773
	B	Sub-centimeter provenience	204		US	Unspecified	10,953
	BJS	Benjamin Schoville	3		VEG	Surrounded by (touching) plants	663
	BLT	Becky Thomas	739	CL	AC	*Antilocapra americana*	31
	BR	Bruno Romero	201		BI	*Bison bison*	2
	C	Sub-centimeter provenience	141		BI VALVE	Bi-valve	2
	CK	Chris Kinneer	15		CC	*Castor canadensis*	2
	CRB	Chad Bates	77		CE	*Cervus elaphus*	160
	DT***	DM001 50 by 50 cm unit	1189		CORE	Soil core	37
	EDM	Ned Matheson	1190		CS	Chipped stone	26,478
	HNS	Heather Stenson	1279		GS	Ground stone	2
	HTH	Paul Burnett	4220		HAR	Heat altered rock	33
	JJC	James Cale	564		HEARTH	Hearth (prehistoric only)	2
	JKR	Julie Risenhoover	22		HM	Hammerstone	3
	JMJ	Jeffrey Johnston	744		HS	Historic (not including portions of 2003 data collected)	558
	JRB	James Barnes	987				
	KJA	Kevin Alumbaugh	125		OT	Other (see comments)	180
	KMD	Kelly Derr	685		PHOTO	Photograph	164
	KMG	Kimberly Gensler	2		POS	Pieces of Scat (all *canid*)	14
	LCT	Lawrence Todd	1639		RI	Researcher introduced	1
	LJM	Lindsay Melson	365		RK	Rock	15
	N	None	4183		RO	Rodent bone	5
	NIN	Justine Rome	839		SFT	Stone feature	8
	NO	Naomi Ollie	426		SM	Survey marker	407
	R***	GR014 sub-centimeter	234		ST	Steatite	4
	RPC	Rollin Croft	1		TREE	Tree	140
	SP	Scott Plested	983		UD	Unidentified diminutive fauna	36
	WTR	William Reitze	1201		UL	Unidentified large ungulate	19
SURVEY	30 cm CRAWL	Hands and knees, slow crawling with 30 cm transects	1433		UN	Unidentified fauna	131
					US	Unspecified	188
	70 cm WALK	Walk surveys with 70 cm transect spacing	1077	EL	ANG	Angular debris	938
					ANGU	Edge-damaged angular debris	5
	RECON	Nonlinear survey method, no transect spacings	23968		ANGW	Worked angular debris	13
					BF	Biface	41
SUBPT	1	Modified-Whittaker subplot	2		BF2	Minimally flaked biface	35
	2	Modified-Whittaker subplot	0		BF3	Regularly flaked biface, edge irregular,	54
	3	Modified-Whittaker subplot	5		BF4	Margins regular, thinned	64
	4	Modified-Whittaker subplot	1		BF5	Final biface	21
	5	Modified-Whittaker subplot	2		CR	Amorphous core	90
	6	Modified-Whittaker subplot	3		ES	End scraper	4
	7	Modified-Whittaker subplot	1		FK	Flake	20,572
	8	Modified-Whittaker subplot	9		FKU	Edge-damaged flake	1002
	9	Modified-Whittaker subplot	107		FKW	Worked flake	329
	10	Modified-Whittaker subplot	1		GR	Graver	4
	A	Modified-Whittaker subplot	0		NDT	Tested nodule	10
	B	Modified-Whittaker subplot	33		NDU	Edge-damaged nodule	1
	C	Modified-Whittaker subplot	207		NDW	Worked nodule	26
	K	Modified-Whittaker plot	324		OF	Other formal tool	2
	N	None	25,783		PL	Potlid	24
FLG	9	No flag color	24,52		PP	Projectile point	224
	B	Nonsystematic find	877		SC	Scraper	27
	R	Systematic find	1,089		SS	Side scraper	4
DOT	N	Marker dot not present (not previously recorded)	26,478		UF	Uniface	8
					US	Unspecified	2980
	Y	Marker dot present on artifact	650				
UP	DR	Dorsal	1508				
	DS	Distal	11				
	EG	Edge	109				
	LT	Lateral	5				
	ME	Medial	1				
	PR	Proximal	8				
	US	Unspecified	23,755				
	VN	Ventral	1731				

Table A.4, continued.

Column Heading	Codes	Description	Uses	Column Heading	Codes	Description	Uses
POR	AX	Axial		HEAT	CN	Carbonized	1
	CO	Complete			CZ	Crazed	286
	DS	Distal			M	Multiple (see comments)	150
	DSH	Distal plus over half complete			N	None	10,143
	END	End			PL	Potlid scars	268
	FR	Fragment			TFR	Thermal fracture	83
	LT	Lateral			US	Unspecified	15,547
	ME	Medial		C/T	C	Clast	17,713
	N	None			N	None	5,671
	PR	Proximal			T	Technological	3094
	PSH	Proximal plus over half complete		SCR	0	No scars (100% dorsal cortex)	27
	PT	Platform bearing			1	One scar	413
	PTN	Non-platform bearing			2	Two scars	853
	US	Unspecified			3	Three scars	785
MAT	BS	Basalt	116		4	Four scars	516
	CH	Chert	11,759		5	Five or more scars	769
	CL	Chalcedony	1175		9	Not recorded or does not apply	23,115
	DMC	Dollar Mountain Chert	2542	CTX	0	No dorsal cortex	17,702
	DMQ	Dollar Mountain Quartzite	4		1	Under 25% cortex	237
	IR	Irish Rock Chert	97		2	25-50% cortex	148
	MAD	Madison Formation Chert	66		3	51-75% cortex	83
	MS	Metamorphosed shale	6		4	76-99% cortex	75
	NDMC	Not Dollar Mountain Chert	1		5	100% cortex	65
	OB	Obsidian	1266		9	Not recorded or does not apply	8168
	PWD	Silicified wood	887				
	QT	Quartzite	1745				
	QTC	Quartz crystal	1				
	QTM	Morrison Formation Quartzite/Siltstone	64				
	SLS	Silicified sediment	2401				
	US	Unspecified	4292				
	VO	Unspecified igneous	56				
CLR1, CLR2, INCL	BK*	Black					
	BR*	Brown					
	BU*	Blue					
	CL*	Clear					
	CM*	Caramel					
	GN*	Green					
	GR*	Gray					
	MR*	Maroon					
	N	None					
	OR*	Orange					
	PC*	Peach					
	PK*	Pink					
	PR*	Purple					
	RB*	Red-brown					
	RD*	Red-brown					
	TN*	Tan					
	WH*	White					
	YL*	Yellow					
	QTC	Quartz crystal (inclusions only)					
	**T	Transparent					
	**S	Semi-transparent					
	**O	Opaque					
	US	Unspecified					

Appendix B: Projectile Point Data

Table B.1. Projectile point data. See Table B.2 for measurement data.

Site	Initials	Name	Projectile Point Time Period	Figure	Projectile Point	Cluster	Cluster Time Period(s)	Number of Projectile Points in Cluster	Elevation (m)	Context	Portion	Material	Color 1	Color 2	Inclusions Color	Heat
48PA2742	HTH	2790	Late Paleoindian	2.3	a	1	Multicomponent	2	2569	SDP	PR	QTM	GRO	TNO	BKO	N
48PA2792	BR	1	Late Paleoindian	2.3	b	1	Multicomponent	2	2409	N	PSH	QT	GRO	US	US	N
48PA2744	HTH	248	Paleoindian or Early Archaic	2.3	c	1	Multicomponent	33	2537	SDP	CO	CH	RBO	WHO	BKO	N
48PA2744	HTH	2989	Early Archaic	2.3	d	1	Multicomponent	33	2546	SDP	PSH	CH	BKO	N	WHO	N
48PA2772	HTH	246	Early Archaic	2.3	e	2	Early Archaic	1	2843	SDP	PSH	CH	CMO	RDO	CLT	N
48PA2803	HTH	400	Early Archaic	2.3	f	1	Early Archaic	1	3200	ERD	PSH	CH	GRO	WHO	US	CZ+PL+TFR
48PA2802	HTH	406	Early Archaic	2.3	g	-	Unspecified	-	3219	RBB	PSH	CH	BRO	BKO	TNO	CZ+PL+TFR
48PA2768	HTH	2870	Early Archaic	2.3	h	-	Unspecified	-	2550	SDP	PR	CH	CMO	CMO	N	N
48PA2721	LCT	5	Early Archaic	2.3	i	-	Unspecified	-	3329	SDP	PSH	CH	GRS	BRS	N	N
48PA2775	NO	60	Paleoindian or Middle Archaic	2.3	j	7	Paleoindian or Middle Archaic	1	2847	VEG	PR	QT	RDO	N	N	N
48PA2741	BJS	2326	Middle Archaic	2.3	k	-	Unspecified	-	2573	SDP	PR	CH	TNO	N	N	N
48PA2775	BR	2	Unspecified Archaic	2.3	l	3	Unspecified Archaic	1	2846	SDP	PSH	QTM	BRO	TNO	RDO	N
48PA2801	LCT	68	Middle Archaic	2.3	m	-	Unspecified	-	3202	SDP	PSH	QT	GRO	TNO	N	N
48PA2774	HTH	3	Middle Archaic	2.3	n	-	Unspecified	-	2829	SDP	PR	OB	BKS	N	N	N
48PA2737	BLT	38	Middle Archaic	2.3	o	2	Middle Archaic	1	2716	US	CO	CH	PRO	N	N	9
48PA2833	ADB	4	Middle Archaic	2.3	p	-	Unspecified	-	3024	SDP	CO	CH	WHO	TNO	WHO	N
48PA2741	HTH	979	Middle Archaic	2.3	q	2	Multicomponent	5	2573	PRG	PR	CH	WHS	N	N	N
48PA250	LCT	155	Unspecified Archaic	2.3	r	-	Unspecified	-	2792	CEX	PR	QT	RDO	N	N	N
48PA2792	HTH	3	Middle Archaic	2.3	s	-	Unspecified	-	2420	SDP	PSH	CH	PRO	N	N	N
48PA2768	HTH	8033	Middle Archaic	2.3	t	-	Unspecified	-	2550	SDP	PSH	CL	WHO	WHS	N	N
48PA2774	HTH	455	Middle Archaic	2.3	u	1	Middle Archaic	1	2843	SDP	PR	OB	BKS	N	N	N
48PA2774	HTH	459	Late Archaic	2.4	a	4	Late Archaic	3	2846	SDP	CO	CH	PRO	N	N	N
48PA2778	HTH	253	Late Archaic	2.4	aa	1	Late Archaic	2	2916	SDP	PSH	CH	RBS	N	PCO	N
48PA2799	ADB	209	Late Archaic	2.4	ab	6	Multicomponent	3	3177	CEX	PR	CH	GRO	WHO	N	N
48PA2744	HTH	2985	Late Archaic	2.4	ac	1	Multicomponent	33	2546	SDP	PR	CH	GRO	N	GRO	N
48PA2744	HTH	401	Late Archaic	2.4	ad	1	Multicomponent	33	2565	SDP	PSH	CH	WHO	ORO	ORO	N
48PA2774	HTH	462	Late Archaic	2.4	ae	4	Late Archaic	3	2844	SDP	PSH	PWD	GRO	N	BRO	N
48PA2727	WTR	16	Late Archaic	2.4	af	-	Unspecified	-	3307	US	PSH	CH	WHO	GRS	N	N
48PA2719	HTH	31	Late Archaic	2.4	ag	1	Late Archaic	2	2387	SDP	PSH	CH	BKO	GRO	BUO	N
48PA2774	LCT	16	Late Archaic	2.4	ah	5	Multicomponent	3	2848	SDP	PSH	CH	WHO	N	N	TFR
48PA2743	HTH	3151	Late Archaic	2.4	ai	-	Unspecified	-	2550	SDP	PSH	MAD	CMO	N	BKO	N
48PA2818	LCT	293	Late Archaic	2.4	aj	1	Late Archaic	3	2800	N	PSH	CH	RDO	N	WHO	9
48PA2776	HTH	131	Late Archaic	2.4	ak	7	Late Archaic	3	2893	SDP	PR	CH	BRO	N	N	CZ
48PA48	HTH	72	Late Archaic	2.4	al	-	Unspecified	-	2517	SDP	PSH	QT	GRO	TNO	BKO	N
48PA2749	HTH	2866	Late Archaic	2.4	am	-	Unspecified	-	2666	SDP	CO	CH	WHO	N	QTC	N
48PA2768	HTH	2871	Late Archaic	2.4	an	-	Unspecified	-	2550	SDP	PR	CH	BRT	N	WHO	N
48PA2783	HTH	13	Late Archaic	2.4	ao	-	Unspecified	-	3223	SDP	PSH	QT	GRO	N	N	N
48PA2776	HTH	110	Late Archaic	2.4	ap	4	Late Archaic	3	2891	SDP	CO	CH	WHO	N	PCO	N
48PA2744	HTH	2991	Late Archaic	2.4	aq	1	Multicomponent	33	2551	SDP	PSH	PWD	CMO	BRT	N	N
48PA2772	HTH	384	Late Archaic	2.4	ar	28	Multicomponent	17	2854	SDP	PR	CH	BRO	BRO	N	N
48PA2790	HTH	9	Late Archaic	2.4	as	-	Unspecified	-	2910	US	PSH	QTM	GRO	TNO	N	N
48PA2781	HTH	66	Late Archaic	2.4	at	-	Unspecified	-	3184	SDP	CO	PWD	BRS	TNO	N	N
48PA2746	BLT	272	Late Archaic	2.4	au	-	Unspecified	-	2674	SDP	CO	CH	RDO	N	RBO	N
48PA2774	HTH	461	Late Archaic	2.4	av	4	Late Archaic	3	2845	SDP	PR	CH	GRO	N	N	N
48PA2821	LCT	184	Late Archaic	2.4	aw	1	Late Archaic	1	2789	SDP	PR	CH	WHS	N	N	9
48PA2760	WTR	89	Late Archaic	2.4	ax	2	Late Archaic	1	2553	SDP	PR	PWD	TNO	CMO	N	N
48PA2744	HTH	1	Late Archaic	2.4	ay	1	Multicomponent	33	2544	SDP	PR	CH	WHS	N	WHO	N

Table B.1, continued.

Site	Initials	Name	Projectile Point Time Period	Figure	Projectile Point	Cluster	Cluster Time Period(s)	Number of Projectile Points in Cluster	Elevation (m)	Context	Portion	Material	Color 1	Color 2	Inclusions Color	Heat
48PA2744	HTH	6400	Late Archaic	2.4	az	1	Multicomponent	33	2540	SDP	PR	CH	WHO	PCO	N	N
48PA2751	RPC	R003	Late Archaic	2.4	b	4	Late Archaic	1	2677	SDP	CO	CH	MRO	N	N	N
48PA2765	HTH	404	Late Archaic	2.4	ba	-	Unspecified	-	2548	US	PSH	CH	WHS	N	N	9
48PA2751	HTH	R574	Late Archaic	2.4	bb	-	Unspecified	-	2674	SDP	PSH	CH	WHO	N	N	N
48PA2762	LCT	73	Late Archaic	2.4	bc	2	Late Archaic	1	3062	US	PSH	CL	WHS	N	N	N
48PA2744	HTH	2986	Late Archaic	2.4	bd	1	Multicomponent	33	2546	SDP	PR	CH	RDO	N	N	CZ
48PA2744	HTH	211	Late Archaic	2.4	be	1	Multicomponent	33	2537	SDP	PR	CH	PCS	PCO	WHO	N
48PA2744	HTH	2850	Late Archaic	2.4	bf	-	Unspecified	-	2545	SDP	PSH	CH	TNS	N	WHO	PL
48PA2744	HTH	2996	Late Archaic	2.4	bg	1	Multicomponent	33	2549	SDP	PSH	CH	GRS	TNO	N	N
48PA2811	ADB	17	Late Archaic	2.4	bh	1	Late Archaic	1	2538	N	CO	OB	BKS	US	US	N
48PA522	NO	1	Late Archaic	2.4	bi	-	Unspecified	-	2892	SDP	CO	CH	RDO	ORO	BKO	N
48PA2744	HTH	358	Late Archaic	2.4	bj	1	Multicomponent	33	2562	SDP	PSH	CH	PKO	N	N	N
48PA2741	HTH	2380	Late Archaic	2.4	bk	7	Late Archaic	7	2573	SDP	PR	OB	BKO	N	TNO	N
48PA2782	HTH	14	Late Archaic	2.4	bl	1	Late Archaic	1	3205	SDP	PSH	CH	RDO	N	WHO	N
48PA2749	HTH	4735	Late Archaic	2.4	bm	-	Unspecified	-	2666	SDP	PSH	CL	GRS	N	N	N
48PA2744	HTH	425	Late Archaic	2.4	bn	1	Multicomponent	33	2552	SDP	PR	CH	CMO	ORO	WHT	N
48PA2772	HTH	263	Late Archaic	2.4	bo	28	Multicomponent	17	2848	SDP	PSH	CH	PCO	WHO	RBO	N
48PA2741	HTH	2316	Late Archaic	2.4	bp	7	Late Archaic	7	2573	SDP	PSH	CH	BKO	PKS	WHO	N
48PA2741	HTH	1245	Late Archaic	2.4	bq	5	Late Archaic	1	2573	SDP	CO	CH	TNO	WHO	N	N
48PA2741	HTH	2661	Late Archaic	2.4	br	7	Late Archaic	7	2573	SDP	PSH	PWD	TNT	BRO	N	N
48PA2741	HTH	2391	Late Archaic	2.4	bs	7	Late Archaic	7	2573	SDP	CO	PWD	TNT	TNO	N	N
48PA2772	A	287	Late Archaic	2.4	bt	-	Unspecified	-	2840	SDP	ME	CH	WHS	GRS	N	N
48PA2772	HTH	247	Late Archaic	2.4	bu	32	Late Archaic	1	2844	SDP	ME	CH	RDO	N	WHO	CZ
48PA2742	KMD	8	Late Archaic	2.4	bv	3	Late Archaic	1	2564	SDP	ME	CH	PCO	N	CLT	N
48PA2755	KMD	152	Late Archaic	2.4	bw	1	Late Archaic	1	2868	US	ME	OB	N	N	N	9
48PA2746	LCT	160	Late Archaic	2.4	c	7	Late Archaic	1	2674	SDP	PR	CH	RDO	N	N	N
48PA2779	HTH	86	Late Archaic	2.4	d	1	Late Archaic	1	3145	SDP	PR	CH	TNO	N	BRO	N
ISO-GR	HTH	2867	Late Archaic	2.4	e	-	Unspecified	-	2660	SDP	PSH	CH	RDO	N	WHO	N
48PA2751	HTH	245PP	Late Archaic	2.4	f	-	Unspecified	-	2675	SDP	PSH	CH	RDO	N	WHO	N
48PA2744	HTH	2988	Late Archaic	2.4	g	1	Multicomponent	33	2546	SDP	PSH	CH	RDO	N	WHO	N
48PA2774	LCT	21	Late Archaic	2.4	h	6	Late Archaic	1	2844	SDP	PSH	CH	MRO	N	BKO	PL
48PA2740	HTH	123	Late Archaic	2.4	i	5	Late Archaic	4	2576	PRG	PSH	CH	GRS	GRS	N	N
48PA2744	KMD	20	Late Archaic	2.4	j	1	Multicomponent	33	2554	SDP	PSH	PWD	TNS	WHT	N	CZ+TFR
48PA2827	JMJ	58	Late Archaic	2.4	k	-	Unspecified	-	2758	SDP	PSH	CH	WHO	TNO	BRO	N
48PA2774	LCT	25	Late Archaic	2.4	l	1	Late Archaic	1	2848	SDP	PSH	CH	WHS	WHO	WHO	N
48PA2751	HTH	4189	Late Archaic	2.4	m	5	Late Archaic	1	2674	SDP	PR	CH	RDO	N	N	N
48PA2746	BLT	269	Late Archaic	2.4	n	1	Late Archaic	2	2667	SDP	PSH	CH	RDO	N	N	N
48PA2746	LCT	197	Late Archaic	2.4	o	5	Late Archaic	1	2670	SDP	PSH	CH	RDO	N	N	N
48PA2742	HTH	4067	Late Archaic	2.4	p	1	Multicomponent	2	2570	PRG	PSH	CH	WHS	N	N	N
48PA2719	LJM	35	Late Archaic	2.4	q	1	Late Archaic	2	2382	ATR	CO	CH	PKO	N	BRO	CZ+TFR
48PA2740	HTH	156	Late Archaic	2.4	r	1	Late Archaic	1	2576	SDP	PSH	CH	WHO	TNO	N	N
48PA2771	LCT	34	Late Archaic	2.4	s	-	Unspecified	-	3141	RBB	CO	CH	GRS	WHO	N	N
48PA2818	LCT	206	Late Archaic	2.4	t	1	Late Archaic	3	2807	N	PSH	CH	BRT	N	WHO	9
48PA2774	LCT	13	Late Archaic	2.4	u	5	Multicomponent	3	2848	SDP	PSH	CH	TNS	WHO	N	N
48PA2818	LCT	287	Late Archaic	2.4	v	1	Late Archaic	3	2806	CEX	PSH	CH	WHT	N	WHO	9
48PA2825	JMJ	1	Late Archaic	2.4	w	-	Unspecified	-	2390	N	PSH	CH	RBO	N	N	9
48PA2746	BLT	299	Late Archaic	2.4	x	1	Late Archaic	2	2676	SDP	PSH	CH	RDO	N	N	N

Table B.1, continued.

Site	Initials	Name	Projectile Point Time Period	Figure	Projectile Point	Cluster	Cluster Time Period(s)	Number of Projectile Points in Cluster	Elevation (m)	Context	Portion	Material	Color 1	Color 2	Inclusions Color	Heat
48PA2744	BJS	2851	Late Archaic	2.4	y	1	Multicomponent	33	2542	SDP	PSH	CH	RDO	N	N	CZ
48PA2778	HTH	294	Late Archaic	2.4	z	1	Late Archaic	2	2913	SDP	CO	CH	WHO	N	RBO	N
48PA2744	HTH	2998	Unspecified Archaic	2.5	a	-	Unspecified	-	2546	SDP	PSH	SLS	GNO	RDO	N	N
48PA876	HTH	VC3	Unspecified Archaic	2.5	aa	-	Unspecified	-	2525	CEX	ME	QT	GRO	N	N	N
48PA2766	HTH	255	Unspecified Archaic	2.5	ab	-	Unspecified	-	2501	US	ME	CH	WHO	N	N	9
48PA2751	ABH	4216	Unspecified Archaic	2.5	ac	6	Unspecified Archaic	2	2676	SDP	CO	CL	WHT	WHO	N	N
48PA2743	HTH	4575	Unspecified Archaic	2.5	b	9	Late Archaic	2	2550	SDP	PR	CH	BRO	RDO	ORO	PL+TFR
ISO-JC	HTH	107	Unspecified Archaic	2.5	c	-	Unspecified	-	2971	SDP	CO	CH	PCS	N	WHS	N
48PA2813	ADB	1	Unspecified Archaic	2.5	d	1	Unspecified Archaic	1	2537	SDP	CO	QT	GRO	N	N	N
48PA2780	HTH	15	Unspecified Archaic	2.5	e	-	Unspecified	-	3181	SDP	PSH	IR	GNO	GNO	N	N
48PA2805	WTR	62	Unspecified Archaic	2.5	f	1	Unspecified Archaic	1	3207	SDP	PR	CL	WHT	N	BKO	N
48PA2776	HTH	109	Unspecified Archaic	2.5	g	4	Late Archaic	3	2891	SDP	PSH	QT	WHO	N	ORO	N
48PA2815	LCT	8	Unspecified Archaic	2.5	h	3	Unspecified Archaic	1	2594	N	PSH	SLS	GRO	US	US	N
48PA48	HTH	38	Unspecified Archaic	2.5	i	-	Unspecified	-	2513	CEX	PSH	CH	WHO	WHO	N	N
48PA2768	HTH	8031	Unspecified Archaic	2.5	j	-	Unspecified	-	2550	SDP	CO	CH	CMO	N	N	N
48PA2749	HTH	4734	Unspecified Archaic	2.5	k	-	Unspecified	-	2666	PRG	CO	QT	RDO	N	N	N
48PA2745	BLT	222	Unspecified Archaic	2.5	l	1	Unspecified Archaic	2	2676	SDP	PSH	CH	GRS	WHO	N	N
48PA2773	HTH	262	Unspecified Archaic	2.5	m	-	Unspecified	-	2881	SDP	CO	QT	TNO	RDO	N	N
48PA2809	HTH	410	Unspecified Archaic	2.5	n	-	Unspecified	-	3217	SDP	PSH	CH	CMO	RDS	BKO	N
48PA2776	HTH	108	Unspecified Archaic	2.5	o	6	Unspecified Archaic	1	2899	SDP	CO	CH	PCO	RDO	N	CZ
48PA2776	HTH	111	Unspecified Archaic	2.5	p	5	Unspecified Archaic	1	2901	SDP	CO	QT	TNO	N	RBO	N
48PA2776	HTH	201	Unspecified Archaic	2.5	q	1	Unspecified Archaic	2	2896	SDP	PR	QT	GRS	N	N	N
48PA2776	HTH	132	Unspecified Archaic	2.5	r	7	Late Archaic	3	2891	SDP	PR	QT	GRO	N	N	N
48PA876	HTH	VC1	Unspecified Archaic	2.5	s	-	Unspecified	-	2522	CEX	PR	CH	RDO	N	N	N
48PA2810	JMJ	2	Unspecified Archaic	2.5	t	-	Unspecified	-	2444	SDP	CO	CH	BRO	TNO	US	N
48PA2834	HTH	463	Unspecified Archaic	2.5	u	-	Unspecified	-	3145	SDP	CO	QTM	CMO	GRO	N	N
48PA2770	HTH	2	Unspecified Archaic	2.5	v	1	Unspecified Archaic	1	3216	RBB	CO	DMC	RDO	N	GRO	PL
48PA2742	HTH	2719	Unspecified Archaic	2.5	w	-	Unspecified	-	2571	SDP	PSH	CH	CMO	N	N	N
48PA2768	HTH	8032	Unspecified Archaic	2.5	x	-	Unspecified	-	2550	SDP	ME	CH	PRO	RDO	N	N
48PA2749	HTH	4731	Unspecified Archaic	2.5	y	-	Unspecified	-	2666	SDP	ME	OB	BKT	N	N	N
48PA2726	HTH	5	Unspecified Archaic	2.5	z	-	Unspecified	-	3270	SDP	ME	QT	GRS	N	N	N
48PA2741	HTH	2180	Late Archaic or Late Prehistoric	2.6	a	2	Multicomponent	5	2573	SDP	PSH	OB	GNS	N	N	N
48PA2790	SP	14	Late Archaic or Late Prehistoric	2.6	b	-	Unspecified	-	2899	SDP	PSH	CH	TNO	GRO	GRO	N
48PA2799	LCT	24	Late Archaic or Late Prehistoric	2.6	c	6	Multicomponent	3	3174	VEG	CO	IR	GNS	CLT	N	N
48PA2772	HTH	96	Late Archaic or Late Prehistoric	2.6	d	28	Multicomponent	17	2848	SDP	ME	CH	TNO	BRO	BKO	N
48PA876	HTH	VC2	Late Archaic or Late Prehistoric	2.6	e	-	Unspecified	-	2535	CEX	ME	CH	RDO	N	N	PL
48PA2744	HTH	247	Late Archaic or Late Prehistoric	2.6	f	1	Multicomponent	33	2525	SDP	FR	CH	WHS	WHO	BKO	N
ISO-GR	HTH	133PP	Late Prehistoric	2.7	a	-	Unspecified	-	2643	SDP	PSH	CH	WHO	N	N	N
48PA2744	KMG	4183	Late Prehistoric	2.7	aa	1	Multicomponent	33	2545	SDP	PSH	PWD	WHS	RDO	N	N
48PA2744	HTH	406	Late Prehistoric	2.7	ab	1	Multicomponent	33	2544	SDP	PSH	CH	PKO	N	WHO	N
48PA2772	HTH	222	Late Prehistoric	2.7	ac	28	Multicomponent	17	2844	SDP	PR	SLS	GRO	N	N	N
48PA2825	ABH	1	Late Prehistoric	2.7	ad	-	Unspecified	-	2386	N	PSH	OB	BKT	N	N	9
48PA2767	HTH	384	Late Prehistoric	2.7	ae	-	Unspecified	-	2504	US	PR	OB	BKO	N	N	9
48PA2826	ADB	44	Late Prehistoric	2.7	af	-	Unspecified	-	2687	US	CO	CH	WHO	N	N	CZ+TFR
48PA2825	CRB	1	Late Prehistoric	2.7	ag	-	Unspecified	-	2392	N	CO	OB	BKO	N	N	9
48PA2772	HTH	241	Late Prehistoric	2.7	ah	14	Multicomponent	2	2842	SDP	PSH	CL	WHS	N	N	PL
ISO-MC	ADB	314	Late Prehistoric	2.7	ai	-	Unspecified	-	3139	SDP	PSH	DMC	CMO	BRO	N	N

Table B.1, continued.

Site	Initials	Name	Projectile Point Time Period	Figure	Projectile Point	Cluster	Cluster Time Period(s)	Number of Projectile Points in Cluster	Elevation (m)	Context	Portion	Material	Color 1	Color 2	Inclusions Color	Heat
48PA2744	HTH	2983	Late Prehistoric	2.7	aj	1	Multicomponent	33	2543	SDP	CO	CL	WHO	BRO	N	N
48PA2743	HTH	1593	Late Prehistoric	2.7	ak	-	Unspecified	-	2550	SDP	CO	CH	WHO	N	N	N
48PA2832	ADB	6	Late Prehistoric	2.7	al	-	Unspecified	-	2871	US	PSH	OB	BKS	N	N	9
48PA2744	HTH	265	Late Prehistoric	2.7	am	1	Multicomponent	33	2546	SDP	CO	CH	TNT	RDS	N	N
48PA2772	HTH	206	Late Prehistoric	2.7	an	28	Multicomponent	17	2845	SDP	ME	OB	BKS	N	N	N
48PA2763	ADR	61	Late Prehistoric	2.7	ao	1	Late Prehistoric	1	2552	PRG	DSH	CH	MRO	N	N	9
48PA2772	A	530	Late Prehistoric	2.7	ap	21	Late Prehistoric	2	2844	SDP	PSH	CH	RBO	PCO	N	N
48PA2772	HTH	387	Late Prehistoric	2.7	aq	28	Multicomponent	17	2847	SDP	CO	CH	PKS	N	N	N
48PA2772	JRB	296	Late Prehistoric	2.7	ar	28	Multicomponent	17	2845	SDP	PSH	OB	BKT	N	N	N
48PA2741	HTH	2086	Late Prehistoric	2.7	as	2	Multicomponent	5	2573	SDP	PSH	CL	WHT	N	N	N
48PA2744	KMD	52	Late Prehistoric	2.7	at	1	Multicomponent	33	2557	SDP	PSH	CH	RDO	N	PRO	N
48PA2741	HTH	839	Late Prehistoric	2.7	au	2	Multicomponent	5	2573	SDP	PSH	CH	WHO	N	N	N
48PA2744	HTH	405	Late Prehistoric	2.7	av	1	Multicomponent	33	2547	SDP	PSH	CH	WHO	PCO	N	N
48PA2772	HTH	245	Late Prehistoric	2.7	aw	28	Multicomponent	17	2847	SDP	DSH	MAD	BRO	GRO	BKO	PL
48PA523	HTH	1001	Late Prehistoric	2.7	b	1	Late Prehistoric	1	2833	SDP	PSH	CH	BRS	BRO	N	N
48PA2799	LCT	25	Late Prehistoric	2.7	c	6	Multicomponent	3	3177	SDP	PSH	CH	TNO	BRO	WHO	N
48PA2792	BR	2	Late Prehistoric	2.7	d	1	Multicomponent	2	2407	N	PSH	OB	BKT	US	US	N
48PA2772	HTH	383	Late Prehistoric	2.7	e	34	Late Prehistoric	1	2848	SDP	PSH	OB	BKT	N	N	N
48PA2744	HTH	3000	Late Prehistoric	2.7	f	1	Multicomponent	33	2538	SDP	PSH	PWD	BKS	BRS	N	N
48PA2772	LJM	999	Late Prehistoric	2.7	g	-	Unspecified	-	2840	US	CO	PWD	BRS	WHS	N	N
48PA2772	HTH	248	Late Prehistoric	2.7	h	28	Multicomponent	17	2846	SDP	PR	OB	BKT	N	N	N
48PA2774	HTH	52	Late Prehistoric	2.7	i	5	Multicomponent	3	2837	SDP	PR	OB	BKS	N	N	N
48PA2772	A	465	Late Prehistoric	2.7	j	-	Unspecified	-	2844	PRG	CO	QT	WHO	N	N	N
48PA2772	HTH	385	Late Prehistoric	2.7	k	28	Multicomponent	17	2848	SDP	PSH	QT	WHO	N	ORO	N
48PA2754	HTH	2720	Late Prehistoric	2.7	l	-	Unspecified	-	2404	SDP	PSH	OB	BKO	N	N	N
48PA2744	HTH	2982	Late Prehistoric	2.7	m	1	Multicomponent	33	2543	SDP	PR	CH	CMS	N	N	N
48PA2744	HTH	246	Late Prehistoric	2.7	n	1	Multicomponent	33	2535	SDP	PSH	OB	BKO	N	N	N
48PA2772	A	599	Late Prehistoric	2.7	o	15	Late Prehistoric	1	2843	SDP	PR	OB	BKS	N	N	N
48PA2772	HTH	386	Late Prehistoric	2.7	p	28	Multicomponent	17	2848	SDP	PR	QT	TNO	N	BKO	N
48PA2744	HTH	491	Late Prehistoric	2.7	q	1	Multicomponent	33	2552	SDP	PSH	CH	WHO	N	BRO	N
48PA2772	HTH	230	Late Prehistoric	2.7	r	-	Unspecified	-	2842	SDP	PR	OB	BKO	N	N	N
48PA2772	HTH	239	Late Prehistoric	2.7	s	28	Multicomponent	17	2842	SDP	PSH	QT	WHO	N	N	N
48PA2772	HTH	30	Late Prehistoric	2.7	t	28	Multicomponent	17	2849	SDP	PSH	QT	TNO	N	N	N
48PA2772	HTH	204	Late Prehistoric	2.7	u	28	Multicomponent	17	2852	SDP	PR	OB	BKS	N	N	N
48PA2815	ADB	14	Late Prehistoric	2.7	v	1	Late Prehistoric	1	2606	N	CO	QT	GRO	US	US	N
48PA2744	HTH	267	Late Prehistoric	2.7	w	1	Multicomponent	33	2545	SDP	CO	CH	TNS	BRS	BRO	N
48PA2772	KMD	26	Late Prehistoric	2.7	x	28	Multicomponent	17	2851	SDP	CO	OB	BKS	BKT	N	N
48PA2744	HTH	292	Late Prehistoric	2.7	y	1	Multicomponent	33	2541	SDP	PR	QT	GRS	N	N	N
48PA2822	ABH	26	Late Prehistoric	2.7	z	-	Unspecified	-	2388	N	PR	OB	BKT	US	US	N
48PA2744	KMD	25	Late Archaic	None	-	1	Multicomponent	33	2550	SDP	PSH	OB	BKO	N	N	N
48PA2741	HTH	2310	Late Archaic	None	-	7	Late Archaic	7	2573	SDP	PR	OB	BKT	N	N	N
48PA2741	HTH	2399	Late Archaic	None	-	7	Late Archaic	7	2573	SDP	PR	CH	TNO	TNO	N	N
48PA2749	HTH	2864	Late Archaic	None	-	-	Unspecified	-	2666	SDP	PSH	OB	BKO	N	N	N
48PA2772	A	520	Late Prehistoric	None	-	21	Late Prehistoric	2	2844	SDP	PR	OB	BKS	N	N	N
48PA2772	A	13	Not Late Prehistoric	None	-	14	Multicomponent	2	2842	SDP	DS	CH	RDO	TNS	N	N
48PA2776	HTH	123	Not Late Prehistoric	None	-	4	Late Archaic	3	2896	SDP	DS	CH	CMO	RDO	GRO	N
48PA2776	HTH	130	Not Late Prehistoric	None	-	7	Late Archaic	3	2897	SDP	ME	CH	GRO	N	WHO	N

Table B.1, continued.

Site	Initials	Name	Projectile Point Time Period	Figure	Projectile Point	Cluster	Cluster Time Period(s)	Number of Projectile Points in Cluster	Elevation (m)	Context	Portion	Material	Color 1	Color 2	Inclusions Color	Heat
48PA2776	HTH	234	Not Late Prehistoric	None	-	8	Not Late Prehistoric	1	2889	SDP	ME	QT	GRS	N	BKO	N
48PA2774	HTH	423	Not Late Prehistoric	None	-	-	Unspecified	-	2849	SDP	DS	QT	WHO	PCO	N	N
48PA2741	KMG	1129	Not Late Prehistoric	None	-	4	Not Late Prehistoric	1	2573	PRG	DS	CH	TNO	WHO	N	N
48PA2741	HTH	2435	Not Late Prehistoric	None	-	7	Late Archaic	7	2573	SDP	DS	CH	CMS	N	ORO	N
48PA2744	HTH	2987	Not Late Prehistoric	None	-	1	Multicomponent	33	2546	SDP	ME	PWD	BRT	WHO	N	N
48PA303	LCT-B	5	Unspecified	None	-	2	Unspecified	1	2325	US	DS	OB	US	US	US	9
48PA2736	BLT	34	Unspecified	None	-	-	Unspecified	-	2718	US	DS	OB	BKS	N	N	N
48PA2769	ADB	49	Unspecified	None	-	1	Unspecified	1	2346	N	ME	OB	BKS	US	US	N
48PA2797	NO	58	Unspecified	None	-	2	Unspecified	1	2729	N	DS	PWD	BRO	US	US	N
48PA2829	LCT	64	Unspecified	None	-	-	Unspecified	-	2757	SDP	DS	CH	GRO	N	N	N
48PA2772	JRB	80	Unspecified	None	-	28	Multicomponent	17	2844	SDP	DS	CH	PKO	N	WHO	N
48PA2789	HTH	158	Unspecified	None	-	2	Unspecified	1	2825	N	DS	CH	RDO	US	US	N
48PA2745	BLT	212	Unspecified	None	-	1	Unspecified Archaic	2	2675	US	DS	CH	N	N	N	9
48PA2744	HTH	295	Unspecified	None	-	1	Multicomponent	33	2552	SDP	DS	CH	WHS	N	N	N
48PA2740	BJS	323	Unspecified	None	-	5	Late Archaic	4	2576	PRG	DS	CH	MRO	N	N	N
48PA2735	LCT	360	Unspecified	None	-	4	Unspecified	1	2728	US	ME	CH	RDO	N	N	9
48PA2744	HTH	452	Unspecified	None	-	1	Multicomponent	33	2547	SDP	ME	CH	GNO	TNO	BKO	N
48PA2740	HTH	641	Unspecified	None	-	5	Late Archaic	4	2576	SDP	ME	CH	GRS	BKO	N	N
48PA2741	HTH	743	Unspecified	None	-	2	Multicomponent	5	2573	PRG	DS	CH	WHO	N	N	N
48PA2740	HTH	2224	Unspecified	None	-	6	Unspecified Archaic	2	2576	SDP	CO	CH	WHO	WHS	N	N
48PA2744	HTH	2292	Unspecified	None	-	-	Unspecified	-	2545	SDP	DS	CH	WHO	N	N	N
48PA2743	HTH	4622	Unspecified	None	-	9	Late Archaic	2	2550	SDP	DS	CH	RDO	N	N	N
48PA2743	HTH	4720	Unspecified	None	-	6	Unspecified	1	2550	SDP	DS	CH	RDO	RDO	N	N
48PA2772	AER	19	Unspecified Archaic	None	-	24	Unspecified Archaic	1	2842	SDP	ME	CH	BUO	N	WHO	CZ+PL+TFR
48PA2740	HTH	148	Unspecified Archaic	None	-	5	Late Archaic	4	2576	SDP	DS	CH	WHO	GRT	N	N
48PA2776	HTH	205	Unspecified Archaic	None	-	1	Unspecified Archaic	2	2893	SDP	ME	QT	GRS	N	N	N
48PA2744	HTH	266	Unspecified Archaic	None	-	1	Multicomponent	33	2545	SDP	DS	CH	BRO	N	N	N
48PA2772	HTH	388	Unspecified Archaic	None	-	28	Multicomponent	17	2851	SDP	ME	CH	WHO	RDO	RDO	N
48PA2772	A	399	Unspecified Archaic	None	-	19	Unspecified Archaic	1	2843	SDP	ME	MAD	RDS	YLS	BKO	TFR
48PA2741	HTH	2188	Unspecified Archaic	None	-	3	Unspecified Archaic	1	2573	SDP	ME	CH	WHO	GRO	N	N
48PA2740	HTH	2235	Unspecified Archaic	None	-	6	Unspecified Archaic	2	2576	PRG	LT	CH	CMO	N	N	N
48PA2744	HTH	2294	Unspecified Archaic	None	-	-	Unspecified	-	2538	SDP	LT	CH	PRO	N	WHO	N
48PA2749	HTH	2860	Unspecified Archaic	None	-	-	Unspecified	-	2666	SDP	DS	QT	GRO	N	N	N
48PA2749	HTH	2862	Unspecified Archaic	None	-	-	Unspecified	-	2666	SDP	CO	CL	CLT	WHS	N	N
48PA2749	HTH	2863	Unspecified Archaic	None	-	-	Unspecified	-	2666	SDP	DS	QT	GRO	N	N	N
48PA2751	ABH	4218	Unspecified Archaic	None	-	6	Unspecified Archaic	2	2673	SDP	ME	CH	GRO	GRO	PCO	N

Table B.2. Projectile point measurement data.

Site	Initials	Name	Max. Lenth	Max. Width	Max. Thickness	Midline Length	Blade Length 1	Blade Length 2	Notch Depth 1	Notch Depth 2	Neck Width	Neck Height	Base Height	Base Width
48PA2742	HTH	2790	12.4	17.4	6.2	12.4	999	999	999	999	999	999	999	8.2
48PA2792	BR	1	34.4	30.9	6.5	31.8	999	999	999	999	22.8	17.7	999	15.1
48PA2744	HTH	248	71.9	21.4	7.3	999	999	999	999	999	999	999	999	999
48PA2744	HTH	2989	31.9	27	6.6	31.9	999	999	4.7	2.5	17.4	13.5	6.9	26.9
48PA2772	HTH	246	20.1	20.1	4.6	20.1	999	999	4.1	3.8	12.2	7.7	4.2	20.1
48PA2803	HTH	400	17.0	25.1	4.4	999	999	999	2.4	999	19.4	7.8	4.7	999
48PA2802	HTH	406	19.5	21.0	3.7	999	999	999	3.7	3.6	13.0	8.6	6.7	20.1
48PA2768	HTH	2870	7.8	24.3	3.7	6.7	999	999	3.2	2.2	18.6	999	1.8	24.3
48PA2721	LCT	5	29.5	25.6	5.0	26.4	999	999	2.8	2.6	20	10.1	5.7	19.6
48PA2775	NO	60	14.4	17.3	4.4	13.5	999	999	999	999	10.7	6.2	0.0	999
48PA2741	BJS	2326	10.5	15.9	5.7	7.6	999	999	999	999	999	999	0	15.7
48PA2775	BR	2	35.7	18.1	4.7	34.6	999	999	1.8	999	15.6	8.5	3.6	17.2
48PA2801	LCT	68	15.9	17.7	5.4	14.4	999	999	4.4	13.1	999	11.6	2.7	16.8
48PA2774	HTH	3	12.3	13.3	5.3	11	999	999	999	999	11.5	999	2.5	999
48PA2737	BLT	38	30.1	23.0	999	27.9	999	999	5.1	3.5	13.7	11	999	15.5
48PA2833	ADB	4	24.3	19.2	4.1	22.7	18.2	17.6	5.8	999	9.8	7.6	1.6	10.5
48PA2741	HTH	979	18.5	17.3	4.4	16.4	999	999	1.7	999	999	8.3	999	13.6
48PA250	LCT	155	9.7	15.4	999	8.2	999	999	1.7	999	13.4	3.9	2.1	13.7
48PA2792	HTH	3	20.1	15.2	5.0	14.8	999	999	999	999	999	999	0	15.1
48PA2768	HTH	8033	23.6	12.9	5.1	21.8	999	999	999	999	12.2	999	0	12.2
48PA2774	HTH	455	10.3	13.0	5.7	9.8	999	999	999	999	11.6	999	0	12.9
48PA2774	HTH	459	24.8	18.9	4.1	23.7	20.6	20.6	6	5.6	7.2	6.9	1.5	12.5
48PA2778	HTH	253	17.7	21.4	3.8	16.6	999	999	4.4	2.3	13.9	6.3	4.4	17.6
48PA2799	ADB	209	7.9	13.9	3.7	7.9	999	999	999	999.0	10.8	5.9	1.9	14.4
48PA2744	HTH	2985	5.7	14.2	3.0	5.7	999	999	999	999	9.4	999	1.9	14.2
48PA2744	HTH	401	18.7	22.0	4.6	16.9	999	999	2.1	2.1	12.4	9.2	3.4	999
48PA2774	HTH	462	26.1	18.2	6.0	25.2	999	999	999	999	11.8	8.3	2.6	12.6
48PA2727	WTR	16	29.5	18.3	999	29.5	999	999	999	999	10.5	6.1	0	11.5
48PA2719	HTH	31	15.4	16.7	4.6	15.4	999	999	1.3	999	13.2	7.6	2	16.0
48PA2774	LCT	16	19.7	20.8	5.1	19.5	999	999	999	999	11.9	7.5	2.2	13.2
48PA2743	HTH	3151	19.1	18.1	4.3	20.3	999	999	999	999	11.1	7.7	2.4	12.5
48PA2818	LCT	293	20.5	20.7	999	20.5	999	999	5.4	999	11.5	6.8	2.4	999
48PA2776	HTH	131	8.3	13.0	3.4	8.3	999	999	999	999	9.8	999	2.7	13
48PA48	HTH	72	35.4	23.3	5.7	35.5	999	999	5.5	999	14.8	8.9	5.0	16.6
48PA2749	HTH	2866	30.7	19.1	3.9	30.7	22	24.8	4.5	3.5	11	10	3	14
48PA2768	HTH	2871	22.4	26.3	6.7	22.4	999	999	5.7	5	15.2	10.9	3.3	17.9
48PA2783	HTH	13	23.4	20.8	4.9	16.3	999	999	4.3	999	10.7	7.5	4.7	999
48PA2776	HTH	110	35.1	22.7	4.7	35	29.1	999	6.7	999	9.6	7.4	3.1	12.9
48PA2744	HTH	2991	32.7	21.5	5.1	32.2	999	999	5.4	999	11	9.6	999	13.5
48PA2772	HTH	384	10.8	17.6	4.4	11	999	999	999	999	12.9	10.3	6	17.6
48PA2790	HTH	9	33.9	26.8	999	33.4	999	999	999	999	11.9	8.5	3.9	14.9
48PA2781	HTH	66	25.9	26.0	5.9	25.9	999	999	7.5	999	14.2	7.6	1.9	17.8
48PA2746	BLT	272	41.5	23.4	4.7	41.2	36.4	35.7	4	3.8	12.3	6.4	4.7	16.4
48PA2774	HTH	461	23.8	18.4	5.5	17.4	999	999	3.3	999	15	8.6	9.2	999
48PA2821	LCT	184	10.8	19.2	999	10.8	999	999	999	999	14.2	999	4.4	19.2
48PA2760	WTR	89	8.7	17.4	3.0	8.7	999	999	999	999	12.1	999	3.5	17.3
48PA2744	HTH	1	7.8	16.1	3.6	7.8	999	999	999	999	12.8	999	2.4	16.1
48PA2744	HTH	6400	13.6	17.8	4.3	13.6	999	999	999	999	10.5	7.9	3.2	16.1
48PA2751	RPC	R003	23	19.8	3.6	21.5	22	999	6.1	999	9.4	6.9	1.4	999
48PA2765	HTH	404	16.7	14.5	3.5	999	999	999	4.2	999	999	8	2.8	999
48PA2751	HTH	R574	22	19.1	4.2	22	999	999	4	999	11.3	6.8	2	14
48PA2762	LCT	73	17.9	20.5	4.2	18	999	999	2.6	3.3	10.9	5.4	3.6	14
48PA2744	HTH	2986	7.4	15.1	3.3	7.4	999	999	999	999	11.7	999	2.4	15.1
48PA2744	HTH	211	7.3	15.7	3.9	7.3	999	999	999	999	12.1	999	4.1	15.8
48PA2744	HTH	2850	21.8	16.7	3.6	21.8	999	999	4	999	12.5	6.9	3.1	999
48PA2744	HTH	2996	23.5	17.5	4.0	23.5	999	999	3.2	2.5	10.9	8.5	2.9	12.6
48PA2811	ADB	17	22.1	14.0	3.4	999	17.7	999	3.8	999	7.6	6.1	1.4	999
48PA522	NO	1	25.5	18.3	3.5	25.4	22	21.9	4.5	4.4	9.4	6.1	2.2	11.5
48PA2744	HTH	358	12.6	9.7	2.9	12.6	999	999	2.7	999	999	999	1.7	999
48PA2741	HTH	2380	6.5	12.6	3.3	6.7	999	999	999	999	9.3	999	2.5	12.6
48PA2782	HTH	14	16.3	14.2	5.0	25.8	23.1	999	4.1	999	10.3	5.8	3	11.6
48PA2749	HTH	4735	20.3	16.3	4.4	20	999	999	3.5	999	10.6	5.8	3.2	12.6
48PA2744	HTH	425	11.5	13.0	3.8	10.3	999	999	999	999	8.8	6.7	4.5	12.8
48PA2772	HTH	263	24.3	16.5	4.6	24.1	999	999	3.8	2.8	9.6	999	1.4	999
48PA2741	HTH	2316	21.4	14.6	4.1	999	999	999	999	999	11.6	999	2.2	999
48PA2741	HTH	1245	26.6	21.4	4.2	26.6	21.1	20.6	4.8	3.8	13.1	5.7	1.7	15.8
48PA2741	HTH	2661	26.2	20.8	4.7	26.2	19.6	999	999	999	13.1	6.3	2.3	16.6
48PA2741	HTH	2391	23.8	19	4.0	23.5	21,7	999	999	999	11.2	5.9	2.6	999
48PA2772	A	287	16.1	19.9	5.5	999	999	999	3.1	3.1	11.6	5.7	0	999
48PA2772	HTH	247	20.1	22.8	4.9	999	999	999	999	999	12.9	999	999	999
48PA2742	KMD	8	24.0	20.0	4.3	999	999	999	4.6	3.9	12.7	999	999	999
48PA2755	KMD	152	23.6	20.3	4.9	999	999	999	999	999	10.9	999	999	999
48PA2746	LCT	160	7.1	15.1	3.4	6.4	999	999	999	999	8.5	999	0.7	15
48PA2779	HTH	86	7.4	13.9	3.5	7.5	999	999	999	999	8.3	999	1.2	13.8
ISO-GR	HTH	2867	24.1	17.1	4.1	23.1	999	999	4.5	999	8.2	7	1.2	12.3

Table B.2, continued.

Site	Initials	Name	Max. Lenth	Max. Width	Max. Thickness	Midline Length	Blade Length 1	Blade Length 2	Notch Depth 1	Notch Depth 2	Neck Width	Neck Height	Base Height	Base Width
48PA2751	HTH	245PP	21.8	20.3	4.5	21	999	999	4.7	999	9.1	6.4	999	9.7
48PA2744	HTH	2988	23	19.4	4.1	23	999	999	4.4	999	11.5	5.3	1	15.2
48PA2774	LCT	21	21.7	20.4	4.8	21.4	999	999	5.5	999	999	5.4	1.3	999
48PA2740	HTH	123	26.2	17.0	4.0	999	999	999	6.3	999	999	5.2	999	999
48PA2744	KMD	20	20.8	13.1	5.5	999	999	999	999	999	999	7.6	0.5	999
48PA2827	JMJ	58	21.0	14.3	3.6	20.5	999	999	999	999	7.3	5.0	999	999
48PA2774	LCT	25	15.5	15.0	3.8	15.5	999	999	4.1	999	6.3	6.1	0.8	999
48PA2751	HTH	4189	9.1	9	2.5	999	999	999	3.3	999	999	5.6	0.6	999
48PA2746	BLT	269	9.9	9.8	4.0	9.8	999	999	999	999	999	5.9	0.6	999
48PA2746	LCT	197	23.4	16.0	3.8	23.2	999	999	4	3.6	8	5.3	0.7	999
48PA2742	HTH	4067	19.8	17.9	3.9	19.4	999	999	4.7	4.7	8.8	6.4	0.7	999
48PA2719	LJM	35	26.7	17.1	3.4	999	999	999	4.4	999	8.8	5.7	1.6	999
48PA2740	HTH	156	21.9	14.7	3.9	21.4	999	999	4.2	999	8.2	3.1	0	6.6
48PA2771	LCT	34	33.1	23.9	5.7	32.8	32.7	999	6.4	999	10.5	7.6	2.4	12.5
48PA2818	LCT	206	25.9	23.5	999	25.8	999	999	4.7	999	14.2	5.1	2.5	15.2
48PA2774	LCT	13	30.1	19.0	4.6	30.1	999	999	5.3	4.8	7.4	4.7	3	999
48PA2818	LCT	287	17.2	19.7	999	16.9	999	999	4.9	999	10.9	4.7	2.4	999
48PA2825	JMJ	1	13.7	19.3	4.4	13.7	999	999	3.7	999	13.5	5.2	2.4	999
48PA2746	BLT	299	14.9	10.4	4.0	14.2	999	999	4.1	999	999	4.7	1.9	999
48PA2744	BJS	2851	15.4	19.2	3.8	15.4	999	999	4.8	999	9.4	5.7	1.9	11.5
48PA2778	HTH	294	22.6	20.9	3.8	22.6	18.1	19.4	3.6	999	12.4	6.6	3	999
48PA2744	HTH	2998	41.7	19.6	7.8	41.7	999	999	2.6	2.5	13.1	10.1	2.5	15.3
48PA876	HTH	VC3	27	24	999	999	999	999	5.2	999	15.2	999	999	999
48PA2766	HTH	255	26.8	15.3	4.9	999	999	999	999	999	999	999	999	999
48PA2751	ABH	4216	18	17.9	3.6	999	15.2	999	3.9	999	13.3	4	999	999
48PA2743	HTH	4575	14.5	19.3	5.7	14.5	999	999	3.5	2.1	13.1	9.1	1.9	16.6
ISO-JC	HTH	107	41.3	21.6	7.0	41.1	30.7	32	4.4	4.2	11.7	10.1	2.7	13.1
48PA2813	ADB	1	44.5	22.2	5.5	999.0	35.0	36.1	5.2	4.1	12.0	10.7	3.1	999.0
48PA2780	HTH	15	35.9	30.4	5.6	36	999	999	6.3	5.8	15.8	11.9	6	18.6
48PA2805	WTR	62	10.3	21.3	4.3	10.0	999	999	999	999.0	15.7	999.0	8	21.3
48PA2776	HTH	109	24.3	25.1	5.4	24.5	999	999	6.5	999	11.6	7.9	999	999
48PA2815	LCT	8	28.8	25.6	5.8	28.8	999	999	999	999	9.2	10.0	3.4	11.9
48PA48	HTH	38	18.9	23.1	4.4	15.5	999	999	5.4	4.5	13.3	8.1	1.7	16.1
48PA2768	HTH	8031	29.2	21.3	4.4	29.2	23.1	999	2.5	999	16.1	8.2	3.9	19
48PA2749	HTH	4734	30.4	17.8	5.3	30.4	22.4	24.1	1.7	2.9	13.1	9.1	4.2	16.4
48PA2745	BLT	222	18.0	20.3	4.3	16.8	999	999	999	999	999	6.3	2.5	999
48PA2773	HTH	262	34.0	22.4	5.8	33.6	23.5	23.1	4.6	3.7	14.5	13.3	3.9	18
48PA2809	HTH	410	28.9	21.0	6.6	28.9	999	999	999	999	12.0	11.9	3.3	17.4
48PA2776	HTH	108	31.1	20.4	4.6	31.1	22.6	23.4	4.9	999	12.1	7	3.9	15.4
48PA2776	HTH	111	26.6	20.7	5.9	26.7	16.3	15.6	6.1	3.1	13	10.7	4	16.9
48PA2776	HTH	201	14.0	16.4	5.1	13.8	999	999	999	999	13.3	999	3.2	16.4
48PA2776	HTH	132	9.2	16.3	4.5	999	999	999	999	999	999	999	2.6	999
48PA876	HTH	VC1	11.6	17.2	999	999	999	999	999	999	14.7	999	4.6	17.2
48PA2810	JMJ	2	28.8	17.8	6.7	28.8	17.7	999	2.4	999	11.9	11.8	6.4	999
48PA2834	HTH	463	27.2	18.9	5.2	23.4	999	999	999	999	999	999	0	11.6
48PA2770	HTH	2	28.8	15.4	4.5	25.2	23.3	21.0	999	999	999	999	999	7.9
48PA2742	HTH	2719	24.2	14.3	3.8	14.3	17.5	999	1	0.7	12.3	999	2.7	13.1
48PA2768	HTH	8032	30.8	20.8	5.2	999	999	999	5.8	999	19.7	999	999	999
48PA2749	HTH	4731	28.7	22.0	6.0	999	999	999	7	999	13.1	999	999	999
48PA2726	HTH	5	29.2	23.3	4.5	999	999	999	9.5	999	999	999	999	999
48PA2741	HTH	2180	17.7	17	4.0	16.8	999	999	1.2	999	13.1	5.2	999	14.8
48PA2790	SP	14	24.8	14.8	3.9	24.7	999	999	4.2	999	7	6	2	6.6
48PA2799	LCT	24	20.5	14.3	5.4	20.7	17.6	16.8	4.8	2.9	6.0	5.4	6.0	999.0
48PA2772	HTH	96	21.7	17.1	3.6	999	999	999	4.2	999	7.7	999	999	999
48PA876	HTH	VC2	18.4	14.9	999	999	999	999	4.9	999	6.3	999	999	999
48PA2744	HTH	247	14.9	10.8	2.1	999	999	999	999	999	999	999	999	999
ISO-GR	HTH	133PP	18.6	16.7	3.5	18.6	999	999	5.7	999	6.1	5.7	1.9	5.7
48PA2744	KMG	4183	13.2	12.7	3.0	11.5	999	999	2.4	2.2	7.1	8.1	6.1	999
48PA2744	HTH	406	18.7	12.5	2.6	16.8	999	999	2.9	2.8	6.6	6.8	5	12.2
48PA2772	HTH	222	7.8	11.8	2.4	999	23.4	999	2.4	999	7.6	999	5.3	999
48PA2825	ABH	1	25.9	14.2	999	999	999	999	1.9	1	11.2	10.5	8.5	999
48PA2767	HTH	384	11.0	13.7	4.2	8.6	999	999	999	999	10.5	7.6	3.8	13.7
48PA2826	ADB	44	11.5	10.7	999	9.8	999	999	0.7	999	9.2	4.6	3.6	999
48PA2825	CRB	1	27.1	12.9	999.0	999	20.1	18.8	2.4	2.3	8.3	7.5	5.5	999
48PA2772	HTH	241	17.5	12.9	3.0	14.8	999	999	2	1.4	8.6	7.6	5.6	12.9
ISO-MC	ADB	314	21.9	11.3	2.5	20.1	999	999	2	1.9	7	7.6	4.8	11.3
48PA2744	HTH	2983	15.9	9.7	2.6	14.1	10.2	11	1	0.7	7	5.7	3.6	9.7
48PA2743	HTH	1593	14.9	8.4	2.0	14.6	10.1	9.7	1.4	1.3	5.4	5.6	2.1	8.4
48PA2832	ADB	6	16.5	12.9	999	999	999	999	1.5	0.7	9.0	6.0	999	999
48PA2744	HTH	265	14.2	12.3	2.6	14.2	999	999	1.7	999	7.8	5.6	4.2	999
48PA2772	HTH	206	4.8	10.9	2.0	999	999	999	999	999	6.9	999	999	999
48PA2763	ADR	61	14.2	11.0	2.3	14	13.1	12.9	1.7	1.7	7.7	999	999	999
48PA2772	A	530	20.1	12.8	1.8	19.1	999	999	999	999	999	999	999	999
48PA2772	HTH	387	16.5	12.2	2.3	15.1	16.9	999	999	999	999	999	999	12.2
48PA2772	JRB	296	10.6	7.8	2.2	9.6	999	999	999	999	999	999	999	6.8

Table B.2, continued.

Site	Initials	Name	Max. Lenth	Max. Width	Max. Thickness	Midline Length	Blade Length 1	Blade Length 2	Notch Depth 1	Notch Depth 2	Neck Width	Neck Height	Base Height	Base Width
48PA2741	HTH	2086	17	12.6	4.7	16.9	999	999	2.4	999	7.9	6.7	2.1	10.8
48PA2744	KMD	52	17.0	15.3	3.6	16.8	999	999	3.1	999	7.8	5.1	2.8	10.8
48PA2741	HTH	839	17.6	13.6	3.0	17.6	999	999	999	999	9.6	6.5	3.1	10.7
48PA2744	HTH	405	11.5	9.9	2.6	11.2	999	999	1.7	999	5.9	3.4	2.5	999
48PA2772	HTH	245	19.4	10.8	2.2	999	15.8	15.1	2.9	1.3	6.6	999	999	999
48PA523	HTH	1001	13.9	13.5	2.6	13.5	999	999	1.6	1.2	9.7	4.9	2.9	13.2
48PA2799	LCT	25	15.8	13.4	2.0	15.8	999	999	1.9	1.9	9.8	5.8	3.0	13.2
48PA2792	BR	2	11.7	11.5	999.0	10.8	999	999	3.2	999	9	4.5	3.2	999
48PA2772	HTH	383	12.3	11.3	2.3	11.7	999	999	1.9	999	6.1	4.5	999	999
48PA2744	HTH	3000	22.5	12.4	3.2	22.1	999	999	2.4	999	7.8	6.8	2.9	12.4
48PA2772	LJM	999	26.4	11.4	999	26.4	20.8	21.1	1.7	1.7	8	5.8	2.7	10.7
48PA2772	HTH	248	9.4	13.1	2.1	9.4	999	999	1	1	10.9	5.4	3.7	12.8
48PA2774	HTH	52	5.3	14.3	2.9	5.5	999	999	999	999	11	999	3.6	14.3
48PA2772	A	465	16.1	12.6	2.9	15.1	8.2	10.8	2.2	1.7	7.7	8.6	6	12.6
48PA2772	HTH	385	12.3	9.5	2.3	12.3	999	999	2.2	999	999	7.7	5.6	999
48PA2754	HTH	2720	13.5	12.0	2.4	13.2	999	999	3	999	7	7	5.3	13.6
48PA2744	HTH	2982	7.6	14.4	3.3	7.2	999	999	2.9	999	8.9	999	4	14.4
48PA2744	HTH	246	17.3	15.1	3.4	17.3	999	999	2.8	1.9	9.8	6.2	4.8	15.1
48PA2772	A	599	6.6	13.2	2.6	5.9	999	999	3.9	999	9.2	999	5.4	999
48PA2772	HTH	386	6.2	13.0	2.0	5.3	999	999	3.4	999	7.3	999	6.1	12.9
48PA2744	HTH	491	16.3	10.2	2.5	16	999	999	2.2	2.1	6.2	6.7	5.2	10.2
48PA2772	HTH	230	10.3	6.1	2.4	999	999	999	2.5	999	999	999	3.7	999
48PA2772	HTH	239	10.3	10.1	2.6	10	999	999	1.6	1.5	6.1	6.3	4.8	10.1
48PA2772	HTH	30	11.1	10.8	2.2	10.5	999	999	2.7	999	6.1	6.4	4.9	10.9
48PA2772	HTH	204	7.4	11.9	2.4	6.8	999	999	999	999	4.9	999	6.6	999
48PA2815	ADB	14	18.8	12.9	2.8	17.9	12.4	12.9	2.1	1.9	9.1	7.9	6.3	12.9
48PA2744	HTH	267	16.5	11.3	1.9	16.2	10.3	10.4	2.6	1.2	5.7	5.6	4.9	11.1
48PA2772	KMD	26	17.5	10.9	1.9	6.5	12.6	12.1	2.4	2.2	7.6	6.1	5.3	999
48PA2744	HTH	292	10.9	14.7	2.3	8.2	999	999	1.9	1.4	6	10.9	8.7	14.7
48PA2822	ABH	26	8	8.7	999.0	999	999	999	999	999	999	999	6.4	999
48PA2744	KMD	25	15.3	9.8	4.2	999	999	999	999	999	999	7.9	3.8	999
48PA2741	HTH	2310	8.2	6.8	4.2	999	999	999	999	999	999	999	999	999
48PA2741	HTH	2399	8.5	18	3.0	8.5	999	999	999	999	999	999	999	18
48PA2749	HTH	2864	15.4	11.9	5.0	999	999	999	2.9	999	8.4	7.9	999	12
48PA2772	A	520	5.1	9.1	3.2	4.8	999	999	5.2	999	999	999	3.5	999
48PA2772	A	13	21.1	16.6	3.6	999	999	999	999	999	999	999	999	999
48PA2776	HTH	123	20.8	21.8	4.2	999	999	999	999	999	999	999	999	999
48PA2776	HTH	130	14.2	16.1	3.5	999	999	999	999	999	999	999	999	999
48PA2776	HTH	234	33.0	21.2	4.5	999	999	999	999	999	999	999	999	999
48PA2774	HTH	423	18.1	14.9	4.4	999	999	999	999	999	999	999	999	999
48PA2741	KMG	1129	12.9	10.0	2.8	999	999	999	999	999	999	999	999	999
48PA2741	HTH	2435	12.1	12.3	3.1	999	999	999	999	999	999	999	999	999
48PA2744	HTH	2987	15.4	15.5	2.5	999	999	999	999	999	999	999	999	999
48PA303	LCT-B	5	16.2	11.5	999	999	999	999	999	999	999	999	999	999
48PA2736	BLT	34	999	999	999	999	999	999	999	999	999	999	999	999
48PA2769	ADB	49	16.9	999	999	999	999	999	999	999	999	999	999	999
48PA2797	NO	58	12.5	9.1	999.0	999	999	999	999	999	999	999	999	999
48PA2829	LCT	64	15.0	11.5	999	999	999	999	999	999	999	999	999	999
48PA2772	JRB	80	11.9	7.9	2.3	999	999	999	999	999	999	999	999	999
48PA2789	HTH	158	10.1	8.5	2.2	999	999	999	999	999	999	999	999	999
48PA2745	BLT	212	11.4	999	999	999	999	999	999	999	999	999	999	999
48PA2744	HTH	295	10.6	7.9	2.8	999	999	999	999	999	999	999	999	999
48PA2740	BJS	323	7.2	5.5	2.5	999	999	999	999	999	999	999	999	999
48PA2735	LCT	360	15.2	12.1	999	999	999	999	999	999	999	999	999	999
48PA2744	HTH	452	13.2	11.2	1.9	999	999	999	999	999	999	999	999	999
48PA2740	HTH	641	9.1	8.6	2.8	999	999	999	999	999	999	999	999	999
48PA2741	HTH	743	14.9	8.5	2.3	999	999	999	999	999	999	999	999	999
48PA2740	HTH	2224	26.6	14.3	2.7	26.6	26	999	999	999	999	999	999	14.3
48PA2744	HTH	2292	11	8.0	1.8	999	999	999	999	999	999	999	999	999
48PA2743	HTH	4622	11	7.3	2.5	999	999	999	999	999	999	999	999	999
48PA2743	HTH	4720	14.4	10.8	2.1	999	999	999	999	999	999	999	999	999
48PA2772	AER	19	18.0	17.2	4.2	999	999	999	4.2	999	9.9	999	999	999
48PA2740	HTH	148	12.4	9.9	3.8	999	999	999	999	999	999	999	999	999
48PA2776	HTH	205	20.2	19.3	5.1	999	999	999	999	999	999	999	999	999
48PA2744	HTH	266	15.8	14.1	2.9	999	999	999	999	999	999	999	999	999
48PA2772	HTH	388	23.8	21.2	6.9	999	999	999	999	999	999	999	999	999
48PA2772	A	399	15.8	18.1	2.6	999	999	999	999	999	11.2	999	999	999
48PA2741	HTH	2188	23	18.4	5.4	999	999	999	999	999	999	999	999	999
48PA2740	HTH	2235	13.6	8.6	3.4	999	999	999	999	999	999	999	999	999
48PA2744	HTH	2294	20.6	8.9	3.6	999	999	999	999	999	999	999	999	999
48PA2749	HTH	2860	25.3	22	4.3	999	999	999	999	999	999	999	999	999
48PA2749	HTH	2862	22.9	16.1	4.4	22.9	22.4	24.4	0	999	16.1	999	999	16.1
48PA2749	HTH	2863	21.8	19.2	4.5	999	999	999	999	999	999	999	999	999
48PA2751	ABH	4218	14.8	13	4.1	999	999	999	999	999	999	999	999	999

APPENDIX C: SUMMARY CLUSTER DATA

Table C.1. Cluster summary data.

Site	Cluster	n CS	Elev. (m)	Time Period
48PA48	1	21	2517	Unspecified
48PA48	2	7	2518	Unspecified
48PA48	3	9	2518	Unspecified
48PA48	4	86	2513	Unspecified
48PA249	1	7	2925	Unspecified
48PA303	1	112	2323	Unspecified
48PA303	2	6	2320	Unspecified
48PA523	1	153	2833	Late Prehistoric
48PA998	1	5	2199	Unspecified
48PA2719	1	43	2380	Late Archaic
48PA2720	1	280	2345	Unspecified
48PA2721	1	32	3333	Unspecified
48PA2721	2	449	3339	Unspecified
48PA2721	3	8	3330	Unspecified
48PA2721	4	19	3327	Unspecified
48PA2721	5	1127	3321	Early Archaic
48PA2721	6	65	3329	Unspecified
48PA2722	1	14	3085	Unspecified
48PA2723	1	7	3233	Unspecified
48PA2723	2	15	3237	Unspecified
48PA2723	3	6	3233	Unspecified
48PA2723	4	6	3231	Unspecified
48PA2723	5	8	3238	Unspecified
48PA2723	6	5	3229	Unspecified
48PA2723	7	15	3221	Unspecified
48PA2723	8	23	3218	Unspecified
48PA2724	1	202	3323	Unspecified
48PA2725	1	79	3339	Unspecified
48PA2726	1	202	3272	Unspecified Archaic
48PA2728	1	14	3248	Unspecified
48PA2729	1	17	3383	Unspecified
48PA2731	1	29	3275	Unspecified
48PA2733	1	15	2736	Unspecified
48PA2735	1	17	2744	Unspecified
48PA2735	2	14	2739	Unspecified
48PA2735	3	9	2738	Unspecified
48PA2735	4	193	2736	Unspecified
48PA2735	5	5	2730	Unspecified
48PA2737	1	6	2718	Unspecified
48PA2737	2	8	2718	Middle Archaic
48PA2740	1	44	2569	Late Archaic
48PA2740	2	5	2563	Unspecified
48PA2740	3	28	2569	Unspecified
48PA2740	4	6	2576	Unspecified
48PA2740	5	227	2579	Late Archaic
48PA2740	6	172	2579	Unspecified Archaic
48PA2740	7	5	2569	Unspecified
48PA2741	1	6	2566	Unspecified
48PA2741	2	457	2566	Multicomponent: Late Archaic or Late Prehistoric, Late Archaic, Middle Archaic, and Late Paleoindian or Middle Archaic
48PA2741	3	153	2573	Unspecified Archaic
48PA2741	4	144	2579	Not Late Prehistoric
48PA2741	5	25	2576	Late Archaic
48PA2741	6	7	2576	Unspecified
48PA2741	7	319	2573	Late Archaic
48PA2742	1	98	2557	Multicomponent: Paleoindian and Late Archaic
48PA2742	2	31	2566	Unspecified
48PA2742	3	45	2554	Late Archaic
48PA2742	4	20	2551	Unspecified
48PA2743	1	8	2524	Unspecified
48PA2743	2	17	2524	Unspecified
48PA2743	3	8	2530	Unspecified
48PA2743	4	26	2533	Unspecified
48PA2743	5	9	2536	Unspecified
48PA2743	6	8	2533	Unspecified
48PA2743	7	8	2530	Unspecified
48PA2743	8	33	2530	Unspecified
48PA2743	9	394	2521	Late Archaic
48PA2743	10	32	2521	Unspecified
48PA2743	11	10	2521	Unspecified
48PA2743	12	6	2521	Unspecified

Table C.1, continued.

Site	Cluster	n CS	Elev. (m)	Time Period
48PA2743	13	344	2521	Unspecified
48PA2743	14	15	2521	Unspecified
48PA2743	15	10	2530	Unspecified
48PA2744	1	5164	2539	Multicomponent: Early Archaic, Late Archaic, Late or Middle Archaic, Late or Early Archaic, and Late Prehistoric
48PA2744	2	118	2557	Unspecified
48PA2744	3	282	2551	Unspecified
48PA2745	1	695	2680	Unspecified Archaic
48PA2746	1	7	2671	Late Archaic
48PA2746	2	83	2674	Late Archaic
48PA2746	3	23	2672	Unspecified
48PA2746	4	23	2677	Unspecified
48PA2746	5	9	2719	Late Archaic
48PA2746	6	15	2674	Unspecified
48PA2746	7	18	2673	Late Archaic
48PA2746	8	10	2674	Unspecified
48PA2747	1	67	2475	Unspecified
48PA2748	1	11	2672	Unspecified
48PA2750	1	20	2644	Unspecified
48PA2751	1	15	2662	Unspecified
48PA2751	2	6	2676	Unspecified
48PA2751	3	9	2662	Unspecified
48PA2751	4	199	2676	Late Archaic
48PA2751	5	34	2675	Late Archaic
48PA2751	6	34	2673	Unspecified Archaic
48PA2751	7	5	2661	Unspecified
48PA2752	1	9	3092	Unspecified
48PA2752	2	140	3094	Unspecified
48PA2753	1	238	2468	Unspecified
48PA2755	1	53	2868	Late Archaic
48PA2757	1	71	2653	Unspecified
48PA2757	2	31	2645	Unspecified
48PA2757	3	6	2639	Unspecified
48PA2757	4	5	2651	Unspecified
48PA2758	1	10	2524	Unspecified
48PA2759	1	95	2523	Unspecified
48PA2759	2	6	2527	Unspecified
48PA2759	3	18	2521	Unspecified
48PA2760	1	18	2533	Unspecified
48PA2760	2	126	2553	Late Archaic
48PA2761	1	37	3035	Unspecified
48PA2762	1	6	3061	Unspecified
48PA2762	2	92	3062	Late Archaic
48PA2763	1	44	2552	Late Prehistoric
48PA2763	2	5	2549	Unspecified
48PA2764	1	18	2546	Unspecified
48PA2764	2	90	2543	Unspecified
48PA2765	1	7	2542	Unspecified
48PA2766	1	5	2506	Unspecified
48PA2766	2	24	2505	Unspecified
48PA2767	1	14	2509	Unspecified
48PA2767	2	45	2518	Unspecified
48PA2767	3	6	2515	Unspecified
48PA2767	4	6	2509	Unspecified
48PA2767	5	7	2508	Unspecified
48PA2767	6	8	2498	Unspecified
48PA2769	1	34	2353	Late Prehistoric
48PA2769	2	12	2348	Unspecified
48PA2769	3	7	2349	Unspecified
48PA2770	1	67	3219	Unspecified Archaic
48PA2770	2	13	3221	Unspecified
48PA2770	3	12	3198	Unspecified
48PA2770	4	6	3208	Unspecified
48PA2771	1	8	3145	Unspecified
48PA2772	1	15	2846	Unspecified
48PA2772	2	36	2851	Early Archaic
48PA2772	3	5	2846	Unspecified
48PA2772	4	18	2841	Unspecified
48PA2772	5	6	2841	Unspecified
48PA2772	6	6	2841	Unspecified
48PA2772	7	7	2841	Unspecified

Table C.1, continued.

Site	Cluster	n CS	Elev. (m)	Time Period
48PA2772	8	5	2841	Unspecified
48PA2772	9	35	2842	Unspecified
48PA2772	10	229	2842	Unspecified
48PA2772	11	12	2842	Unspecified
48PA2772	12	8	2841	Unspecified
48PA2772	13	108	2842	Unspecified
48PA2772	14	272	2843	Multicomponent: Late Archaic and Late Prehistoric
48PA2772	15	133	2843	Late Prehistoric
48PA2772	16	16	2842	Unspecified
48PA2772	17	11	2840	Unspecified
48PA2772	18	29	2843	Unspecified
48PA2772	19	24	2843	Unspecified Archaic
48PA2772	20	11	2843	Unspecified
48PA2772	21	380	2843	Late Prehistoric
48PA2772	22	24	2843	Unspecified
48PA2772	23	19	2841	Unspecified
48PA2772	24	115	2839	Unspecified Archaic
48PA2772	25	122	2847	Unspecified
48PA2772	26	42	2842	Unspecified
48PA2772	27	5	2850	Unspecified
48PA2772	28	3130	2851	Multicomponent: Late Archaic and Late Prehistoric
48PA2772	29	323	2847	Unspecified
48PA2772	30	40	2845	Unspecified
48PA2772	31	7	2843	Unspecified
48PA2772	32	6	2846	Late Archaic
48PA2772	33	9	2848	Unspecified
48PA2772	34	79	2843	Late Prehistoric
48PA2773	1	6	2884	Unspecified
48PA2773	2	25	2883	Unspecified
48PA2774	1	80	2841	Unspecified
48PA2774	2	27	2837	Unspecified
48PA2774	3	7	2843	Unspecified
48PA2774	4	136	2845	Late Archaic
48PA2774	5	80	2844	Multicomponent: Late Archaic and Late Prehistoric
48PA2774	6	10	2847	Late Archaic
48PA2775	1	52	2843	Late Archaic
48PA2775	2	35	2846	Unspecified
48PA2775	3	23	2847	Unspecified Archaic
48PA2775	4	6	2848	Unspecified
48PA2775	5	79	2849	Unspecified
48PA2775	6	25	2850	Unspecified
48PA2775	7	14	2846	Paleoindian or Middle Archaic
48PA2776	1	53	2893	Unspecified Archaic
48PA2776	2	23	2894	Unspecified
48PA2776	3	6	2893	Unspecified
48PA2776	4	84	2894	Late Archaic
48PA2776	5	9	2905	Unspecified Archaic
48PA2776	6	16	2894	Unspecified Archaic
48PA2776	7	83	2894	Unspecified Archaic
48PA2776	8	11	2893	Not Late Prehistoric
48PA2776	9	7	2891	Unspecified
48PA2777	1	22	2834	Unspecified
48PA2778	1	352	2910	Late Archaic
48PA2779	1	13	3144	Late Archaic
48PA2780	1	11	3178	Unspecified
48PA2782	1	36	3204	Late Archaic
48PA2782	2	74	3207	Unspecified
48PA2783	1	11	3222	Unspecified
48PA2784	1	6	3160	Unspecified
48PA2786	1	64	2942	Unspecified
48PA2788	1	7	2855	Unspecified
48PA2788	2	8	2847	Unspecified
48PA2788	3	11	2851	Unspecified
48PA2788	4	6	2854	Unspecified
48PA2788	5	8	2861	Unspecified
48PA2788	6	6	2866	Unspecified
48PA2789	1	5	2855	Unspecified
48PA2789	2	245	2846	Unspecified
48PA2789	3	84	2819	Unspecified
48PA2790	1	10	2930	Unspecified
48PA2792	1	279	2399	Multicomponent: Paleoindian and Late Prehistoric

Table C.1, continued.

Site	Cluster	n CS	Elev. (m)	Time Period
48PA2792	2	6	2419	Unspecified
48PA2793	1	9	2817	Unspecified
48PA2796	1	6	2794	Unspecified
48PA2796	2	12	2797	Unspecified
48PA2796	3	7	2790	Unspecified
48PA2797	1	5	2758	Unspecified
48PA2797	2	44	2748	Unspecified
48PA2798	1	28	3256	Unspecified
48PA2799	1	5	3174	Unspecified
48PA2799	2	9	3177	Unspecified
48PA2799	3	59	3177	Unspecified
48PA2799	4	38	3172	Unspecified
48PA2799	5	8	3168	Unspecified
48PA2799	6	516	3175	Multicomponent: Late Archaic and Late Prehistoric
48PA2799	7	82	3176	Unspecified
48PA2799	8	12	3173	Unspecified
48PA2799	9	10	3170	Unspecified
48PA2803	1	18	3200	Early Archaic
48PA2803	2	21	3202	Unspecified
48PA2805	1	16	3211	Unspecified Archaic
48PA2805	2	58	3213	Unspecified
48PA2806	1	10	3227	Unspecified
48PA2808	1	9	3193	Unspecified
48PA2809	1	11	3200	Unspecified
48PA2811	1	390	2539	Late Archaic
48PA2811	2	14	2543	Unspecified
48PA2811	3	9	2540	Unspecified
48PA2813	1	32	2535	Unspecified Archaic
48PA2815	1	6	2605	Late Prehistoric
48PA2815	2	11	2607	Unspecified
48PA2815	3	48	2587	Unspecified Archaic
48PA2815	4	5	2590	Unspecified
48PA2815	5	6	2588	Unspecified
48PA2815	6	14	2578	Unspecified
48PA2816	1	7	2754	Unspecified
48PA2817	1	6	2808	Unspecified
48PA2817	2	26	2807	Unspecified
48PA2817	3	32	2825	Unspecified
48PA2817	4	13	2806	Unspecified
48PA2817	5	11	2807	Unspecified
48PA2817	6	6	2807	Unspecified
48PA2817	7	11	2802	Unspecified
48PA2818	1	89	2803	Late Archaic
48PA2819	1	49	2576	Unspecified
48PA2819	2	10	2592	Unspecified
48PA2819	3	5	2594	Unspecified
48PA2821	1	9	2791	Late Archaic
48PA2822	1	6	2388	Unspecified
48PA2824	1	75	2675	Unspecified
48PA2829	1	5	2754	Unspecified
48PA2829	2	46	2748	Unspecified
48PA2829	3	5	2748	Unspecified
48PA2829	4	9	2740	Unspecified
48PA2834	1	9	3023	Unspecified
48PA2834	2	6	3027	Unspecified
48PA2835	1	169	2504	Unspecified
48PA2837	1	12	2198	Unspecified
48PA2837	2	8	2200	Unspecified

Table C.2. Raw toolstone data for every cluster in the project area. See Table A.3 for code descriptions.

Site	Cluster	BS	CH	CL	DMC	DMQ	IR	MAD	MS	OB	PWD	QT	QTM	SLS	US	VO
48PA249	1	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0
48PA2719	1	0	31	2	0	0	0	0	0	6	2	0	0	1	1	0
48PA2720	1	0	0	0	0	0	0	0	0	0	0	280	0	0	0	0
48PA2721	1	0	0	0	22	0	0	0	0	0	0	0	0	0	10	0
48PA2721	2	0	16	22	403	1	0	4	1	0	0	2	0	0	0	0
48PA2721	3	0	2	0	6	0	0	0	0	0	0	0	0	0	0	0
48PA2721	4	0	0	0	18	1	0	0	0	0	0	0	0	0	0	0
48PA2721	5	0	2	5	1117	0	0	0	0	0	0	2	0	0	1	0
48PA2721	6	0	0	1	64	0	0	0	0	0	0	0	0	0	0	0
48PA2722	1	0	3	1	8	0	0	0	0	0	0	0	0	1	1	0
48PA2723	1	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0
48PA2723	2	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0
48PA2723	3	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0
48PA2723	4	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0
48PA2723	5	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0
48PA2723	6	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0
48PA2723	7	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0
48PA2723	8	0	0	0	1	0	0	0	0	0	0	0	0	0	22	0
48PA2724	1	0	2	2	196	0	0	1	0	0	0	1	0	0	0	0
48PA2725	1	0	2	0	62	2	0	1	0	0	0	0	0	12	0	0
48PA2726	1	0	0	0	0	0	0	0	0	0	0	1	0	0	201	0
48PA2728	1	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0
48PA2729	1	0	0	0	17	0	0	0	0	0	0	0	0	0	0	0
48PA2731	1	0	0	0	28	0	0	0	0	0	0	1	0	0	0	0
48PA2733	1	0	0	0	1	0	0	0	0	0	0	0	0	0	14	0
48PA2735	1	0	0	0	0	0	0	0	0	0	0	0	0	0	17	0
48PA2735	2	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0
48PA2735	3	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0
48PA2735	4	0	1	0	0	0	0	0	0	9	0	0	0	0	183	0
48PA2735	5	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0
48PA2737	1	0	0	0	0	0	0	0	0	1	0	0	0	0	5	0
48PA2737	2	0	1	0	0	0	0	0	0	0	0	0	0	0	7	0
48PA2740	1	0	21	1	0	0	1	0	1	0	8	9	0	3	0	0
48PA2740	2	0	3	0	0	0	0	0	0	0	0	2	0	0	0	0
48PA2740	3	0	19	1	0	0	0	0	0	4	2	2	0	0	0	0
48PA2740	4	0	5	0	0	0	0	0	0	1	0	0	0	0	0	0
48PA2740	5	0	169	4	0	0	1	1	0	23	19	8	0	0	1	1
48PA2740	6	0	119	3	0	0	0	0	0	17	19	13	0	1	0	0
48PA2740	7	0	4	1	0	0	0	0	0	0	0	0	0	0	0	0
48PA2741	1	0	3	1	0	0	0	0	0	0	1	1	0	0	0	0
48PA2741	2	0	290	22	0	0	3	1	0	42	62	26	1	5	1	4
48PA2741	3	0	120	12	0	0	1	0	0	1	13	5	0	0	1	0
48PA2741	4	0	87	46	0	0	0	0	0	0	2	8	0	0	1	0
48PA2741	5	0	16	0	0	0	0	0	0	0	8	1	0	0	0	0
48PA2741	6	0	6	0	0	0	0	0	0	1	0	0	0	0	0	0
48PA2741	7	0	204	16	0	0	1	0	0	15	42	36	1	4	0	0
48PA2742	1	0	73	5	0	0	0	0	0	0	9	10	1	0	0	0
48PA2742	2	0	20	2	0	0	0	0	0	1	2	6	0	0	0	0
48PA2742	3	0	21	20	0	0	0	0	0	0	3	0	1	0	0	0
48PA2742	4	0	1	19	0	0	0	0	0	0	0	0	0	0	0	0
48PA2743	1	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0
48PA2743	2	0	0	0	0	0	0	0	0	0	0	17	0	0	0	0
48PA2743	3	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0
48PA2743	4	0	22	0	0	0	0	0	0	0	2	2	0	0	0	0
48PA2743	5	0	4	0	0	0	0	0	0	0	0	0	0	0	0	5
48PA2743	6	0	5	0	0	0	0	0	0	0	1	1	0	0	0	1
48PA2743	7	0	6	0	0	0	0	0	0	0	1	0	1	0	0	0
48PA2743	8	0	29	2	0	0	0	0	0	0	1	1	0	0	0	0
48PA2743	9	0	290	11	0	0	2	0	0	11	56	20	0	3	0	1
48PA2743	10	0	24	0	0	0	0	0	0	2	4	1	0	0	0	1
48PA2743	11	0	6	4	0	0	0	0	0	0	0	0	0	0	0	0
48PA2743	12	0	5	0	0	0	0	0	0	0	1	0	0	0	0	0
48PA2743	13	0	280	3	0	0	2	0	1	10	19	22	1	0	2	4
48PA2743	14	0	14	0	0	0	0	0	0	0	1	0	0	0	0	0
48PA2743	15	0	8	0	0	0	0	0	0	2	0	0	0	0	0	0
48PA2744	1	8	2159	166	12	0	13	0	0	78	239	209	0	325	1938	17
48PA2744	2	0	5	0	0	0	0	0	0	0	0	0	0	0	113	0
48PA2744	3	0	45	0	0	0	1	0	0	0	0	2	0	4	230	0
48PA2745	1	0	628	37	0	0	0	0	0	2	3	18	0	3	1	3
48PA2746	1	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0
48PA2746	2	41	23	0	0	0	0	0	0	4	1	14	0	0	0	0

Table C.2, continued.

Site	Cluster	BS	CH	CL	DMC	DMQ	IR	MAD	MS	OB	PWD	QT	QTM	SLS	US	VO
48PA2746	3	7	8	1	0	0	0	0	0	0	0	7	0	0	0	0
48PA2746	4	1	11	0	0	0	0	0	0	1	0	10	0	0	0	0
48PA2746	5	0	2	0	0	0	0	0	0	0	0	7	0	0	0	0
48PA2746	6	2	9	2	0	0	0	0	0	0	0	2	0	0	0	0
48PA2746	7	1	15	0	0	0	0	0	0	0	0	2	0	0	0	0
48PA2746	8	0	1	4	0	0	0	0	0	1	0	4	0	0	0	0
48PA2747	1	0	67	0	0	0	0	0	0	0	0	0	0	0	0	0
48PA2748	1	0	5	3	0	0	0	0	0	3	0	0	0	0	0	0
48PA2750	1	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0
48PA2751	1	0	14	0	0	0	0	0	0	1	0	0	0	0	0	0
48PA2751	2	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0
48PA2751	3	0	7	0	0	0	0	0	0	1	0	1	0	0	0	0
48PA2751	4	0	174	0	0	0	0	0	0	8	2	15	0	0	0	0
48PA2751	5	0	31	1	0	0	0	0	0	1	0	1	0	0	0	0
48PA2751	6	0	22	1	0	0	0	0	0	4	2	4	0	0	0	1
48PA2751	7	0	3	2	0	0	0	0	0	0	0	0	0	0	0	0
48PA2752	1	0	7	0	0	0	0	0	0	0	0	0	0	2	0	0
48PA2752	2	0	100	5	20	0	0	0	0	0	5	2	0	5	2	1
48PA2753	1	0	160	11	0	0	0	0	0	42	1	16	0	7	0	1
48PA2755	1	0	42	4	0	0	0	0	0	2	2	2	0	1	0	0
48PA2757	1	0	47	10	0	0	8	0	0	3	0	1	0	2	0	0
48PA2757	2	0	27	0	0	0	0	0	0	0	0	1	0	2	0	1
48PA2757	3	0	5	1	0	0	0	0	0	0	0	0	0	0	0	0
48PA2757	4	0	4	0	0	0	0	0	0	0	0	0	0	1	0	0
48PA2758	1	0	1	5	0	0	0	0	0	0	0	4	0	0	0	0
48PA2759	1	0	63	2	0	0	2	0	0	6	6	11	0	4	1	0
48PA2759	2	0	5	0	0	0	0	0	0	0	0	1	0	0	0	0
48PA2759	3	0	17	0	0	0	0	0	0	0	0	1	0	0	0	0
48PA2760	1	0	18	0	0	0	0	0	0	0	0	0	0	0	0	0
48PA2760	2	0	74	4	0	0	0	0	0	2	18	11	0	17	0	0
48PA2761	1	0	12	13	0	0	0	0	0	2	0	9	0	1	0	0
48PA2762	1	0	4	1	0	0	0	0	0	0	1	0	0	0	0	0
48PA2762	2	0	57	18	0	0	0	0	0	1	3	12	0	1	0	0
48PA2763	1	0	29	5	0	0	0	0	0	4	3	3	0	0	0	0
48PA2763	2	0	3	0	0	0	0	0	0	0	1	1	0	0	0	0
48PA2764	1	0	14	0	0	0	0	0	0	2	2	0	0	0	0	0
48PA2764	2	0	46	12	0	0	1	0	0	1	26	3	0	1	0	0
48PA2765	1	0	1	0	0	0	0	0	0	0	6	0	0	0	0	0
48PA2766	1	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0
48PA2766	2	0	13	9	0	0	0	0	0	0	1	1	0	0	0	0
48PA2767	1	0	6	1	0	0	0	0	0	2	5	0	0	0	0	0
48PA2767	2	0	27	6	0	0	0	0	0	2	0	9	0	0	0	1
48PA2767	3	0	4	1	0	0	0	0	0	0	0	1	0	0	0	0
48PA2767	4	0	2	0	0	0	0	0	0	0	0	1	0	3	0	0
48PA2767	5	0	0	0	0	0	0	0	0	3	3	0	0	0	0	1
48PA2767	6	0	6	0	0	0	0	0	0	0	1	1	0	0	0	0
48PA2769	1	0	11	0	0	0	0	0	0	18	0	5	0	0	0	0
48PA2769	2	0	8	0	0	0	0	0	0	1	0	2	0	1	0	0
48PA2769	3	0	3	1	0	0	0	0	0	2	0	1	0	0	0	0
48PA2770	1	1	14	0	50	0	0	1	0	1	0	0	0	0	0	0
48PA2770	2	0	2	0	9	0	0	0	0	0	0	2	0	0	0	0
48PA2770	3	0	2	0	9	0	0	0	0	0	1	0	0	0	0	0
48PA2770	4	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0
48PA2771	1	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0
48PA2772	1	0	13	2	0	0	0	0	0	0	0	0	0	0	0	0
48PA2772	2	0	34	0	0	0	0	0	0	0	0	2	0	0	0	0
48PA2772	3	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0
48PA2772	4	0	11	0	0	0	0	0	0	0	0	3	0	2	2	0
48PA2772	5	0	1	0	0	0	0	0	0	0	0	5	0	0	0	0
48PA2772	6	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0
48PA2772	7	0	5	0	0	0	0	0	0	0	0	2	0	0	0	0
48PA2772	8	0	4	0	0	0	0	0	0	0	0	1	0	0	0	0
48PA2772	9	0	27	2	0	0	0	0	0	1	0	3	0	1	1	0
48PA2772	10	0	180	3	4	0	0	1	0	0	0	13	1	1	26	0
48PA2772	11	0	8	0	0	0	0	0	0	0	0	0	0	2	2	0
48PA2772	12	0	7	0	0	0	0	0	0	0	0	0	0	1	0	0
48PA2772	13	0	73	2	0	0	0	0	0	25	0	6	0	0	2	0
48PA2772	14	0	194	29	0	0	0	0	0	1	0	39	0	0	9	0
48PA2772	15	0	96	6	0	0	1	0	0	6	0	11	0	3	10	0
48PA2772	16	0	0	0	0	0	0	0	0	0	0	0	0	0	16	0
48PA2772	17	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0

Table C.2, continued.

Site	Cluster	BS	CH	CL	DMC	DMQ	IR	MAD	MS	OB	PWD	QT	QTM	SLS	US	VO
48PA2772	18	0	17	4	0	0	0	0	0	1	0	1	0	0	6	0
48PA2772	19	0	16	0	0	0	0	1	0	2	0	0	0	0	5	0
48PA2772	20	0	10	0	0	0	0	0	0	0	0	1	0	0	0	0
48PA2772	21	5	185	6	0	0	2	0	0	8	4	9	0	5	156	0
48PA2772	22	0	13	0	0	0	0	0	0	0	0	0	0	0	11	0
48PA2772	23	0	16	1	0	0	0	0	0	1	0	0	0	1	0	0
48PA2772	24	21	68	2	5	0	0	0	0	6	2	4	0	7	0	0
48PA2772	25	0	99	6	1	0	0	0	0	11	1	3	0	1	0	0
48PA2772	26	0	31	4	3	0	0	0	0	0	3	0	0	1	0	0
48PA2772	27	0	3	0	1	0	0	0	0	0	0	0	0	1	0	0
48PA2772	28	11	1315	137	76	0	20	10	0	176	25	154	1	1196	4	5
48PA2772	29	1	265	9	0	0	2	0	0	4	3	6	0	31	0	2
48PA2772	30	0	14	0	1	0	0	0	0	22	1	2	0	0	0	0
48PA2772	31	0	5	0	0	0	0	0	0	1	0.0	1	0	0.0	0.0	0.0
48PA2772	32	0	4	0	0	0	0	0	0	0	0	1	0	1	0	0
48PA2772	33	0	6	0	0	0	0	0	0	1	1	0	0	1	0	0
48PA2772	34	1	58	1	0	0	11	0	0	4	0	2	0	2	0	0
48PA2773	1	0	3	0	0	0	0	0	0	0	0	0	0	2	0	1
48PA2773	2	0	12	2	6	0	0	0	0	4	0	0	0	0	0	1
48PA2774	1	0	0	0	0	0	0	0	0	1	0	0	0	0	79	0
48PA2774	2	0	0	0	0	0	0	0	0	0	0	0	0	0	27	0
48PA2774	3	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0
48PA2774	4	0	2	0	0	0	0	0	0	0	1	0	0	0	133	0
48PA2774	5	0	2	0	0	0	0	0	0	0	1	0	0	0	77	0
48PA2774	6	0	1	0	0	0	0	0	0	0	0	0	0	0	9	0
48PA2775	1	0	25	2	0	0	0	0	0	3	0	18	3	1	0	0
48PA2775	2	0	27	1	0	0	0	0	0	0	0	4	2	1	0	0
48PA2775	3	0	7	9	0	0	0	0	0	1	0	5	1	0	0	0
48PA2775	4	0	0	0	0	0	0	0	0	0	0	1	0	5	0	0
48PA2775	5	0	77	0	0	0	0	0	0	1	0	1	0	0	0	0
48PA2775	6	0	20	2	0	0	0	0	0	0	1	2	0	0	0	0
48PA2775	7	0	3	5	0	0	0	0	0	0	0	6	0	0	0	0
48PA2776	1	0	13	3	0	0	0	0	0	0	0	33	1	3	0	0
48PA2776	2	0	5	0	0	0	0	0	0	0	0	7	0	11	0	0
48PA2776	3	0	2	0	0	0	0	0	0	0	0	3	0	1	0	0
48PA2776	4	0	57	5	0	0	0	0	0	0	0	17	0	5	0	0
48PA2776	5	2	2	0	0	0	0	0	0	0	0	4	0	1	0	0
48PA2776	6	0	15	0	0	0	0	0	0	0	0	1	0	0	0	0
48PA2776	7	1	34	0	0	0	0	0	0	0	0	45	0	3	0	0
48PA2776	8	0	6	0	0	0	0	0	0	0	0.0	5	0	0	0.0	0.0
48PA2776	9	0	3	0	0	0	0	0	0	1	0	2	0	1	0	0
48PA2777	1	0	13	5	1	0	0	0	0	1	0	0	0	2	0	0
48PA2778	1	0	226	24	0	0	0	25	0	14	47	4	0	11	1	0
48PA2779	1	0	7	3	0	0	0	0	0	0	2	0	1	0	0	0
48PA2780	1	1	7	0	0	0	0	0	0	0	1	2	0	0	0	0
48PA2782	1	0	33	0	0	0	0	0	0	1	0	2	0	0	0	0
48PA2782	2	0	25	11	0	0	0	0	0	1	35	1	0	1	0.0	0.0
48PA2783	1	0	10	0	0	0	0	0	0	0	0	0	0	1	0	0
48PA2784	1	0	4	0	0	0	0	0	0	0	0	0	0	2	0	0
48PA2786	1	0	44	5	0	0	1	0	0	1	1	12	0	0	0	0
48PA2788	1	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0
48PA2788	2	0	3	3	0.0	0	0	0	0	2	0.0	0.0	0	0.0	0.0	0.0
48PA2788	3	0	9	1	0	0	0	0	0	0	0	1	0	0	0	0
48PA2788	4	0	6	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
48PA2788	5	0	4	0	0	0	0	0	0	0	0	2	0	2	0	0
48PA2788	6	0	3	2	0	0	0	0	0	1	0	0	0	0	0	0
48PA2789	1	0	1	0	0	0	0	0	0	1	1	0	0	2	0	0
48PA2789	2	0	47	3	0	0	0	0	0	43	1	2	0	149	0	0
48PA2789	3	0	19	5	1	0	0	0	0	3	1	0	0	55	0	0
48PA2790	1	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0
48PA2792	1	0	91	16	0	0	1	0	0	6	7	11	3	143	1	0
48PA2792	2	0	2	1	0	0	0	0	0	0	0	3	0	0	0	0
48PA2793	1	0	6	0	0	0	0	0	0	0	0	3	0	0	0	0
48PA2796	1	0	5	0	0	0	0	0	0	0	0	0	0	1	0	0
48PA2796	2	0	6	0	0	0	4	0	0	1	0	0	0	1	0	0
48PA2796	3	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0
48PA2797	1	0	2	1	0	0	0	0	0	1	0	1	0	0	0	0
48PA2797	2	0	19	5	0	0	1	0	0	4	1	12	0	2	0	0
48PA2798	1	0	13	0	5	0	0	0	0	0	8	1	0	1	0	0
48PA2799	1	0	3	0	0	0	0	0	0	0	0	2	0	0	0	0
48PA2799	2	0	6	1	1	0	0	0	0	0	0	0	0	1	0	0

Table C.2., continued.

Site	Cluster	BS	CH	CL	DMC	DMQ	IR	MAD	MS	OB	PWD	QT	QTM	SLS	US	VO
48PA2799	3	0	43	5	5	0	0	0	0	0	2	0	1	3	0	0
48PA2799	4	0	19	0	9	0	2	1	0	1	1	2	1	2	0	0
48PA2799	5	0	3	0	0	0	0	0	0	0	0	5	0	0	0	0
48PA2799	6	0	281	42	82	0	3	8	0	6	7	36	21	30	0	0
48PA2799	7	0	33	9	22	0	1	0	0	1	0	6	0	10	0	0
48PA2799	8	0	6	0	2	0	0	0	0	0	1	3	0	0	0	0
48PA2799	9	0	6	0	0	0	0	0	0	0	1	2	0	1	0	0
48PA2803	1	0	8	1	2	0	0	0	0	0	1	1	0	5	0	0
48PA2803	2	0	14	1	1	0	0	0	0	0	4	1	0	0	0	0
48PA2805	1	0	10	1	1	0	0	0	0	0	0	0	1	2	1	0
48PA2805	2	0	19	3	31	0	0	1	0	0	0	2	1	1	0	0
48PA2806	1	0	7	0	2	0	0	0	0	0	0	0	0	1	0	0
48PA2808	1	0	5	0	2	0	0	0	0	0	1	0	0	1	0	0
48PA2809	1	0	3	1	7	0	0	0	0	0	0	0	0	0	0	0
48PA2811	1	3	178	32	3	0	0	0	0	68	17	51	8	30	0	0
48PA2811	2	0	7	0	0	0	0	0	0	1	0	4	0	2	0	0
48PA2811	3	0	4	0	0	0	0	0	0	2	0	1	0	2	0	0
48PA2813	1	0	14	7	0	0	0	0	0	0	5	1	0	5	0	0
48PA2815	1	0	4	0.0	0.0	0	0.0	0.0	0.0	0.0	1	1	0.0	0	0	0
48PA2815	2	0	3	3	0	0	0	0	0	1	1	2	0	1	0	0
48PA2815	3	0	31	3	0	0	1	1	0	2	1	4	0	5	0	0
48PA2815	4	0	4	0	0	0	0	0	0	0	0	1	0	0	0	0
48PA2815	5	0	5	0	0	0	0	0	0	0	0	1	0	0	0	0
48PA2815	6	0	10	0	1	0	0	0	0	0	1	1	1	0	0	0
48PA2816	1	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0
48PA2817	1	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0
48PA2817	2	0	0	0	0	0	0	0	0	0	0	0	0	0	26	0
48PA2817	3	0	0	0	0	0	0	0	0	0	0	0	0	0	32	0
48PA2817	4	0	0	0	0	0	0	0	0	1	0	0	0	0	12	0
48PA2817	5	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0
48PA2817	6	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0
48PA2817	7	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0
48PA2818	1	0	3	0	0	0	0	0	0	3	0	0	0	0	83	0
48PA2819	1	0	25	14	0	0	0	0	0	0	1	7	0	2	0	0
48PA2819	2	0	6	0	0	0	0	0	0	0	1	0	1	2	0	0
48PA2819	3	0	0	1	0	0	0	0	0	0	0	2	0	2	0	0
48PA2821	1	0	1	0	0	0	0	0	0	1	0	1	0	0	6	0
48PA2822	1	0	3	0	0	0	0	0	0	1	0	2	0	0	0	0
48PA2824	1	0	18	6	0	0	0	0	0	0	0	0	0	51	0	0
48PA2829	1	0	0	0	0	0	0	0	0	1	0	0	0	0	4	0
48PA2829	2	0	0	0	0	0	0	0	0	1	1	0	0	0	44	0
48PA2829	3	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0
48PA2829	4	0	1	0	0	0	0	0	0	0	0	0	0	0	8	0
48PA2834	1	0	6	1	0	0	0	0	0	0	0	0	0	2	0	0
48PA2834	2	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0
48PA2835	1	0	105	38	10	0	0	2	0	6	0	7	0	1	0	0
48PA2837	1	0	7	1	0	0	1	0	0	1	0	0	2	0	0	0
48PA2837	2	0	5	3	0	0	0	0	0	0	0	0	0	0	0	0
48PA303	1	0	0	0	0	0	0	0	0	0	0	0	0	0	112	0
48PA303	2	0	0	0	0	0	0	0	0	1	0	0	0	0	5	0
48PA48	1	0	4	1	0	0	0	0	0	0	0	16	0	0	0	0
48PA48	2	0	0	4	2	0	0	0	0	0	0	1	0	0	0	0
48PA48	3	0	3	2	1	0	0	0	0	1	1	1	0	0	0	0
48PA48	4	0	52	2	4	0	0	1	0	9	2	14	1	1	0	0
48PA523	1	0	53	0	0	0	0	0	0	96	0	1	0	0	3	0
48PA998	1	0	1	1	0	0	0	1	0	0	0	2	0	0	0	0

Table C.3. Toolstone variability for all clusters with 20 or more flaked stone artifacts. V values are the observed toolstone percentages subtracted by the expected percentages (see Table 3.3 for expected percentages). TV values are the sum of the absolute values of the V values, and TVI is the TV converted to a 0-100 scale. The most positive V values are shaded.

				V values													
Site	Cluster	TVI	TV	BS	CH	CL	DMC	DMQ	IR	MAD	MS	OB	PWD	QT	QTM	SLS	VO
48PA48	1	74	136.6	-0.5	-34.0	-0.5	-11.5	0.0	-0.4	-0.3	0.0	-5.7	-4.0	68.3	-0.3	-10.8	-0.3
48PA48	4	24	44.7	-0.5	7.5	-3.0	-6.8	0.0	-0.4	0.9	0.0	4.8	-1.7	8.4	0.9	-9.6	-0.3
48PA523	1	63	116.6	-0.5	-17.7	-5.3	-11.5	0.0	-0.4	-0.3	0.0	58.3	-4.0	-7.2	-0.3	-10.8	-0.3
48PA2719	1	33	60.3	-0.5	20.8	-0.5	-11.5	0.0	-0.4	-0.3	0.0	8.6	0.8	-7.9	-0.3	-8.4	-0.3
48PA2720	1	100	184.2	-0.5	-53.0	-5.3	-11.5	0.0	-0.4	-0.3	0.0	-5.7	-4.0	92.1	-0.3	-10.8	-0.3
48PA2721	1	96	177.0	-0.5	-53.0	-5.3	88.5	0.0	-0.4	-0.3	0.0	-5.7	-4.0	-7.9	-0.3	-10.8	-0.3
48PA2721	2	86	158.6	-0.5	-49.4	-0.4	78.3	0.2	-0.4	0.6	0.2	-5.7	-4.0	-7.5	-0.3	-10.8	-0.3
48PA2721	5	95	175.4	-0.5	-52.8	-4.9	87.7	0.0	-0.4	-0.3	0.0	-5.7	-4.0	-7.7	-0.3	-10.8	-0.3
48PA2721	6	94	173.9	-0.5	-53.0	-3.8	87.0	0.0	-0.4	-0.3	0.0	-5.7	-4.0	-7.9	-0.3	-10.8	-0.3
48PA2724	1	93	171.4	-0.5	-52.0	-4.3	85.5	0.0	-0.4	0.2	0.0	-5.7	-4.0	-7.4	-0.3	-10.8	-0.3
48PA2725	1	81	149.7	-0.5	-50.5	-5.3	67.0	2.5	-0.4	1.0	0.0	-5.7	-4.0	-7.9	-0.3	4.4	-0.3
48PA2781	1	92	170.1	-0.5	-53.0	-5.3	85.1	0.0	-0.4	-0.3	0.0	-5.7	-4.0	-4.5	-0.3	-10.8	-0.3
48PA2740	1	34	61.8	-0.5	-5.3	-3.0	-11.5	0.0	1.9	-0.3	2.3	-5.7	14.2	12.6	-0.3	-4.0	-0.3
48PA2740	3	29	53.2	-0.5	14.9	-1.7	-11.5	0.0	-0.4	-0.3	0.0	8.6	3.1	-0.8	-0.3	-10.8	-0.3
48PA2740	5	34	62.0	-0.5	21.8	-3.5	-11.5	0.0	0.0	0.1	0.0	4.5	4.4	-4.4	-0.3	-10.8	0.1
48PA2740	6	30	54.8	-0.5	16.2	-3.6	-11.5	0.0	-0.4	-0.3	0.0	4.2	7.0	-0.3	-0.3	-10.2	-0.3
48PA2741	2	27	49.1	-0.5	10.6	-0.5	-11.5	0.0	0.3	-0.1	0.0	3.5	9.6	-2.2	-0.1	-9.7	0.6
48PA2741	3	36	66.7	-0.5	25.9	2.6	-11.5	0.0	0.3	-0.3	0.0	-5.0	4.6	-4.6	-0.3	-10.8	-0.3
48PA2741	4	38	69.4	-0.5	7.8	26.9	-11.5	0.0	-0.4	-0.3	0.0	-5.7	-2.6	-2.3	-0.3	-10.8	-0.3
48PA2741	5	42	78.0	-0.5	11.0	-5.3	-11.5	0.0	-0.4	-0.3	0.0	-5.7	28.0	-3.9	-0.3	-10.8	-0.3
48PA2741	7	26	47.0	-0.5	10.9	-0.3	-11.5	0.0	-0.1	-0.3	0.0	-1.0	9.2	3.4	0.0	-9.5	-0.3
48PA2742	1	32	59.4	-0.5	21.5	-0.2	-11.5	0.0	-0.4	-0.3	0.0	-5.7	5.2	2.3	0.7	-10.8	-0.3
48PA2742	2	29	53.1	-0.5	11.5	1.2	-11.5	0.0	-0.4	-0.3	0.0	-2.5	2.5	11.5	-0.3	-10.8	-0.3
48PA2742	3	47	87.5	-0.5	-6.3	39.1	-11.5	0.0	-0.4	-0.3	0.0	-5.7	2.7	-7.9	1.9	-10.8	-0.3
48PA2742	4	97	179.4	-0.5	-48.0	89.7	-11.5	0.0	-0.4	-0.3	0.0	-5.7	-4.0	-7.9	-0.3	-10.8	-0.3
48PA2743	4	38	70.6	-0.5	31.6	-5.3	-11.5	0.0	-0.4	-0.3	0.0	-5.7	3.7	-0.2	-0.3	-10.8	-0.3
48PA2743	8	39	71.3	-0.5	34.9	0.8	-11.5	0.0	-0.4	-0.3	0.0	-5.7	-1.0	-4.9	-0.3	-10.8	-0.3
48PA2743	9	34	61.8	-0.5	20.6	-2.5	-11.5	0.0	0.1	-0.3	0.0	-2.9	10.2	-2.8	-0.3	-10.0	0.0
48PA2743	10	37	67.8	-0.5	22.0	-5.3	-11.5	0.0	-0.4	-0.3	0.0	0.6	8.5	-4.8	-0.3	-10.8	2.8
48PA2743	13	34	63.5	-0.5	28.9	-4.4	-11.5	0.0	0.2	-0.3	0.3	-2.8	1.6	-1.5	0.0	-10.8	0.9
48PA2744	1	19	35.1	-0.3	13.9	-0.2	-11.1	0.0	0.0	-0.3	0.0	-3.3	3.4	-1.4	-0.3	-0.7	0.2
48PA2744	2	51	94.0	-0.5	47.0	-5.3	-11.5	0.0	-0.4	-0.3	0.0	-5.7	-4.0	-7.9	-0.3	-10.8	-0.3
48PA2744	3	38	70.1	-0.5	33.5	-5.3	-11.5	0.0	1.5	-0.3	0.0	-5.7	-4.0	-4.1	-0.3	-3.1	-0.3
48PA2745	1	41	75.3	-0.5	37.5	0.0	-11.5	0.0	-0.4	-0.3	0.0	-5.4	-3.6	-5.3	-0.3	-10.4	0.1
48PA2746	2	63	115.7	48.9	-25.3	-5.3	-11.5	0.0	-0.4	-0.3	0.0	-0.9	-2.8	9.0	-0.3	-10.8	-0.3
48PA2746	3	57	104.9	29.9	-18.2	-1.0	-11.5	0.0	-0.4	-0.3	0.0	-5.7	-4.0	22.5	-0.3	-10.8	-0.3
48PA2746	4	43	78.9	3.8	-5.2	-5.3	-11.5	0.0	-0.4	-0.3	0.0	-1.4	-4.0	35.6	-0.3	-10.8	-0.3
48PA2747	1	51	94.0	-0.5	47.0	-5.3	-11.5	0.0	-0.4	-0.3	0.0	-5.7	-4.0	-7.9	-0.3	-10.8	-0.3
48PA2750	1	51	94.0	-0.5	47.0	-5.3	-11.5	0.0	-0.4	-0.3	0.0	-5.7	-4.0	-7.9	-0.3	-10.8	-0.3
48PA2751	4	37	68.9	-0.5	34.4	-5.3	-11.5	0.0	-0.4	-0.3	0.0	-1.7	-3.0	-0.4	-0.3	-10.8	-0.3
48PA2751	5	41	76.4	-0.5	38.2	-2.4	-11.5	0.0	-0.4	-0.3	0.0	-2.8	-4.0	-5.0	-0.3	-10.8	-0.3
48PA2751	6	28	52.3	-0.5	11.7	-2.4	-11.5	0.0	-0.4	-0.3	0.0	6.1	1.9	3.9	-0.3	-10.8	2.6
48PA2752	2	25	45.8	-0.5	19.5	-1.7	3.0	0.0	-0.4	-0.3	0.0	-5.7	-0.4	-6.5	-0.3	-7.2	0.4
48PA2753	1	29	52.6	-0.5	14.2	-0.7	-11.5	0.0	-0.4	-0.3	0.0	11.9	-3.6	-1.2	-0.3	-7.9	0.1
48PA2755	1	31	57.0	-0.5	26.2	2.2	-11.5	0.0	-0.4	-0.3	0.0	-1.9	-0.2	-4.1	-0.3	-8.9	-0.3
48PA2757	1	36	65.7	-0.5	13.2	8.8	-11.5	0.0	10.9	-0.3	0.0	-1.5	-4.0	-6.5	-0.3	-8.0	-0.3
48PA2757	2	40	74.0	-0.5	34.1	-5.3	-11.5	0.0	-0.4	-0.3	0.0	-5.7	-4.0	-4.7	-0.3	-4.3	2.9
48PA2759	1	25	45.2	-0.5	14.0	-3.2	-11.5	0.0	1.7	-0.3	0.0	0.7	2.4	3.8	-0.3	-6.5	-0.3
48PA2760	2	21	39.1	-0.5	5.7	-2.1	-11.5	0.0	-0.4	-0.3	0.0	-4.1	10.3	0.8	-0.3	2.7	-0.3
48PA2761	1	50	92.5	-0.5	-20.6	29.8	-11.5	0.0	-0.4	-0.3	0.0	-0.3	-4.0	16.4	-0.3	-8.1	-0.3
48PA2762	2	31	56.7	-0.5	9.0	14.3	-11.5	0.0	-0.4	-0.3	0.0	-4.6	-0.7	5.1	-0.3	-9.7	-0.3
48PA2763	1	27	50.4	-0.5	12.9	6.1	-11.5	0.0	-0.4	-0.3	0.0	3.4	2.8	-1.1	-0.3	-10.8	-0.3
48PA2764	2	37	67.3	-0.5	-1.9	8.0	-11.5	0.0	0.7	-0.3	0.0	-4.6	24.9	-4.6	-0.3	-9.7	-0.3
48PA2766	2	36	67.1	-0.5	1.2	32.2	-11.5	0.0	-0.4	-0.3	0.0	-5.7	0.2	-3.7	-0.3	-10.8	-0.3
48PA2767	2	32	58.1	-0.5	7.0	8.0	-11.5	0.0	-0.4	-0.3	0.0	-1.3	-4.0	12.1	-0.3	-10.8	1.9
48PA2769	1	59	108.1	-0.5	-20.6	-5.3	-11.5	0.0	-0.4	-0.3	0.0	47.2	-4.0	6.8	-0.3	-10.8	-0.3
48PA2770	1	71	130.6	1.0	-32.1	-5.3	63.1	0.0	-0.4	1.2	0.0	-4.2	-4.0	-7.9	-0.3	-10.8	-0.3
48PA2772	2	45	82.9	-0.5	41.4	-5.3	-11.5	0.0	-0.4	-0.3	0.0	-5.7	-4.0	-2.3	-0.3	-10.8	-0.3
48PA2772	9	30	55.8	-0.5	26.4	0.6	-11.5	0.0	-0.4	-0.3	0.0	-2.8	-4.0	0.9	-0.3	-7.9	-0.3
48PA2772	10	39	72.1	-0.5	35.7	-3.8	-9.5	0.0	-0.4	0.2	0.0	-5.7	-4.0	-1.5	0.2	-10.3	-0.3
48PA2772	13	37	67.5	-0.5	15.9	-3.4	-11.5	0.0	-0.4	-0.3	0.0	17.9	-4.0	-2.2	-0.3	-10.8	-0.3

Table C.3, continued.

Site	Cluster	TVI	TV	BS	CH	CL	DMC	DMQ	IR	MAD	MS	OB	PWD	QT	QTM	SLS	VO
				V values													
48PA2772	14	36	66.8	-0.5	20.8	5.7	-11.5	0.0	-0.4	-0.3	0.0	-5.3	-4.0	6.9	-0.3	-10.8	-0.3
48PA2772	15	29	53.0	-0.5	25.0	-0.4	-11.5	0.0	0.4	-0.3	0.0	-0.8	-4.0	1.0	-0.3	-8.4	-0.3
48PA2772	18	36	66.0	-0.5	20.9	12.1	-11.5	0.0	-0.4	-0.3	0.0	-1.4	-4.0	-3.6	-0.3	-10.8	-0.3
48PA2772	19	45	82.0	-0.5	31.2	-5.3	-11.5	0.0	-0.4	5.0	0.0	4.8	-4.0	-7.9	-0.3	-10.8	-0.3
48PA2772	21	35	63.6	1.7	29.6	-2.6	-11.5	0.0	0.5	-0.3	0.0	-2.1	-2.2	-3.9	-0.3	-8.6	-0.3
48PA2772	22	51	94.0	-0.5	47.0	-5.3	-11.5	0.0	-0.4	-0.3	0.0	-5.7	-4.0	-7.9	-0.3	-10.8	-0.3
48PA2772	24	26	47.8	17.8	6.1	-3.6	-7.2	0.0	-0.4	-0.3	0.0	-0.5	-2.3	-4.4	-0.3	-4.7	-0.3
48PA2772	25	34	62.9	-0.5	28.1	-0.4	-10.7	0.0	-0.4	-0.3	0.0	3.3	-3.2	-5.4	-0.3	-10.0	-0.3
48PA2772	26	31	56.4	-0.5	20.8	4.2	-4.4	0.0	-0.4	-0.3	0.0	-5.7	3.1	-7.9	-0.3	-8.4	-0.3
48PA2772	28	30	55.4	-0.1	-10.9	-0.9	-9.1	0.0	0.2	0.0	0.0	-0.1	-3.2	-3.0	-0.3	27.5	-0.1
48PA2772	29	32	59.2	-0.2	29.0	-2.5	-11.5	0.0	0.2	-0.3	0.0	-4.5	-3.1	-6.0	-0.3	-1.2	0.3
48PA2772	30	54	98.6	-0.5	-18.0	-5.3	-9.0	0.0	-0.4	-0.3	0.0	49.3	-1.5	-2.9	-0.3	-10.8	-0.3
48PA2772	34	38	69.4	0.8	20.4	-4.0	-11.5	0.0	13.5	-0.3	0.0	-0.6	-4.0	-5.4	-0.3	-8.3	-0.3
48PA2773	2	32	58.4	-0.5	-5.0	2.7	12.5	0.0	-0.4	-0.3	0.0	10.3	-4.0	-7.9	-0.3	-10.8	3.7
48PA2775	1	35	64.5	-0.5	-4.9	-1.5	-11.5	0.0	-0.4	-0.3	0.0	0.1	-4.0	26.7	5.5	-8.9	-0.3
48PA2775	2	36	66.2	-0.5	24.1	-2.4	-11.5	0.0	-0.4	-0.3	0.0	-5.7	-4.0	3.5	5.4	-7.9	-0.3
48PA2775	3	56	103.4	-0.5	-22.6	33.8	-11.5	0.0	-0.4	-0.3	0.0	-1.4	-4.0	13.8	4.0	-10.8	-0.3
48PA2775	5	48	88.9	-0.5	44.5	-5.3	-11.5	0.0	-0.4	-0.3	0.0	-4.4	-4.0	-6.6	-0.3	-10.8	-0.3
48PA2775	6	32	59.6	-0.5	27.0	2.7	-11.5	0.0	-0.4	-0.3	0.0	-5.7	0.0	0.1	-0.3	-10.8	-0.3
48PA2776	1	61	112.6	-0.5	-28.5	0.4	-11.5	0.0	-0.4	-0.3	0.0	-5.7	-4.0	54.4	1.6	-5.1	-0.3
48PA2776	2	65	119.1	-0.5	-31.3	-5.3	-11.5	0.0	-0.4	-0.3	0.0	-5.7	-4.0	22.5	-0.3	37.0	-0.3
48PA2776	4	30	55.7	-0.5	14.9	0.7	-11.5	0.0	-0.4	-0.3	0.0	-5.7	-4.0	12.3	-0.3	-4.8	-0.3
48PA2776	7	51	94.0	0.7	-12.0	-5.3	-11.5	0.0	-0.4	-0.3	0.0	-5.7	-4.0	46.3	-0.3	-7.2	-0.3
48PA2777	1	26	47.0	-0.5	6.1	17.4	-7.0	0.0	-0.4	-0.3	0.0	-1.2	-4.0	-7.9	-0.3	-1.7	-0.3
48PA2778	1	32	58.3	-0.5	11.4	1.5	-11.5	0.0	-0.4	6.8	0.0	-1.7	9.4	-6.8	-0.3	-7.7	-0.3
48PA2782	1	42	77.3	-0.5	38.7	-5.3	-11.5	0.0	-0.4	-0.3	0.0	-2.9	-4.0	-2.3	-0.3	-10.8	-0.3
48PA2782	2	57	105.7	-0.5	-19.2	9.6	-11.5	0.0	-0.4	-0.3	0.0	-4.3	43.3	-6.5	-0.3	-9.4	-0.3
48PA2786	1	33	60.6	-0.5	15.8	2.5	-11.5	0.0	1.2	-0.3	0.0	-4.1	-2.4	10.9	-0.3	-10.8	-0.3
48PA2789	2	67	123.7	-0.5	-33.8	-4.1	-11.5	0.0	-0.4	-0.3	0.0	11.9	-3.6	-7.1	-0.3	50.0	-0.3
48PA2789	3	60	110.7	-0.5	-30.4	0.7	-10.3	0.0	-0.4	-0.3	0.0	-2.1	-2.8	-7.9	-0.3	54.7	-0.3
48PA2792	1	45	83.7	-0.5	-20.3	0.5	-11.5	0.0	0.0	-0.3	0.0	-3.5	-1.5	-3.9	0.8	40.6	-0.3
48PA2797	2	33	61.4	-0.5	-9.8	6.1	-11.5	0.0	1.9	-0.3	0.0	3.4	-1.7	19.4	-0.3	-6.3	-0.3
48PA2798	1	34	61.9	-0.5	-6.6	-5.3	6.4	0.0	-0.4	-0.3	0.0	-5.7	24.6	-4.3	-0.3	-7.2	-0.3
48PA2799	3	27	48.9	-0.5	19.9	3.2	-3.0	0.0	-0.4	-0.3	0.0	-5.7	-0.6	-7.9	1.4	-5.7	-0.3
48PA2799	4	24	43.4	-0.5	-3.0	-5.3	12.2	0.0	4.9	2.3	0.0	-3.1	-1.4	-2.6	2.3	-5.5	-0.3
48PA2799	6	15	27.8	-0.5	1.5	2.8	4.4	0.0	0.2	1.3	0.0	-4.5	-2.6	-0.9	3.8	-5.0	-0.3
48PA2799	7	25	46.4	-0.5	-12.8	5.7	15.3	0.0	0.8	-0.3	0.0	-4.5	-4.0	-0.6	-0.3	1.4	-0.3
48PA2803	2	31	57.4	-0.5	13.7	-0.5	-6.7	0.0	-0.4	-0.3	0.0	-5.7	15.0	-3.1	-0.3	-10.8	-0.3
48PA2805	2	49	89.6	-0.5	-20.2	-0.1	41.9	0.0	-0.4	1.4	0.0	-5.7	-4.0	-4.5	1.4	-9.1	-0.3
48PA2811	1	24	44.4	0.3	-7.4	2.9	-10.7	0.0	-0.4	-0.3	0.0	11.7	0.4	5.2	1.8	-3.1	-0.3
48PA2813	1	36	66.1	-0.5	-9.3	16.6	-11.5	0.0	-0.4	-0.3	0.0	-5.7	11.6	-4.8	-0.3	4.8	-0.3
48PA2815	3	18	32.9	-0.5	11.6	1.0	-11.5	0.0	1.7	1.8	0.0	-1.5	-1.9	0.4	-0.3	-0.4	-0.3
48PA2819	1	32	59.3	-0.5	-2.0	23.3	-11.5	0.0	-0.4	-0.3	0.0	-5.7	-2.0	6.4	-0.3	-6.7	-0.3
48PA2824	1	65	119.8	-0.5	-29.0	2.7	-11.5	0.0	-0.4	-0.3	0.0	-5.7	-4.0	-7.9	-0.3	57.2	-0.3
48PA2835	1	30	54.4	-0.5	9.1	17.2	-5.6	0.0	-0.4	0.9	0.0	-2.1	-4.0	-3.8	-0.3	-10.2	-0.3

Table C.4. Artifact type tallies for every cluster in the project area. See Table A.3 for code descriptions.

Cluster		ANG	ANGU	ANGW	BF	BF2	BF3	BF4	BF5	CR	FK	FKU	FKW	GR	NDU	NDT	NDW	OF	PL	PP	SC	UF	US
48PA249	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
48PA303	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	112
48PA303	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	5
48PA48	1	3	0	0	0	0	0	0	0	0	15	2	1	0	0	0	0	0	0	0	0	0	0
48PA48	2	0	0	0	0	0	0	0	0	0	5	2	0	0	0	0	0	0	0	0	0	0	0
48PA48	3	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0
48PA48	4	1	0	0	0	0	0	1	0	0	76	6	2	0	0	0	0	0	0	0	0	0	0
48PA998	1	0	0	0	0	0	0	0	0	0	3	1	1	0	0	0	0	0	0	0	0	0	0
48PA2719	1	0	0	0	0	0	0	1	0	1	35	3	1	0	0	0	0	0	0	2	0	0	0
48PA2720	1	0	0	0	0	0	0	0	0	0	280	0	0	0	0	0	0	0	0	0	0	0	0
48PA2721	1	2	0	0	0	0	0	0	0	0	28	1	0	0	0	0	0	0	0	0	0	0	1
48PA2721	2	29	1	0	0	0	0	0	0	4	319	93	3	0	0	0	0	0	0	0	0	0	0
48PA2721	3	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0
48PA2721	4	2	0	0	0	0	0	0	0	0	15	2	0	0	0	0	0	0	0	0	0	0	0
48PA2721	5	0	0	0	3	0	0	1	1	0	1121	0	0	0	0	0	0	0	0	1	0	0	0
48PA2721	6	0	0	0	0	0	0	0	0	1	64	0	0	0	0	0	0	0	0	0	0	0	0
48PA2722	1	0	0	0	0	1	0	1	0	0	9	3	0	0	0	0	0	0	0	0	0	0	0
48PA2723	1	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0
48PA2723	2	4	0	0	0	0	0	0	0	1	10	0	0	0	0	0	0	0	0	0	0	0	0
48PA2723	3	1	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0
48PA2723	4	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0
48PA2723	5	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0
48PA2723	6	0	0	0	0	0	0	0	0	1	4	0	0	0	0	0	0	0	0	0	0	0	0
48PA2723	7	0	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0
48PA2723	8	1	0	0	0	0	0	0	0	0	22	0	0	0	0	0	0	0	0	0	0	0	0
48PA2724	1	20	0	0	0	1	0	1	0	3	140	37	0	0	0	0	0	0	0	0	0	0	0
48PA2725	1	8	0	0	0	0	0	0	0	2	64	5	0	0	0	0	0	0	0	0	0	0	0
48PA2726	1	0	0	0	1	0	0	0	0	1	198	1	0	0	0	0	0	0	0	1	0	0	0
48PA2728	1	0	0	0	1	0	0	0	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0
48PA2729	1	0	0	0	0	0	0	0	0	0	13	3	0	0	0	1	0	0	0	0	0	0	0
48PA2731	1	3	0	0	0	0	1	0	0	0	24	0	0	0	0	0	0	0	0	0	1	0	0
48PA2733	1	0	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0
48PA2735	1	0	0	0	0	0	0	0	0	0	17	0	0	0	0	0	0	0	0	0	0	0	0
48PA2735	2	0	0	0	1	0	0	0	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0
48PA2735	3	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0
48PA2735	4	0	0	0	0	0	0	0	0	0	192	0	0	0	0	0	0	0	0	1	0	0	0
48PA2735	5	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0
48PA2737	1	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0
48PA2737	2	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	1	0	0	0
48PA2740	1	0	0	0	2	0	0	0	0	0	36	2	2	0	1	0	0	0	0	1	0	0	0
48PA2740	2	0	0	0	0	0	0	0	0	0	4	0	1	0	0	0	0	0	0	0	0	0	0
48PA2740	3	2	0	1	1	0	0	1	0	0	18	3	2	0	0	0	0	0	0	0	0	0	0
48PA2740	4	0	0	0	0	0	0	0	0	0	4	1	1	0	0	0	0	0	0	0	0	0	0
48PA2740	5	14	0	0	1	0	0	0	0	0	177	18	13	0	0	0	0	0	0	4	0	0	0
48PA2740	6	3	0	2	1	0	1	0	0	0	126	18	19	0	0	0	0	0	0	2	0	0	0
48PA2740	7	0	0	0	0	0	0	0	0	0	4	0	1	0	0	0	0	0	0	0	0	0	0
48PA2741	1	0	0	0	0	0	0	0	0	0	5	0	1	0	0	0	0	0	0	0	0	0	0
48PA2741	2	17	0	1	3	1	1	1	2	0	346	53	24	0	0	0	1	0	0	6	1	0	0
48PA2741	3	13	0	0	0	0	0	0	0	0	121	15	3	0	0	0	0	0	0	1	0	0	0
48PA2741	4	58	0	0	1	0	0	0	0	0	80	2	2	0	0	0	0	0	0	1	0	0	0
48PA2741	5	2	0	0	0	0	0	1	0	0	17	3	1	0	0	0	0	0	0	1	0	0	0
48PA2741	6	0	0	0	0	0	0	0	0	0	5	1	1	0	0	0	0	0	0	0	0	0	0
48PA2741	7	15	2	0	3	0	0	1	0	0	253	23	14	0	0	0	0	0	0	7	1	0	0
48PA2742	1	9	0	0	0	0	0	0	1	0	77	7	1	0	0	1	0	0	0	2	0	0	0
48PA2742	2	2	0	0	1	1	0	0	0	0	22	2	2	0	0	0	0	0	0	0	1	0	0
48PA2742	3	11	0	1	1	0	0	0	0	0	29	1	1	0	0	0	0	0	0	1	0	0	0
48PA2742	4	5	0	0	1	0	0	0	0	4	8	2	0	0	0	0	0	0	0	0	0	0	0
48PA2743	1	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0
48PA2743	2	0	0	0	0	0	0	0	0	0	17	0	0	0	0	0	0	0	0	0	0	0	0
48PA2743	3	2	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0
48PA2743	4	4	0	0	1	0	0	0	0	0	18	2	1	0	0	0	0	0	0	0	0	0	0
48PA2743	5	2	0	0	1	0	0	1	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0
48PA2743	6	0	0	0	1	0	0	0	0	0	6	0	0	0	0	0	0	0	0	1	0	0	0
48PA2743	7	1	0	0	0	0	0	0	0	0	6	1	0	0	0	0	0	0	0	0	0	0	0
48PA2743	8	2	0	0	0	0	0	0	0	0	28	0	2	0	0	0	0	0	0	0	0	1	0
48PA2743	9	24	0	0	0	0	0	0	0	0	353	8	7	0	0	0	0	0	0	2	0	0	0
48PA2743	10	1	0	0	0	0	0	0	0	1	30	0	0	0	0	0	0	0	0	0	0	0	0
48PA2743	11	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0
48PA2743	12	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0
48PA2743	13	23	0	0	3	0	0	0	1	1	297	12	7	0	0	0	0	0	0	0	0	0	0
48PA2743	14	1	0	0	1	0	0	0	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0

Table C.4, continued.

Cluster		ANG	ANGU	ANGW	BF	BF2	BF3	BF4	BF5	CR	FK	FKU	FKW	GR	NDU	NDT	NDW	OF	PL	PP	SC	UF	US
48PA2743	15	0	0	0	0	0	0	0	0	0	9	0	1	0	0	0	0	0	0	0	0	0	0
48PA2744	1	186	1	1	1	2	3	5	2	5	2899	56	26	1	0	2	1	0	1	33	2	1	1936
48PA2744	2	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	113
48PA2744	3	9	0	0	0	0	0	0	0	0	43	0	0	0	0	0	0	0	0	0	0	0	230
48PA2745	1	8	0	0	0	0	0	0	0	1	682	1	0	0	0	0	0	0	0	2	1	0	0
48PA2746	1	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	1	0	0	0
48PA2746	2	1	0	0	0	0	0	0	0	0	80	0	0	0	0	0	0	0	0	1	0	0	1
48PA2746	3	1	0	0	0	0	0	0	0	0	22	0	0	0	0	0	0	0	0	0	0	0	0
48PA2746	4	1	0	0	1	0	0	0	0	0	21	0	0	0	0	0	0	0	0	0	0	0	0
48PA2746	5	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	1	0	0	0
48PA2746	6	0	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0
48PA2746	7	1	0	0	1	0	0	1	0	0	14	0	0	0	0	0	0	0	0	1	0	0	0
48PA2746	8	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0
48PA2747	1	31	0	0	0	0	0	0	0	5	31	0	0	0	0	0	0	0	0	0	0	0	0
48PA2748	1	0	0	0	0	0	0	0	0	1	10	0	0	0	0	0	0	0	0	0	0	0	0
48PA2750	1	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0
48PA2751	1	2	0	0	0	0	0	0	0	0	8	2	3	0	0	0	0	0	0	0	0	0	0
48PA2751	2	1	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	1	0	0
48PA2751	3	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0
48PA2751	4	4	0	0	0	0	0	0	0	0	166	19	8	0	0	0	0	1	0	1	0	0	0
48PA2751	5	1	0	0	0	0	0	0	0	1	24	6	1	0	0	0	0	0	0	1	0	0	0
48PA2751	6	1	0	0	0	0	0	0	0	1	20	4	6	0	0	0	0	0	0	2	0	0	0
48PA2751	7	0	0	0	0	0	0	0	0	0	3	1	1	0	0	0	0	0	0	0	0	0	0
48PA2752	1	2	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0
48PA2752	2	9	0	0	0	0	1	0	0	1	118	9	1	0	0	0	0	0	0	0	1	0	0
48PA2753	1	0	0	0	0	1	0	0	0	0	236	1	0	0	0	0	0	0	0	0	0	0	0
48PA2755	1	1	0	0	0	0	0	0	0	0	51	0	0	0	0	0	0	0	0	1	0	0	0
48PA2757	1	0	0	0	0	0	0	0	0	0	71	0	0	0	0	0	0	0	0	0	0	0	0
48PA2757	2	0	0	0	0	0	0	0	0	0	31	0	0	0	0	0	0	0	0	0	0	0	0
48PA2757	3	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0
48PA2757	4	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0
48PA2758	1	0	0	0	0	1	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0
48PA2759	1	3	0	0	0	0	0	1	0	0	90	0	1	0	0	0	0	0	0	0	0	0	0
48PA2759	2	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0
48PA2759	3	0	0	0	0	0	0	0	0	0	18	0	0	0	0	0	0	0	0	0	0	0	0
48PA2760	1	0	0	0	0	0	0	0	0	0	18	0	0	0	0	0	0	0	0	0	0	0	0
48PA2760	2	1	0	0	0	0	0	0	1	0	118	3	2	0	0	0	0	0	0	1	0	0	0
48PA2761	1	0	0	0	1	0	0	0	0	0	36	0	0	0	0	0	0	0	0	0	0	0	0
48PA2762	1	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0
48PA2762	2	0	0	0	1	0	0	0	0	0	85	2	2	0	0	0	1	0	0	1	0	0	0
48PA2763	1	1	0	0	0	0	0	0	0	0	42	0	0	0	0	0	0	0	0	1	0	0	0
48PA2763	2	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0
48PA2764	1	2	0	0	0	0	0	0	0	0	16	0	0	0	0	0	0	0	0	0	0	0	0
48PA2764	2	1	0	0	0	0	0	0	0	0	87	1	0	0	0	0	0	0	1	0	0	0	0
48PA2765	1	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0
48PA2766	1	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0
48PA2766	2	0	0	0	0	0	0	0	0	0	24	0	0	0	0	0	0	0	0	0	0	0	0
48PA2767	1	0	0	0	0	0	0	0	0	0	13	0	0	0	0	0	1	0	0	0	0	0	0
48PA2767	2	0	0	0	0	0	0	0	0	0	45	0	0	0	0	0	0	0	0	0	0	0	0
48PA2767	3	0	0	0	0	0	0	0	0	1	5	0	0	0	0	0	0	0	0	0	0	0	0
48PA2767	4	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0
48PA2767	5	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0
48PA2767	6	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0
48PA2769	1	0	0	0	0	0	0	0	0	0	31	2	0	0	0	0	0	0	0	1	0	0	0
48PA2769	2	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0
48PA2769	3	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	1	0	0
48PA2770	1	1	0	0	0	0	0	0	0	0	64	0	1	0	0	0	0	0	0	1	0	0	0
48PA2770	2	0	0	0	0	0	0	0	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0
48PA2770	3	0	0	0	0	0	0	0	0	2	9	1	0	0	0	0	0	0	0	0	0	0	0
48PA2770	4	0	0	0	0	0	0	0	0	0	4	2	0	0	0	0	0	0	0	0	0	0	0
48PA2771	1	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0
48PA523	1	5	0	0	0	0	0	0	0	0	143	1	0	0	0	0	0	0	0	1	0	0	3
48PA2772	1	3	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0
48PA2772	2	4	0	0	0	0	0	0	0	0	31	0	0	0	0	0	0	0	0	1	0	0	0
48PA2772	3	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0
48PA2772	4	2	0	0	0	0	0	0	0	0	14	1	0	0	0	0	0	0	1	0	0	0	0
48PA2772	5	1	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0
48PA2772	6	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0
48PA2772	7	0	0	0	0	0	0	0	0	0	6	1	0	0	0	0	0	0	0	0	0	0	0
48PA2772	8	0	0	0	0	0	0	0	0	0	4	1	0	0	0	0	0	0	0	0	0	0	0
48PA2772	9	0	0	0	0	0	0	0	0	1	32	2	0	0	0	0	0	0	0	0	0	0	0

Table C.4, continued.

Cluster		ANG	ANGU	ANGW	BF	BF2	BF3	BF4	BF5	CR	FK	FKU	FKW	GR	NDU	NDT	NDW	OF	PL	PP	SC	UF	US
48PA2772	10	0	0	1	0	0	0	0	0	0	225	3	0	0	0	0	0	0	0	0	0	0	0
48PA2772	11	0	0	0	0	0	0	0	0	0	11	1	0	0	0	0	0	0	0	0	0	0	0
48PA2772	12	1	0	0	0	0	0	0	0	0	6	1	0	0	0	0	0	0	0	0	0	0	0
48PA2772	13	3	0	0	0	0	0	0	0	0	102	0	3	0	0	0	0	0	0	0	0	0	0
48PA2772	14	10	0	0	0	0	1	0	0	0	253	6	0	0	0	0	0	0	0	2	0	0	0
48PA2772	15	3	0	0	0	0	0	1	0	0	126	1	0	0	0	0	0	1	0	1	0	0	0
48PA2772	16	0	0	0	0	0	0	0	0	0	16	0	0	0	0	0	0	0	0	0	0	0	0
48PA2772	17	0	0	0	0	0	0	0	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0
48PA2772	18	4	0	1	0	0	0	0	0	0	23	0	1	0	0	0	0	0	0	0	0	0	0
48PA2772	19	0	0	0	0	0	0	0	0	0	22	1	0	0	0	0	0	0	0	1	0	0	0
48PA2772	20	1	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0
48PA2772	21	3	0	0	0	1	1	0	0	0	213	3	0	0	0	0	1	0	0	2	0	0	156
48PA2772	22	2	0	0	0	0	0	0	0	0	20	2	0	0	0	0	0	0	0	0	0	0	0
48PA2772	23	3	0	0	0	0	0	0	0	1	14	1	0	0	0	0	0	0	0	0	0	0	0
48PA2772	24	8	0	0	0	0	0	2	1	6	86	5	2	0	0	1	0	0	0	1	3	0	0
48PA2772	25	3	0	0	0	0	1	1	0	0	105	10	1	0	0	0	0	0	0	0	1	0	0
48PA2772	26	3	0	0	0	0	0	0	0	0	34	5	0	0	0	0	0	0	0	0	0	0	0
48PA2772	27	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0
48PA2772	28	162	1	1	0	4	16	5	5	3	2680	172	32	0	0	2	9	0	14	17	5	1	1
48PA2772	29	11	0	0	0	0	1	0	0	0	290	21	0	0	0	0	0	0	0	0	0	0	0
48PA2772	30	3	0	0	0	0	0	0	0	0	29	8	0	0	0	0	0	0	0	0	0	0	0
48PA2772	31	3	0	0	0	0	0	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0
48PA2772	32	1	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	1	0	0	0
48PA2772	33	0	0	0	0	0	0	0	0	0	7	2	0	0	0	0	0	0	0	0	0	0	0
48PA2772	34	5	0	0	0	0	0	1	0	0	65	7	0	0	0	0	0	0	0	1	0	0	0
48PA2773	1	1	0	0	0	0	0	0	0	0	4	1	0	0	0	0	0	0	0	0	0	0	0
48PA2773	2	3	0	0	0	1	0	1	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0
48PA2774	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	78
48PA2774	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27
48PA2774	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
48PA2774	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	133
48PA2774	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	77
48PA2774	6	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	8
48PA2775	1	1	0	0	0	0	1	1	0	0	45	1	2	0	0	0	0	0	0	1	0	0	0
48PA2775	2	2	0	0	0	1	0	0	0	0	20	9	2	0	0	0	1	0	0	0	0	0	0
48PA2775	3	1	0	0	0	0	0	1	0	0	16	3	1	0	0	0	0	0	0	1	0	0	0
48PA2775	4	0	0	0	0	0	0	0	0	0	5	0	1	0	0	0	0	0	0	0	0	0	0
48PA2775	5	4	0	0	0	0	0	0	0	0	64	11	0	0	0	0	0	0	0	0	0	0	0
48PA2775	6	1	0	0	0	0	0	0	0	0	22	2	0	0	0	0	0	0	0	0	0	0	0
48PA2775	7	0	0	0	0	0	0	0	0	0	13	0	0	0	0	0	0	0	0	1	0	0	0
48PA2776	1	0	0	0	0	0	0	0	0	0	49	2	0	0	0	0	0	0	0	2	0	0	0
48PA2776	2	0	0	0	0	0	0	0	0	0	22	1	0	0	0	0	0	0	0	0	0	0	0
48PA2776	3	0	0	0	0	0	0	1	0	0	4	1	0	0	0	0	0	0	0	0	0	0	0
48PA2776	4	0	0	0	0	0	0	1	0	0	74	4	1	0	0	0	1	0	0	3	0	0	0
48PA2776	5	0	0	0	0	0	0	0	0	0	7	1	0	0	0	0	0	0	0	1	0	0	0
48PA2776	6	0	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0	0	1	0	0	0
48PA2776	7	1	0	0	0	0	0	0	0	0	74	5	0	0	0	0	0	0	0	3	0	0	0
48PA2776	8	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	1	0	0	0
48PA2776	9	0	0	0	0	0	0	0	0	0	6	1	0	0	0	0	0	0	0	0	0	0	0
48PA2777	1	1	0	0	0	0	0	0	0	0	18	3	0	0	0	0	0	0	0	0	0	0	0
48PA2778	1	12	0	1	0	0	0	2	2	0	309	21	1	0	0	0	0	0	2	2	0	0	0
48PA2779	1	1	0	0	0	0	0	0	0	0	11	0	0	0	0	0	0	0	0	1	0	0	0
48PA2780	1	1	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0
48PA2782	1	1	0	0	0	0	0	0	0	0	33	1	0	0	0	0	0	0	0	1	0	0	0
48PA2782	2	0	0	0	0	0	0	0	0	0	72	2	0	0	0	0	0	0	0	0	0	0	0
48PA2783	1	1	0	0	0	0	0	0	0	0	8	2	0	0	0	0	0	0	0	0	0	0	0
48PA2784	1	0	0	0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0
48PA2786	1	2	0	0	0	0	0	0	0	0	61	1	0	0	0	0	0	0	0	0	0	0	0
48PA2788	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
48PA2788	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
48PA2788	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11
48PA2788	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
48PA2788	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
48PA2788	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
48PA2789	1	0	0	0	0	0	0	1	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0
48PA2789	2	4	0	0	0	0	0	1	0	1	233	3	2	0	0	0	0	0	0	1	0	0	0
48PA2789	3	0	0	0	0	0	0	0	0	0	84	0	0	0	0	0	0	0	0	0	0	0	0
48PA2790	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
48PA2792	1	1	0	0	0	0	0	2	0	0	260	10	4	0	0	0	0	0	0	2	0	0	0
48PA2792	2	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0
48PA2793	1	0	0	0	0	0	0	1	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0

Table C.4, continued.

Cluster		ANG	ANGU	ANGW	BF	BF2	BF3	BF4	BF5	CR	FK	FKU	FKW	GR	NDU	NDT	NDW	OF	PL	PP	SC	UF	US
48PA2796	1	0	0	0	0	0	0	0	0	1	4	0	1	0	0	0	0	0	0	0	0	0	0
48PA2796	2	2	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0
48PA2796	3	0	0	0	0	0	0	0	0	0	6	0	1	0	0	0	0	0	0	0	0	0	0
48PA2797	1	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0
48PA2797	2	2	0	0	0	0	0	0	0	0	39	2	0	0	0	0	0	0	0	1	0	0	0
48PA2798	1	0	0	0	0	0	0	1	0	1	23	3	0	0	0	0	0	0	0	0	0	0	0
48PA2799	1	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0
48PA2799	2	1	0	0	0	0	0	0	0	0	6	0	1	0	0	0	0	0	1	0	0	0	0
48PA2799	3	0	0	0	0	1	1	0	0	3	52	2	0	0	0	0	0	0	0	0	0	0	0
48PA2799	4	2	0	0	0	0	0	0	0	0	36	0	0	0	0	0	0	0	0	0	0	0	0
48PA2799	5	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0
48PA2799	6	9	0	0	0	3	5	2	1	0	464	19	7	0	0	0	1	0	0	3	2	0	0
48PA2799	7	2	0	0	0	0	1	1	0	0	75	3	0	0	0	0	0	0	0	0	0	0	0
48PA2799	8	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0
48PA2799	9	0	0	1	0	1	0	1	0	0	6	1	0	0	0	0	0	0	0	0	0	0	0
48PA2803	1	0	0	0	0	0	0	0	0	0	17	0	0	0	0	0	0	0	0	1	0	0	0
48PA2803	2	1	0	0	0	0	0	1	0	0	13	4	0	0	0	0	0	0	0	0	2	0	0
48PA2805	1	0	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0	0	1	0	0	0
48PA2805	2	3	0	0	0	0	0	0	0	0	49	4	1	0	0	0	0	0	1	0	0	0	0
48PA2806	1	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0
48PA2808	1	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0
48PA2809	1	0	0	0	0	1	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0
48PA2811	1	8	0	0	1	2	2	3	1	0	343	19	9	0	0	0	1	0	0	1	0	0	0
48PA2811	2	0	0	0	0	0	0	0	0	0	14	0	0	0	0	0	0	0	0	0	0	0	0
48PA2811	3	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0
48PA2813	1	4	0	0	0	0	0	0	0	3	20	1	2	0	0	0	0	0	0	1	1	0	0
48PA2815	1	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	1	0	0	0
48PA2815	2	0	0	0	0	0	0	0	0	0	8	3	0	0	0	0	0	0	0	0	0	0	0
48PA2815	3	0	0	0	0	0	2	0	0	0	40	4	1	0	0	0	0	0	0	1	0	0	0
48PA2815	4	0	0	0	0	0	0	0	0	0	3	1	1	0	0	0	0	0	0	0	0	0	0
48PA2815	5	0	0	0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0
48PA2815	6	0	0	0	0	1	0	0	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0
48PA2816	1	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0
48PA2817	1	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0
48PA2817	2	0	0	0	0	0	0	0	0	0	26	0	0	0	0	0	0	0	0	0	0	0	0
48PA2817	3	0	0	0	0	0	0	0	0	0	32	0	0	0	0	0	0	0	0	0	0	0	0
48PA2817	4	0	0	0	0	0	0	0	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0
48PA2817	5	0	0	0	0	0	0	0	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0
48PA2817	6	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0
48PA2817	7	0	0	0	0	0	0	0	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0
48PA2818	1	0	0	0	0	0	0	0	0	0	86	0	0	0	0	0	0	0	0	3	0	0	0
48PA2819	1	2	0	0	0	0	0	0	0	0	39	0	6	0	0	0	1	0	0	0	1	0	0
48PA2819	2	1	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	1	0	0
48PA2819	3	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0
48PA2821	1	0	0	0	1	0	0	0	0	0	7	0	0	0	0	0	0	0	0	1	0	0	0
48PA2822	1	0	0	0	0	0	0	1	0	0	4	1	0	0	0	0	0	0	0	0	0	0	0
48PA2824	1	7	0	0	0	1	1	0	0	4	54	5	2	0	0	1	0	0	0	0	0	0	0
48PA2829	1	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0
48PA2829	2	0	0	0	0	0	0	0	0	1	45	0	0	0	0	0	0	0	0	0	0	0	0
48PA2829	3	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0
48PA2829	4	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0
48PA2834	1	0	0	0	0	0	0	0	0	0	6	2	1	0	0	0	0	0	0	0	0	0	0
48PA2834	2	0	0	0	0	0	0	0	0	0	4	2	0	0	0	0	0	0	0	0	0	0	0
48PA2835	1	1	0	0	0	0	0	0	1	0	166	0	1	0	0	0	0	0	0	0	0	0	0
48PA2837	1	0	0	0	0	0	0	0	0	1	11	0	0	0	0	0	0	0	0	0	0	0	0
48PA2837	2	0	0	0	0	0	1	0	0	1	6	0	0	0	0	0	0	0	0	0	0	0	0

Table C.5. Artifact type variability for all clusters with 20 or more flaked stone artifacts. V values are the observed modified lithic artifact type percentages subtracted by the expected value (see Table 3.4). Clusters with zero % modified lithics have 100 % debitage, and their V values are therefore not shown. AV values are the sum of the absolute values of the V values, and AVI is the AV converted to a 0-100 scale. Shaded V values are the farthest from zero.

							V values								
Site	Cluster	Elev. (m)	n CS	% Modified Lithics	AVI	AV	ANGU, ANGW	BF, BF1-5	CR	FKU	FKW	NDU, NDT, NDW	OF, GR, UF	PP	SC
48PA48	1	2517	21	14.3	34	64	-0.9	-10.9	-4.6	15.7	16.5	-1.9	-0.7	-11.4	-1.8
48PA48	4	2513	86	10.5	22	43	-0.9	0.2	-4.6	15.7	5.4	-1.9	-0.7	-11.4	-1.8
48PA523	1	2833	153	3.3	40	77	-0.9	-10.9	-4.6	-1.0	-16.8	-1.9	-0.7	38.6	-1.8
48PA2719	1	2380	43	18.6	24	46	-0.9	1.6	7.9	-13.5	-4.3	-1.9	-0.7	13.6	-1.8
48PA2720	1	2345	280	0.0	52	100									
48PA2721	1	3333	32	6.3	51	98	-0.9	-10.9	-4.6	49.0	-16.8	-1.9	-0.7	-11.4	-1.8
48PA2721	2	3339	449	22.5	43	82	0.1	-10.9	-0.6	41.1	-13.8	-1.9	-0.7	-11.4	-1.8
48PA2721	5	3321	1127	0.5	81	155	-0.9	72.4	-4.6	-51.0	-16.8	-1.9	-0.7	5.3	-1.8
48PA2721	6	3329	65	1.5	100	191	-0.9	-10.9	95.4	-51.0	-16.8	-1.9	-0.7	-11.4	-1.8
48PA2723	8	3218	23	0.0	52	100									
48PA2724	1	3323	202	20.8	42	79	-0.9	-6.1	2.5	37.1	-16.8	-1.9	-0.7	-11.4	-1.8
48PA2725	1	3339	79	8.9	47	89	-0.9	-10.9	24.0	20.4	-16.8	-1.9	-0.7	-11.4	-1.8
48PA2726	1	3272	202	2.0	50	96	-0.9	14.1	20.4	-26.0	-16.8	-1.9	-0.7	13.6	-1.8
48PA2731	1	3275	29	6.9	92	175	-0.9	39.1	-4.6	-51.0	-16.8	-1.9	-0.7	-11.4	48.2
48PA2735	4	2736	193	0.5	93	177	-0.9	-10.9	-4.6	-51.0	-16.8	-1.9	-0.7	88.6	-1.8
48PA2740	1	2569	44	18.2	36	68	-0.9	14.1	-4.6	-26.0	8.2	10.6	-0.7	1.1	-1.8
48PA2740	3	2569	28	28.6	36	68	11.6	14.1	-4.6	-13.5	8.2	-1.9	-0.7	-11.4	-1.8
48PA2740	5	2579	227	15.9	20	39	-0.9	-8.1	-4.6	-1.0	19.3	-1.9	-0.7	-0.3	-1.8
48PA2740	6	2579	172	25.0	33	62	3.8	-6.2	-4.6	-9.1	27.4	-1.9	-0.7	-6.7	-1.8
48PA2741	2	2566	457	20.6	15	29	0.2	-2.4	-4.6	5.4	8.7	-0.8	-0.7	-5.0	-0.7
48PA2741	3	2573	153	12.4	29	56	-0.9	-10.9	-4.6	27.9	-1.0	-1.9	-0.7	-6.1	-1.8
48PA2741	4	2579	144	4.2	29	55	-0.9	5.8	-4.6	-17.7	16.5	-1.9	-0.7	5.3	-1.8
48PA2741	5	2576	25	24.0	12	22	-0.9	5.8	-4.6	-1.0	-0.1	-1.9	-0.7	5.3	-1.8
48PA2741	7	2573	319	16.0	17	32	3.0	-3.1	-4.6	-5.9	10.7	-1.9	-0.7	2.3	0.2
48PA2742	1	2557	98	12.2	20	38	-0.9	-2.6	-4.6	7.3	-8.5	6.4	-0.7	5.3	-1.8
48PA2742	2	2566	31	22.6	44	84	-0.9	17.7	-4.6	-22.4	11.8	-1.9	-0.7	-11.4	12.5
48PA2742	3	2554	45	11.1	42	80	19.1	9.1	-4.6	-31.0	3.2	-1.9	-0.7	8.6	-1.8
48PA2742	4	2551	20	35.0	59	112	-0.9	3.4	52.5	-22.4	-16.8	-1.9	-0.7	-11.4	-1.8
48PA2743	4	2533	26	15.4	23	45	-0.9	14.1	-4.6	-1.0	8.2	-1.9	-0.7	-11.4	-1.8
48PA2743	8	2530	33	9.1	86	165	-0.9	-10.9	-4.6	-51.0	49.9	-1.9	32.6	-11.4	-1.8
48PA2743	9	2521	394	4.3	26	49	-0.9	-10.9	-4.6	-3.9	24.4	-1.9	-0.7	0.4	-1.8
48PA2743	10	2521	32	3.1	100	191	-0.9	-10.9	95.4	-51.0	-16.8	-1.9	-0.7	-11.4	-1.8
48PA2743	13	2521	344	7.0	19	36	-0.9	5.8	-0.4	-1.0	12.4	-1.9	-0.7	-11.4	-1.8
48PA2744	1	2539	5164	40.3	15	30	0.5	-1.7	-1.1	-11.6	1.5	0.2	0.7	11.8	-0.4
48PA2745	1	2680	695	0.7	65	124	-0.9	-10.9	15.4	-31.0	-16.8	-1.9	-0.7	28.6	18.2
48PA2746	2	2674	83	2.4	93	177	-0.9	-10.9	-4.6	-51.0	-16.8	-1.9	-0.7	88.6	-1.8
48PA2746	3	2672	23	0.0	52	100									
48PA2746	4	2677	23	4.3	93	178	-0.9	89.1	-4.6	-51.0	-16.8	-1.9	-0.7	-11.4	-1.8
48PA2747	1	2475	67	7.5	100	191	-0.9	-10.9	95.4	-51.0	-16.8	-1.9	-0.7	-11.4	-1.8
48PA2750	1	2644	20	0.0	52	100									
48PA2751	4	2676	199	14.6	29	56	-0.9	-10.9	-4.6	14.5	10.8	-1.9	2.7	-8.0	-1.8
48PA2751	5	2675	34	26.5	23	44	-0.9	-10.9	6.5	15.7	-5.7	-1.9	-0.7	-0.3	-1.8
48PA2751	6	2673	34	38.2	38	73	-0.9	-10.9	3.1	-20.2	29.4	-1.9	-0.7	4.0	-1.8
48PA2752	2	3094	140	9.3	29	54	-0.9	-3.2	3.1	18.2	-9.1	-1.9	-0.7	-11.4	5.9
48PA2753	1	2468	238	0.8	41	78	-0.9	39.1	-4.6	-1.0	-16.8	-1.9	-0.7	-11.4	-1.8
48PA2755	1	2868	53	1.9	93	177	-0.9	-10.9	-4.6	-51.0	-16.8	-1.9	-0.7	88.6	-1.8
48PA2757	1	2653	71	0.0	52	100									
48PA2757	2	2645	31	0.0	52	100									
48PA2759	1	2523	95	2.1	76	145	-0.9	39.1	-4.6	-51.0	33.2	-1.9	-0.7	-11.4	-1.8
48PA2760	2	2553	126	5.6	19	36	-0.9	3.4	-4.6	-8.1	11.8	-1.9	-0.7	2.9	-1.8
48PA2761	1	3035	37	2.7	93	178	-0.9	89.1	-4.6	-51.0	-16.8	-1.9	-0.7	-11.4	-1.8
48PA2762	2	3062	92	7.6	32	61	-0.9	3.4	-4.6	-22.4	11.8	12.4	-0.7	2.9	-1.8
48PA2763	1	2552	44	2.3	93	177	-0.9	-10.9	-4.6	-51.0	-16.8	-1.9	-0.7	88.6	-1.8
48PA2764	2	2543	90	2.2	51	98	-0.9	-10.9	-4.6	49.0	-16.8	-1.9	-0.7	-11.4	-1.8
48PA2766	2	2505	24	0.0	52	100									
48PA2767	2	2518	45	0.0	52	100									
48PA2769	1	2353	34	8.8	39	75	-0.9	-10.9	-4.6	15.7	-16.8	-1.9	-0.7	21.9	-1.8
48PA2770	1	3219	67	3.0	75	144	-0.9	-10.9	-4.6	-51.0	33.2	-1.9	-0.7	38.6	-1.8
48PA2772	2	2851	36	2.8	93	177	-0.9	-10.9	-4.6	-51.0	-16.8	-1.9	-0.7	88.6	-1.8
48PA2772	9	2842	35	8.6	47	89	-0.9	-10.9	28.7	15.7	-16.8	-1.9	-0.7	-11.4	-1.8
48PA2772	10	2842	229	1.7	50	96	24.1	-10.9	-4.6	24.0	-16.8	-1.9	-0.7	-11.4	-1.8

Table C.5, continued.

							V values								
Site	Cluster	Elev. (m)	n CS	% Modified Lithics	AVI	AV	ANGU, ANGW	BF, BF1-5	CR	FKU	FKW	NDU, NDT, NDW	OF, GR, UF	PP	SC
48PA2772	13	2842	108	2.8	87	166	-0.9	-10.9	-4.6	-51.0	83.2	-1.9	-0.7	-11.4	-1.8
48PA2772	14	2843	272	3.3	28	53	-0.9	0.2	-4.6	15.7	-16.8	-1.9	-0.7	10.8	-1.8
48PA2772	15	2843	133	3.0	55	104	-0.9	14.1	-4.6	-26.0	-16.8	-1.9	24.3	13.6	-1.8
48PA2772	18	2843	29	6.9	86	165	49.1	-10.9	-4.6	-51.0	33.2	-1.9	-0.7	-11.4	-1.8
48PA2772	19	2843	24	8.3	40	77	-0.9	-10.9	-4.6	-1.0	-16.8	-1.9	-0.7	38.6	-1.8
48PA2772	21	2843	380	43.2	40	77	-0.9	14.1	-4.6	-13.5	-16.8	10.6	-0.7	13.6	-1.8
48PA2772	22	2843	24	8.3	51	98	-0.9	-10.9	-4.6	49.0	-16.8	-1.9	-0.7	-11.4	-1.8
48PA2772	24	2839	115	18.3	45	85	-0.9	3.4	24.0	-27.2	-7.3	2.9	-0.7	-6.6	12.5
48PA2772	25	2847	122	11.5	31	58	-0.9	3.4	-4.6	20.4	-9.7	-1.9	-0.7	-11.4	5.3
48PA2772	26	2842	42	11.9	51	98	-0.9	-10.9	-4.6	49.0	-16.8	-1.9	-0.7	-11.4	-1.8
48PA2772	28	2851	3130	9.2	15	29	-0.2	0.1	-3.5	12.0	-5.1	2.1	-0.3	-5.2	0.0
48PA2772	29	2847	323	6.8	47	89	-0.9	-6.4	-4.6	44.5	-16.8	-1.9	-0.7	-11.4	-1.8
48PA2772	30	2845	40	20.0	51	98	-0.9	-10.9	-4.6	49.0	-16.8	-1.9	-0.7	-11.4	-1.8
48PA2772	34	2843	79	11.4	28	54	-0.9	0.2	-4.6	26.8	-16.8	-1.9	-0.7	-0.3	-1.8
48PA2773	2	2883	25	8.0	93	178	-0.9	89.1	-4.6	-51.0	-16.8	-1.9	-0.7	-11.4	-1.8
48PA2775	1	2843	52	11.5	46	88	-0.9	22.4	-4.6	-34.3	16.5	-1.9	-0.7	5.3	-1.8
48PA2775	2	2846	35	37.1	25	48	-0.9	-3.2	-4.6	18.2	-1.4	5.8	-0.7	-11.4	-1.8
48PA2775	3	2847	23	26.1	12	22	-0.9	5.8	-4.6	-1.0	-0.1	-1.9	-0.7	5.3	-1.8
48PA2775	5	2849	79	13.9	51	98	-0.9	-10.9	-4.6	49.0	-16.8	-1.9	-0.7	-11.4	-1.8
48PA2775	6	2850	25	8.0	51	98	-0.9	-10.9	-4.6	49.0	-16.8	-1.9	-0.7	-11.4	-1.8
48PA2776	1	2893	53	7.5	40	77	-0.9	-10.9	-4.6	-1.0	-16.8	-1.9	-0.7	38.6	-1.8
48PA2776	2	2894	23	4.3	51	98	-0.9	-10.9	-4.6	49.0	-16.8	-1.9	-0.7	-11.4	-1.8
48PA2776	4	2894	84	11.9	28	53	-0.9	-0.9	-4.6	-11.0	-6.8	8.1	-0.7	18.6	-1.8
48PA2776	7	2894	83	9.6	39	75	-0.9	-10.9	-4.6	11.5	-16.8	-1.9	-0.7	26.1	-1.8
48PA2777	1	2834	22	13.6	51	98	-0.9	-10.9	-4.6	49.0	-16.8	-1.9	-0.7	-11.4	-1.8
48PA2778	1	2910	352	8.8	28	54	2.5	2.9	-4.6	21.4	-13.4	-1.9	-0.7	-4.5	-1.8
48PA2782	1	3204	36	5.6	40	77	-0.9	-10.9	-4.6	-1.0	-16.8	-1.9	-0.7	38.6	-1.8
48PA2782	2	3207	74	2.7	51	98	-0.9	-10.9	-4.6	49.0	-16.8	-1.9	-0.7	-11.4	-1.8
48PA2786	1	2942	64	1.6	51	98	-0.9	-10.9	-4.6	49.0	-16.8	-1.9	-0.7	-11.4	-1.8
48PA2789	2	2846	245	3.3	20	38	-0.9	1.6	7.9	-13.5	8.2	-1.9	-0.7	1.1	-1.8
48PA2789	3	2819	84	0.0	52	100									
48PA2792	1	2399	279	6.5	11	20	-0.9	0.2	-4.6	4.6	5.4	-1.9	-0.7	-0.3	-1.8
48PA2797	2	2748	44	6.8	39	75	-0.9	-10.9	-4.6	15.7	-16.8	-1.9	-0.7	21.9	-1.8
48PA2798	1	3256	28	17.9	35	67	-0.9	9.1	15.4	9.0	-16.8	-1.9	-0.7	-11.4	-1.8
48PA2799	3	3177	59	11.9	59	112	-0.9	17.7	38.3	-22.4	-16.8	-1.9	-0.7	-11.4	-1.8
48PA2799	4	3172	38	0.0	52	100									
48PA2799	6	3175	516	8.3	19	36	-0.9	14.7	-4.6	-6.8	-0.5	0.4	-0.7	-4.4	2.9
48PA2799	7	3176	82	6.1	40	76	-0.9	29.1	-4.6	9.0	-16.8	-1.9	-0.7	-11.4	-1.8
48PA2803	2	3202	21	33.3	38	73	-0.9	3.4	-4.6	6.1	-16.8	-1.9	-0.7	-11.4	26.8
48PA2805	2	3213	58	10.3	34	64	-0.9	-10.9	-4.6	29.0	3.2	-1.9	-0.7	-11.4	-1.8
48PA2811	1	2539	390	10.0	20	38	-0.9	12.2	-4.6	-2.3	6.3	0.7	-0.7	-8.8	-1.8
48PA2813	1	2535	32	25.0	55	106	-0.9	-10.9	32.9	-38.5	8.2	-1.9	-0.7	1.1	10.7
48PA2815	3	2587	48	16.7	16	30	-0.9	14.1	-4.6	-1.0	-4.3	-1.9	-0.7	1.1	-1.8
48PA2817	2	2807	26	0.0	52	100									
48PA2817	3	2825	32	0.0	52	100									
48PA2818	1	2803	89	3.4	93	177	-0.9	-10.9	-4.6	-51.0	-16.8	-1.9	-0.7	88.6	-1.8
48PA2819	1	2576	49	16.3	83	159	-0.9	-10.9	-4.6	-51.0	58.2	10.6	-0.7	-11.4	10.7
48PA2824	1	2675	75	18.7	34	65	-0.9	3.4	24.0	-15.3	-2.5	5.2	-0.7	-11.4	-1.8
48PA2829	2	2748	46	2.2	100	191	-0.9	-10.9	95.4	-51.0	-16.8	-1.9	-0.7	-11.4	-1.8
48PA2835	1	2504	169	1.2	76	145	-0.9	39.1	-4.6	-51.0	33.2	-1.9	-0.7	-11.4	-1.8

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