INVESTIGATIONS AT 5GN149, A LITHIC WORKSHOP IN THE UPPER GUNNISON BASIN, COLORADO

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ABSTRACT

5GN149 is a lithic workshop on a high bench overlooking the Gunnison River in western Colorado. Among the artifacts initially recorded on its surface were several displaying attributes reminiscent of Paleoindian technology. In an effort to ascertain the site's age and function, detailed surface mapping and test excavations were conducted from 2002 to 2004. Subsequent laboratory investigation involved lithic analysis, an extensive GIS-aided refitting effort, and spatial analysis of the lithic scatter. The analytical goals were to determine if 5GN149 represents an intense occupation within a short time period or multiple brief occupation episodes spanning a long time period; to identify the types of activities that occurred here; to identify the technology (or technologies) present and the period(s) of occupation—not least whether 5GN149 represents a Clovis occupation. Our results indicate the site functioned primarily as a quarry workshop and tool production locality for mobile hunter-gatherers (high quality quartzite cobbles are available in the immediate vicinity), although the occurrence of scrapers and other chipped stone tools suggest additional activities occurred during what appear to have been relatively brief visits to the site. Discrete artifact concentrations marking episodes of stone tool reduction were observed within the larger lithic scatter, and analysis of these reveals differential use, activities, and technologies at the site over time. The precise span is unknown: the site has yielded diagnostic projectile points and point preforms ranging in age from Late Paleoindian to the Late Prehistoric or Protohistoric period. Although we were able to tease apart aspects of this palimpsest of occupations, the lack of suitable material for radiometric dating makes it impossible to provide more specific age(s) for 5GN149.

INTRODUCTION

5GN149 is located in the Upper Gunnison Basin of west-central Colorado, approximately 15 km west of Gunnison, atop a high, relatively narrow bench at ~2,420 m above sea level and slightly more than 100 m above the Gunnison River (which in this area today forms Blue Mesa Lake, an artificial impoundment) (Figure 1). The site consists of an extensive (~8,500 m^2) shallow, non-stratified scatter of stone tools and chipping debris dominated by high-quality, locally obtained fine-grained quartzite. Within this scatter are spatially discrete areas of high artifact density, interpreted upon initial examination to represent isolated flintknapping events.

The site was discovered in 1976 by Mark Stiger of Western State College (Gunnison, CO), who took us there in summer 2002. Visible on the surface of the site during that visit were large, thin, foliate-shaped bifaces; numerous large, biface thinning flakes with heavily ground platforms; overshot flakes; blades; and blade manufacturing debris. Artifacts of this sort can be indicative of Clovis lithic technology (Bradley 1991, 1993; Collins 1999). Although Folsom and later Paleoindian artifacts appear at a number of sites in the Gunnison Basin (Pitblado 2003; Pitblado and Brunswig 2007; Stiger 2001, 2006), Clovis sites are rare, limited to isolated point finds, often reported by local artifact collectors (Jones 1982; Stiger 1980). Nonetheless, one such find was made on a ranch less than 2 km east of 5GN149, and one was purportedly recovered from a drainage just west of 5GN149, suggesting Clovis groups had been in the immediate vicinity.

The potential for the site to be Clovis in age prompted our field investigations, which took place during relatively brief stints over several field seasons from 2002 to 2004. Key questions we hoped to answer through field and lab analysis were:

- Does 5GN149 represent an intense occupation spanning a short time period or multiple brief occupations over a longer span?
- What types of activities occurred at the site?
- What technologies are present and can these be assigned to time period(s)? and, finally,
- Does 5GN149 contain Clovis materials?

To answer these questions, we sought through excavation and intensive surface collection evidence of diagnostic projectile points; samples that might produce radiocarbon ages; a lithic assemblage complete and representative enough to permit refitting; and high resolution spatial data of artifacts to evaluate intrasite relationships and, potentially, identify specific activities. Our fieldwork was followed by laboratory analyses, including macroscopic lithic debitage and tool analysis,

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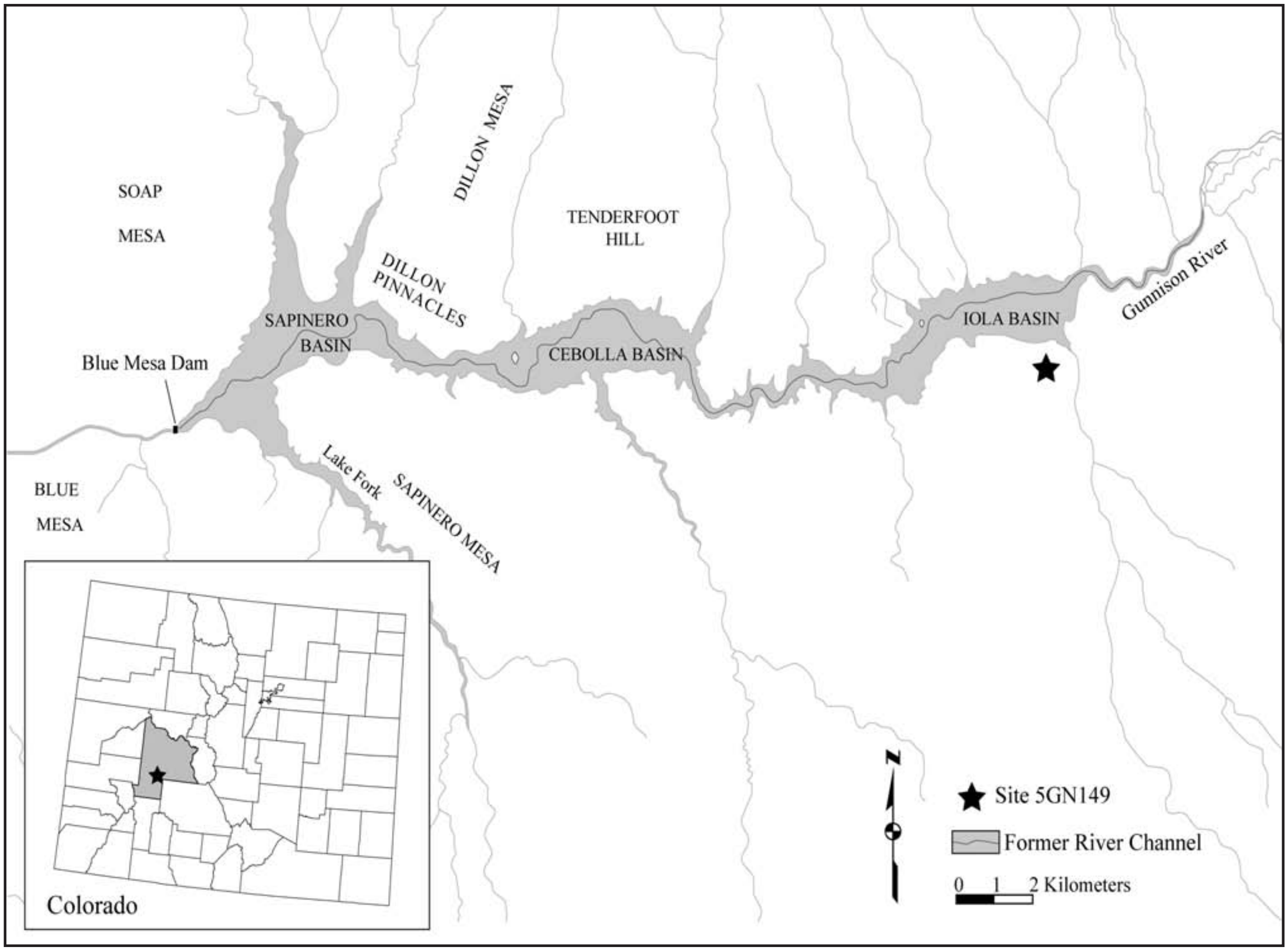

FIGURE 1. Map showing Blue Mesa Reservoir and the location of 5GN149. Figure adapted from Curecanti Park Map (National Park Service, U.S. Dept. of Interior).

minimum analytical nodule analysis, lithic refitting, and intrasite spatial analysis using Geographic Information Systems (GIS).

Although we were ultimately unable to precisely pin down the age of 5GN149—let alone demonstrate a Clovis affinity—this locality provided an opportunity to explore and utilize different methodologies to tease apart surface palimpsests, and much was learned. We describe these in detail below, as part of our larger aim of placing on record a descriptive and analytical report of 5GN149. For regardless of what is still not known of this site, it is a substantial and now well-documented locality in the Gunnison Basin, and thus may aid the understanding and interpretation of other, perhaps similar localities.

PREVIOUS RESEARCH AND REGIONAL PREHISTORY

For decades, much of the archaeological investigations conducted in the Upper Gunnison Basin—primarily by C. T. Hurst of Western State College (Schroeder 1953; Stiger 1980) —were relatively small-scale. Broader survey work under the direction of Robert Lister of the University of Colorado began with the pending construction of the Blue Mesa dam and reservoir (Lister 1962). In the 1970s, the University of Colorado returned to conduct a more comprehensive archaeological inventory of the Curecanti Recreation Area (Stiger 1980). One hundred and thirty sites were recorded on this project (Jones 1982), including 5GN149. Because the goal was to identify and record sites within the survey area, only a small sample of artifacts (n = 32) was collected from 5GN149, including some quartzite debitage, utilized flakes, a non-utilized core, a chert knife, and a felsite mano (Stiger 1980).

Throughout the 1980s and 1990s, the Midwest Archeological Center conducted multiple investigations in the Curecanti Recreation Area around Blue Mesa Lake (Dial 1989; Jones 1984, 1986, 1996). These aimed to identify new sites and monitor existing sites within the Curecanti boundaries, especially archaeological remains exposed along the reservoir shoreline and subject to erosion by wave action and lake level change. 5GN149 was not investigated at this time, though survey and excavation of the surrounding area resulted in work at several nearby sites, including Kezar Basin (5GN191) (Euler and Stiger 1981; Stiger 1981; Jones 1986), Elk Creek Village (5GN2478) (Rood 1998), and the Pioneer Point site (5GN41) (Dial 1989; Jones 1986).

These decades of investigations have revealed a deep and rich culture history for the Upper Gunnison Basin, and a nearly continuous utilization of the area from Paleoindian times until the Historic period (Jones 1984; Reed and Metcalf 1999; Stiger 2001, 2006; cf. Lister 1962; Schroeder 1953). At the early end of the temporal spectrum, Clovis sites are rare; however, numerous Folsom localities have been discovered, which indicate at least seasonal use of the region during what was, arguably at this elevation, a period of considerable climatic challenges (the Younger Dryas). In fact, evidence of stone structures at the Mountaineer site suggests that Folsom groups may have even occupied this cold, high-elevation basin in winter (Stiger 2006).

The Late Paleoindian period in the region can be seen in several sites. Chance Gulch (5GN817), located ~18 km from 5GN149, contained Angostura projectile points (small, concave-based lanceolate projectile points with parallel-oblique flaking [Pitblado 1994:11] synonymous to the Foothill-Mountain tradition projectile point type used elsewhere [Frison 1991, 1992]) and dates to around 8000 B.P. (Pitblado 2003; Pitblado and Camp 2003). Likewise, the Iola site (5GN212), located less than 2 km from 5GN149, contained a Jimmy Allen projectile point (Jones 1982:6, 1996:39). Other diagnostic Late Paleoindian point types that are occasionally identified in the Gunnison Basin include Plainview, Scottsbluff, Eden/Firstview, along with Western Stemmed forms and might indicate seasonal incursions into the basin by foreign groups (Pitblado 1993).

The Archaic period in the Upper Gunnison Basin is well documented (Cassells 1997; Jones 1982, 1986, 1996; Reed and Metcalf 1999), and the increase in frequency of residential sites of Early to Middle Archaic age may support Benedict's (1979) theory of the Rocky Mountains serving as an Altithermal refugium (Jones 1984). Sites of this age, including Kezar Basin (5GN191) and Vandergrift (5GN2192), which is located just 0.5 km north and below 5GN149, are generally residential in nature, characterized by the appearance of house structures and fire pits for the processing of plant and animal remains. Vandergrift, for example, contains 21 possible hearth features, two of which produced dates of 6350 ± 210 B.P. and 7350 ± 120 B.P. (Jones 1996). Vandergrift also contained a Pinto Basin series projectile point, which dates to the Early Archaic in the Great Basin as well as the Western Slope of the Rocky Mountains in Colorado (Jones 1996:15). Given the close proximity of these Archaic sites to 5GN149, it is quite possible their inhabitants utilized the quartzite cobbles found at 5GN149, and perhaps 5GN149 itself.

Structures disappear after about 4000–3000 B.P., suggesting a shift in strategy from residential-sedentary occupations to more mobile, seasonal use of the Gunnison Basin. This shift is attributed to cooling and deforestation, and winters perhaps too harsh for sedentary occupation (Black 1983:22; Reed and Metcalf 1999; Stiger 2001).

That pattern of high residential mobility continues into the Late Prehistoric and Historic periods (Stiger 2001), as the Upper Gunnison Basin continued to be occupied only seasonally by populations who likely resided elsewhere, but who utilized the basin for its resources, and occupied temporary structures such as wickiups (Binford 1980; Reed and Metcalf 1999). The Pioneer Point site (5GN41), for example, which dates to A.D. ~1470, contained Desert Side-Notched and Cottonwood Triangular points, as well as Uncompahgre Brown ware ceramics (Dial 1989; Jones 1984; Reed and Metcalf 1999). (Note: ceramics generally appear in the region sometime before A.D. 1100 [Reed and Metcalf 1999]. They do not occur at 5GN149; nor, for that matter, were metal or European trade goods recovered at 5GN149). Because use of the Upper Gunnison Basin during this time was sporadic, the archaeological record lacks the abundant cultural features characteristic of the earlier Archaic period. Though prehistoric continuity cannot be directly established (Buckles 1971), it is generally accepted that Late Prehistoric or Protohistoric sites in the area are attributable to ancestral Ute populations.

RECENT FIELDWORK AT 5GN149

In June 2002 Forest Frost, National Park Service archaeologist for the Curecanti Recreation Area, revisited 5GN149 to assess its status and condition. On that occasion, he set up a site datum (FF in Figure 2) and mapped and collected a dozen artifacts from the surface. These were mostly formal tools, bifaces, and blades, all made from quartzite and welded tuff, and included four projectile points, one resembling a Late Paleoindian lanceolate, the others Archaic in age. Frost also identified a possible collapsed wickiup (six juniper limbs oriented in a spoke-like arrangement) on the edge of 5GN149, and an additional nearby site (5GN3758) from which he collected several Late Paleoindian projectile points and some lithic debitage (Forest Frost, personal communication, 2003). The relationship of 5GN3758 to 5GN149 is not clear, nor is it certain that the juniper limbs represented a collapsed wickiup (no further investigations were conducted to determine its authenticity).

In July 2002, Mark Stiger of Western State College brought 5GN149 to our attention. He and Meltzer visited the site, and seeing on the surface numerous large, foliate-shaped bifaces, prismatic blades, biface and blade cores, and the occasional biface overshot flake, agreed it might be worth investigating as a possible early Paleoindian locality. But because our attention that summer was focused on ongoing excavations at the Mountaineer site, it was possible to divert only a small crew for a couple of days of work at 5GN149.

Accordingly, the effort was limited to preliminary topographic mapping (using an EDM) and collection of artifacts exposed on the surface, with the goal of gaining a sense of the kind, density, and distribution of such material. Collection efforts focused on potentially diag-

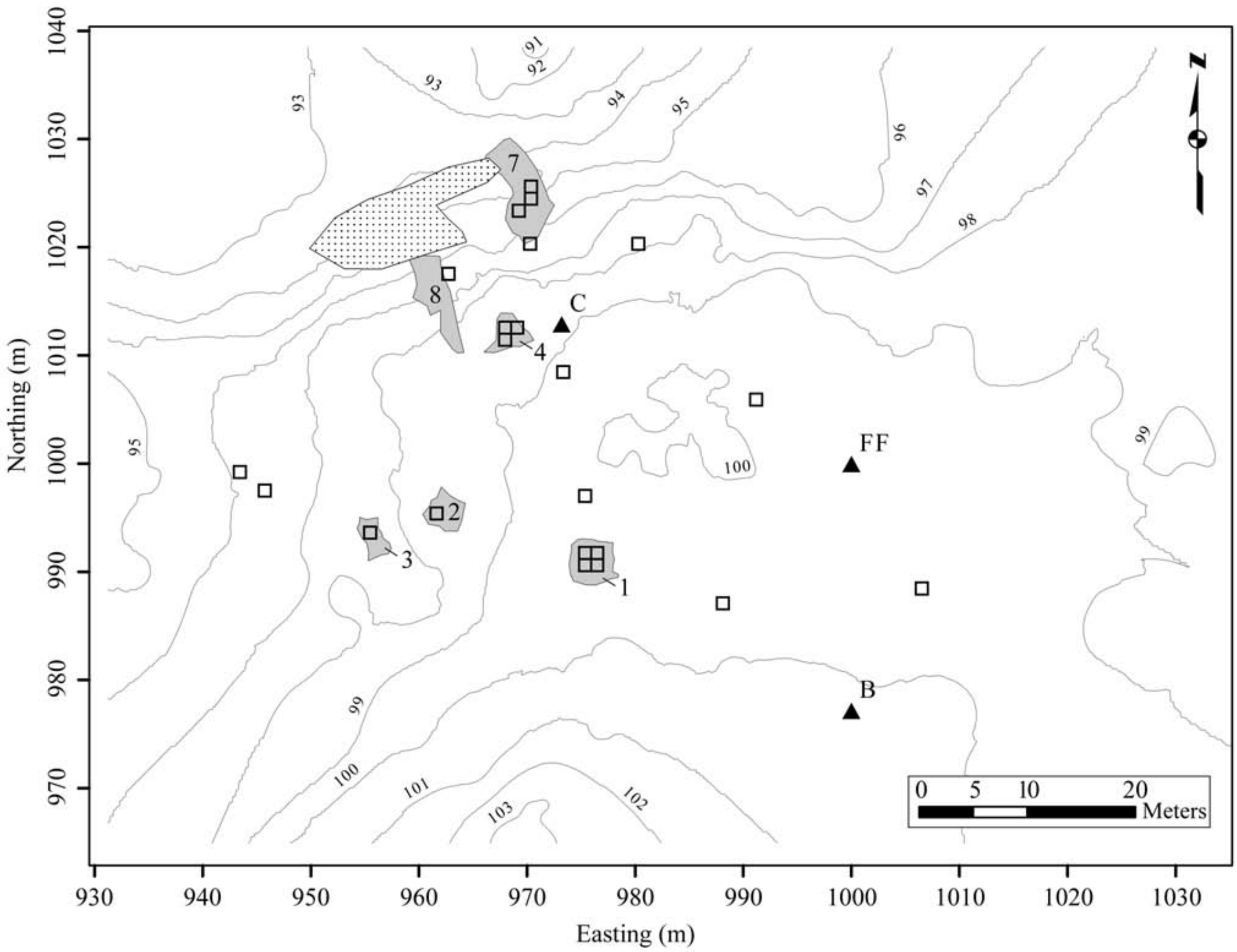

FIGURE 2. Map of 5GN149, showing chipping clusters (gray polygons) with labels, ashy sediment (stippled polygon), and excavation units (black squares). Triangles denote datums and grid on left and bottom axis show northing and easting in meters, respectively.

nostic artifacts—namely blades, bifaces, and associated blade/biface production debris. There was also a size bias to the collections: we used a 7 cm cutoff, below which we did not collect a specimen unless it was a prepared tool, biface, or blade fragment. The size cutoff was prompted in part by the sheer number of artifacts on the site's surface and the time available for sampling, coupled with a concern that the site's proximity to the highway made it vulnerable to collector activity—which would also naturally focus on large and/or diagnostic material.

For purposes of mapping, two additional datum points were established on site using the iron-rebar set by Forest Frost as our principal datum (and subsequently assigned by us the arbitrary grid coordinates of N1000 E1000 Elevation 100). The datums we set were an instrument backsight (Datum **B** at grid coordinates N977.19 E1000.00 Elevation 101.89), and one close to the lip of the slope, to serve as a secondary mapping station for artifacts on the sloping northern edge of the bench (Datum **C** at N1012.92 E973.20 Elevation 98.90; Figure 2). All artifacts were mapped with the EDM prior to their collection, providing spatial data at sub-centimeter accuracy.

This initial work at the site in 2002 yielded a small sample of stone artifacts (n = 153) representing a number of different artifact classes, primarily bifaces, cores, blades, and large thinning flakes, but also a couple of projectile points, neither of which were diagnostic Paleoindian forms. Examination and mapping of the density of artifacts on the surface also seemed to indicate there were several separate and spatially discrete clusters of artifacts (labeled as Clusters 1–3, Figure 2), thought to possibly represent isolated chipping events. Of additional interest was a heavy concentration of bifaces, large biface thinning flakes, and blades apparently associated with a gray ashy sediment exposure observed on the steep slope in northwest area of the site (Figure 2).

In the fall of 2002, Frost returned to 5GN149 and made an additional collection of potentially diagnostic artifacts (n = 19) from the site surface. The artifacts were mapped using a GPS. Again, these were primarily bifaces and blades made of quartzite.

In summer 2003, we re-commenced work at 5GN149. A crew (usually five members) spent 11 days on site. The goals of this second stint of work were several: to conduct a more extensive surface artifact collection,

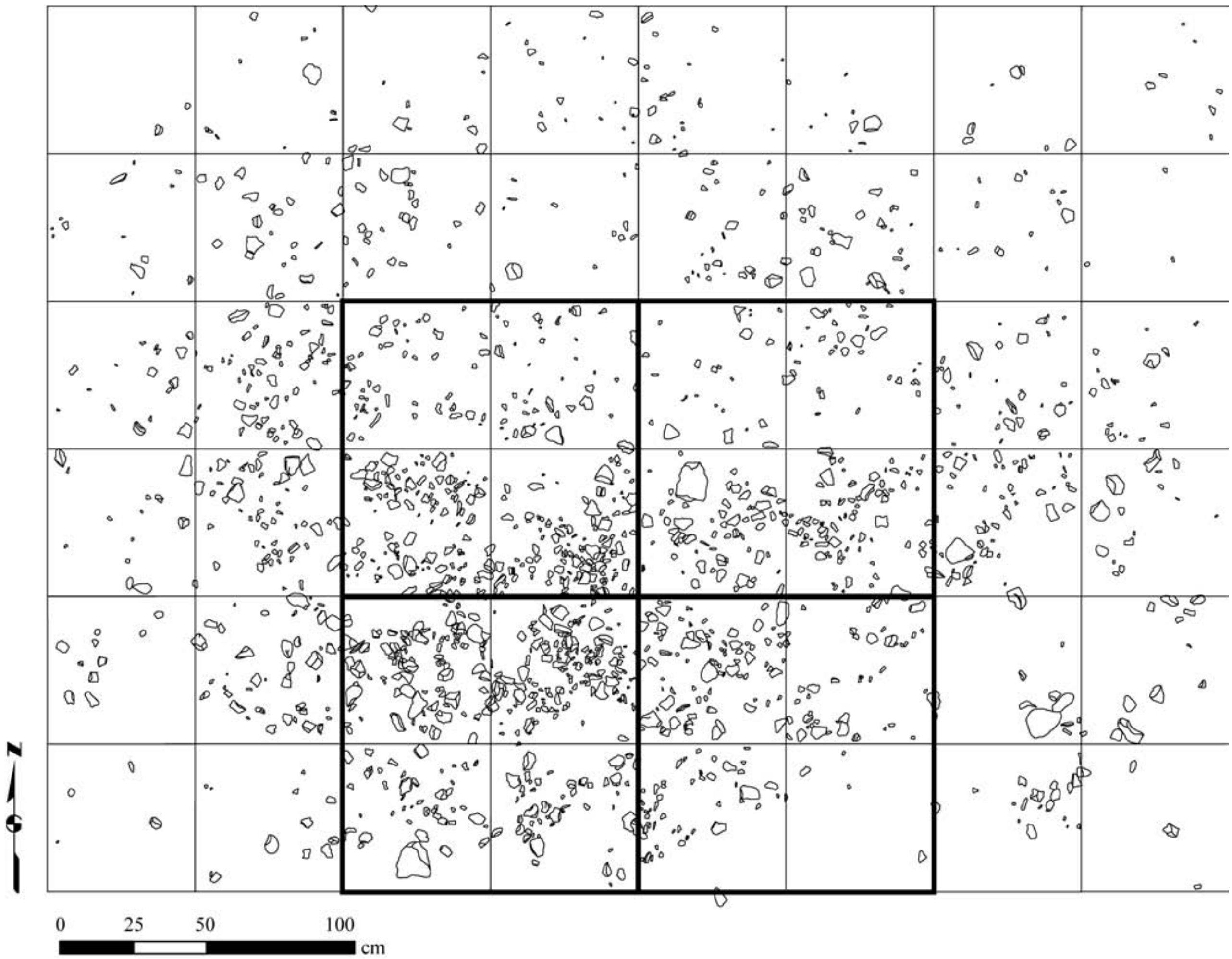

FIGURE 3. Plan map of Cluster 1. Dark outline shows test excavation units. The western units were excavated in 2003 and the eastern units were excavated in 2004.

with the goals of obtaining a more representative sample of the overall assemblage and locating diagnostic artifacts; to collect one of the dense chipping clusters on site, with the aim of recovering conjoinable pieces; and to conduct limited hand coring, sediment sampling, or possibly subsurface testing, to determine the depth of deposits on site and, if possible, locate material suitable for radiocarbon dating, and thus help provide a secure age for the site. In this last effort, we were unsuccessful.

The additional sample of artifacts collected across the site surface (*n* = 220) was again composed of formal tools, as well as any non-diagnostic materials equal to or greater than 7 cm in size. A size cut-off was not used in the mapping and collection of artifacts within Cluster 1—the cluster chosen for more intensive examination (it was the densest of the several artifact concentrations, with thousands of artifacts visible on its surface, and with well-defined boundaries, suggesting its horizontal integrity was mostly undisturbed). Rather, Cluster 1 was divided into 12 square-meter units, which were further subdivided into four 50 cm^2 blocks (Figure 3). All artifacts were hand drawn on a plan map, located with an EDM, and then collected in individually labeled bags. This effort yielded just over 1,900 artifacts, most of which were flakes and debris of stone tool production using what appeared to be locally derived quartzite.

Once the surface collection was complete, two test units were excavated within Cluster 1 to ascertain the depth of the archaeological deposit (Figure 3). These particular units were selected because each yielded a high number of surface artifacts. Units were excavated in 50 cm quads, in 5 cm vertical levels, and all material was screened through 1/8-inch mesh. Excavation stopped when persistent bedrock deposits were reached, which was no more than 15 cm below surface in all cases. The majority of artifacts were concentrated in the first 5 cm below the surface. Items were bagged and provenienced by quad designation. Due to the high volume of artifacts (over 775 artifacts > 2 cm in size) and shortage of time, some excavated sediment samples were bagged without screening to be water-screened in the lab.

Although small charcoal fragments were recovered in our excavations, these were identified in the top 10 cm of loose, unconsolidated sediment. Given the dynamic nature of the shallow surface sediment, which is subject to the frequent mixing and churning caused by both bioturbation and cryoturbation, the charcoal fragments are likely relatively recent, and in any case were not unequivocally associated with any archaeological features or remains. Linking any resultant radiocarbon ages to cultural deposits at the site would have been tenuous at best.

A final round of fieldwork was undertaken at 5GN149 in 2004. This was a 10-day session conducted by a four-person field crew, aimed at generating a more detailed site topographic map, increasing the general surface collection artifact sample (but still using the 7 cm size cutoff), collecting any remaining surface and near-surface artifacts from Cluster 1, collecting surface and near-surface artifacts from square-meter units dispersed throughout the entire site, and intensively collecting an additional chipping cluster to compare to Cluster 1 (in hopes of determining if the separate artifact concentrations were similar in age and function, thus informing on overall space use within the site).

In the course of generating a more detailed and complete site map, the survey area was expanded beyond previous site boundaries, primarily to the north (downslope) and west (along the bench surface). Also, the perimeters of visible artifact clusters were flagged and mapped using the EDM, creating Clusters 1 to 8 (Clusters 5 and 6 later excluded) (Figure 2). The perimeter of a dense patch of bushes adjacent Cluster 4 was also mapped in order to account for the paucity of artifacts in that area.

An additional 3,795 surface artifacts were collected during 2004, resulting in a total surface collection sample of 5,854 artifacts. Numerous (n = 47) new bifaces were recovered during this season, as well as several projectile points and point preforms, and scrapers. All artifacts 2 cm or greater in size still remaining on the surface of Cluster 1 (n = 112) were first mapped with the EDM and then were piece-plotted and collected. Two additional square-meter test units were laid out within Cluster 1 (Figure 3). The units were then subdivided into 50 cm^2 quads and excavated to 5 cm below surface. All collected artifacts were mapped and bagged according to quad provenience.

With the goal of attaining a more representative sample of the entire site, 18 near-surface test excavation units were placed throughout the site in addition to those placed in Cluster 1, for a total of 22 excavation units (Figure 2). Square-meter units were placed in areas of interest (e.g., within an artifact concentration), in areas of apparent low surface artifact density, and near the maximum site boundaries. This was done in order to assess whether the surface artifact density reflected the subsurface density and to estimate the density and distribution of artifacts across the site. Each unit was first surface collected intensively, with all artifacts piece-plotted and bagged separately. Each unit was then excavated in 50 cm quads to 5 cm below surface. All artifacts 2 cm or greater in size were collected and bagged according to quad provenience. The 2 cm cut-off was implemented due to the high volume of artifacts found within the excavated sediment within many of the units.

Cluster 4 was then selected for more intensive collection; the cluster was gridded into 16 one-square-meter units. All surface artifacts 2 cm or greater in size were piece-plotted using the EDM and bagged individually. This produced a sample of 489 artifacts. Three of the aforementioned square-meter shallow test excavation units were placed in Cluster 4.

Figure 4 combines the surface artifact collection from all three years of investigation at 5GN149. Note the areas of high artifact density and their correspondence to the chipping clusters designated in Figure 2. Additionally, the number of surface artifacts recovered per quadrant was found to be highly correlated with the number of near surface artifacts for that same quadrant ($r = 0.834$, $df = 73$, $p<.001$). Therefore, although a limited number of test units were excavated, we are fairly certain that the number of artifacts on the site's surface closely corresponds to the number of artifacts beneath the surface.

All of the material was brought back to the laboratory, and analysis of the 5GN149 artifact assemblage was conducted over a four-year period (the assemblage included artifacts collected by Frost in 2002 and by Quest from 2002 to 2004). The goals of the laboratory analysis were twofold. First, we aimed to distinguish the types of technologies present at the site with the hopes of determining if Clovis materials were indeed present and to ascertain the time periods during which the site was occupied. To do so, we macroscopically analyzed all lithic artifacts greater than 2 cm in size recovered at the site. Second, we aimed to tease apart different activity areas and occupations of different time periods within the palimpsest deposit. This was accomplished using various methods, including a modified version of minimum analytical nodule analysis, lithic refitting, and spatial analysis using Geographic Information Systems (GIS). The results of each of these are discussed in turn.

THE 5GN149 LITHICS

The methods used for lithic analysis were developed and modified from Andrefsky (1998), and included recording the following attributes: artifact type, raw material type, artifact metrics (length, width, thickness, and weight), artifact portion, percent dorsal cortex, dorsal flake scar count, platform preparation, and distal termination. The attributes to be recorded were selected with several goals in mind. First, the analysis was structured such that it would yield information on the site's use or function. This required the collection of data that would identify stages of lithic reduction. Second, we hoped to differentiate activity areas in space and time by identifying different technological strategies. Finally, the lithic analysis sought to provide a dataset that could be used to design and test a computerized model for lithic refitting (discussed in detail in Cooper and Qiu 2006).

The lithic analysis was performed in two stages. The first stage was directed towards differentiating between (1) debitage, cores, and tools and, (2) chips, blocky debitage or shatter, unmodified raw material chunks, and

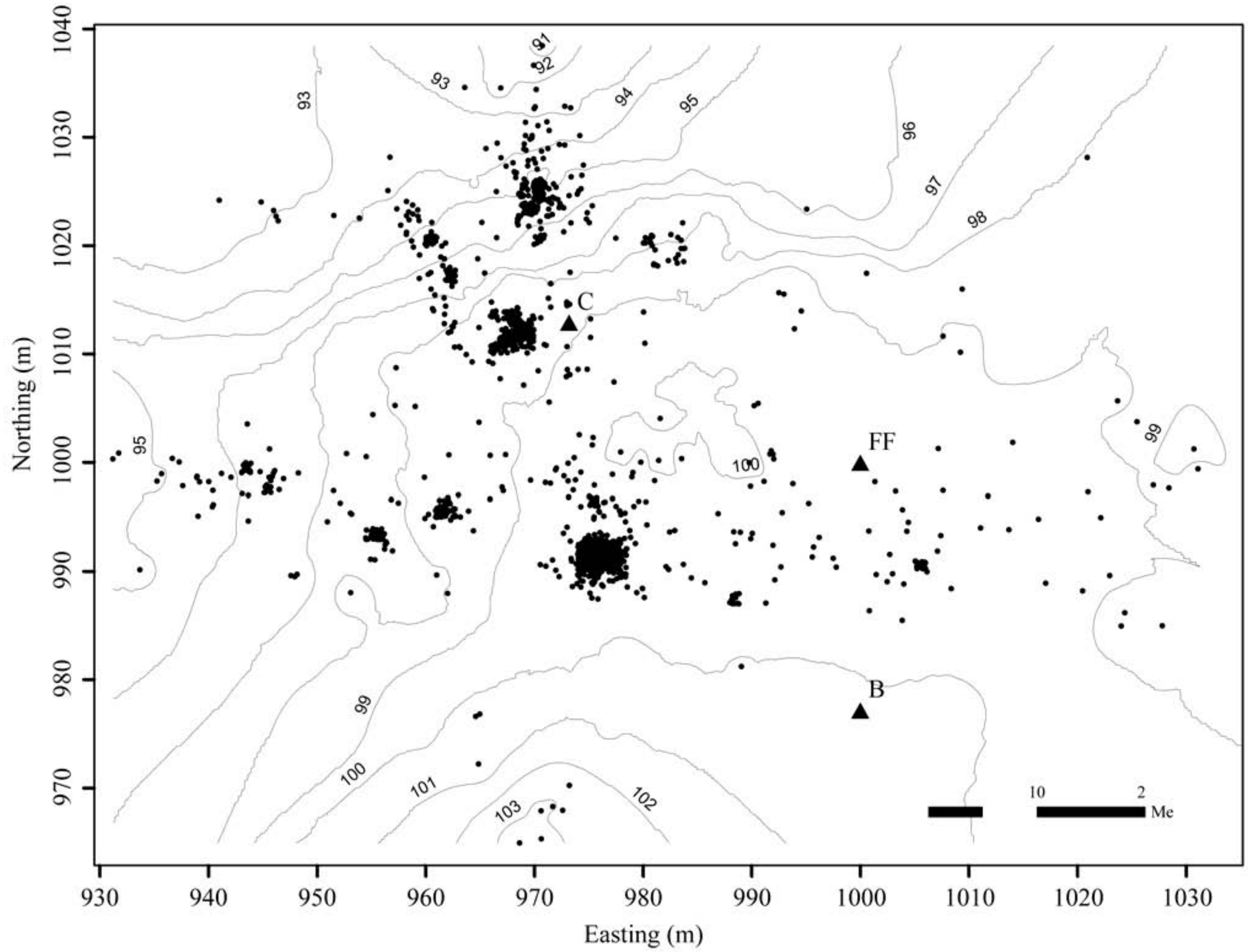

FIGURE 4. All recorded surface artifacts at 5GN149. Triangles denote datums and grid on left and bottom axis show northing and easting in meters, respectively.

non-cultural rocks. The following criteria were used to classify types:

- *debitage* includes any lithic specimen greater than 2 cm in maximum dimension that displays one or more landmark or morphological trait characteristic of a flake (e.g., platform, bulb of percussion, hinge termination, etc.)
- *cores* include any piece of material that does not demonstrate flake morphology and has one or more flake removals on its surface;
- *tools* include formal and informal tools, including projectile points, scrapers, bifaces, utilized flakes, and more, regardless of size;
- *chips* include any flake smaller than 2 cm in maximum dimension which was piece-plotted during field collection;
- *blocky debitage* or *shatter* includes items that apparently resulted from lithic reduction, but lack clear landmarks or do not exhibit flake morphology;
- *unmodified raw material* chunks include items of apparently knappable material that do not occur naturally on-site (e.g., chert) but lack flake morphology or flake removals;
- *non-cultural rocks* include recovered lithic specimens that have no apparent cultural modification and occur naturally on-site. The final category was not collected intentionally.

In the first stage of analysis, all items were also classified by raw material type (e.g., quartzite, chert, or volcanic tuff), percent cortex on dorsal surface (0 percent, 1–49 percent, 50 percent–99 percent, or 100 percent), and weight (grams [gm]).

For all items identified as debitage, cores, or tools, additional information was recorded. First, maximum length, width, and thickness were measured. The former were found by measuring the maximum distance along the long axis (length) and maximum distance along the perpendicular axis (width); the last was measured at the thickest section of the flake, core, or tool.

Debitage, cores, or tools were then further classified as to type (e.g., unmodified flake, projectile point, blade, biface thinning flake, retouched flake, etc.). If applicable, the portion of the artifact was identified (proximal, medial, distal, complete, or unspecified). Dorsal flake scar count was collected for all modified and unmodified flakes, counted as 0, 1, 2, 3, or more. For complete or proximal modified or unmodified flakes, the number of facets on the platform was identified as well as whether the platform displayed modification (grinding, hinging, both, or no modification). Distal termination was recorded when applicable (on complete or distal flake portions) as feathering, hinge, step, or overshot.

Data on all items were entered and stored in a relational database (Microsoft Access™). A total of 5,854 items was recorded during lithic analysis. The assemblage contains additional collected artifacts less than 2 cm in size that derive from near-surface excavations. These artifacts were not piece-plotted but instead located by quad. Therefore we treated these as bulk quad samples and weighed them.

Table 1 provides a summary of the artifact classes recovered at 5GN149 with the frequency of specimens in each class. The formal tool assemblage consists of projectile points and point preforms (*n* = 17), scrapers (*n* = 41), bifaces (*n* = 159), and miscellaneous tools (*n* = 6). The debitage assemblage consists of cores (*n* = 56), utilized or expedient flake tools (*n* = 61), blades (*n* = 176), biface thinning flakes (*n* = 379), and unmodified flakes (*n* = 3,585). The nearly 4,000 artifacts we recovered might represent slightly more than 10 percent of the specimens present at the site, if one projects a total based on the density of the site and area surveyed, and the ratio of artifacts greater than:less than 7 cm in size in areas intensively sampled (which provides a very rough measure of numbers that might be expected in areas where only artifacts 7 cm or greater were collected). Of course, this is only a rough estimate, and it is likely inappropriate to assume that the ratio recovered within chipping clusters is the same across the entire site (assuming flintknapping would result in the production of numerous small waste flakes). Nonetheless, this highlights the potential artifact density at the site.

The majority of the 5GN149 assemblage was manufactured from quartzite (97.23 percent), followed by welded tuff (1.65 percent), quartz (0.61 percent), chert (0.43 percent), sandstone (0.05 percent), and petrified wood (0.04 percent). The quartzite is presumed to be local. Within the bedrock of the region there is an abundance of quartzite outcrops, which includes the large, high quality quartzite quarry at 5GN1 on the Gunnison valley floor, just 4 km west of 5GN149 (Jones 1996). Additionally, secondary quartzite cobble sources occur throughout the Gunnison basin, especially on terraces and drainages, including ones immediately adjacent to 5GN149 (several large, minimally tested cobbles were recovered at 5GN149 and suggest raw material was immediately available, assuming an individual would not transport a large cobble a great distance uphill only to test and discard it). The quartzite formed when existing aeolian sandstone formations (Morrison and Junction Creek sandstone) were thermally altered and silicified by contact with overlying igneous rock. These quartzites come in a variety of colors, grain-sizes, and quality—some of exceptionally high-quality (Stiger 2006).

TABLE 1. Artifact classes recovered at 5GN149.

Artifact Class	Count
Formal Tools	
Projectile points and preforms	17
Scrapers	41
Bifaces	159
Miscellaneous tools	6
Debitage	
Cores	54
Utilized flakes	61
Blades	176
Biface thinning flakes	379
Unmodified flakes	3,585

Likewise, the welded tuff is also presumed to have derived from the site or very close by, given its natural abundance in this area. Episodic volcanic eruptions, particularly during the Middle Phase of the Post-Laramide Magnetism (~30–26.5 mya [Chronic and Williams 2002]), blanketed the region with layers of ash. This ash formed layers of tuff and, where internal heat was great enough, welded tuff. The soft tuff later eroded to form ashy sediment (some of which is evident at 5GN149), while the resistant welded tuff forms the blocky upper bedrock layer across much of the region—and was occasionally used to manufacture stone tools.

Fine-grained cherts occur in the Upper Gunnison Basin as well, but are far less common, and none outcrop in the immediate vicinity of 5GN149, though their distribution is patchy and poorly known (see Stiger 2001). It is also not known if the petrified wood specimens derived from local or exotic sources, though we are inclined to think the latter. A large proportion of the artifacts of chert and petrified wood from the site occur as exhausted tools and cores (37 percent of the chert and petrified wood artifacts are scrapers, bifaces, or cores).

Though all reduction stages are represented at 5GN149, the site is dominated by middle to late stage reduction activities. The majority of debitage (68.12 percent) lacks cortex, has three or more dorsal flake scars (54.52 percent), and is less than 5 gm in weight (64.38 percent). But, given that 7.14 percent of the assemblage is greater than 40 gm in weight, it is clear that some early stage reduction activities took place on site. As we discuss below, groups here at different time periods might be responsible for the different stages of reduction apparent on the site.

The majority (81.14 percent) of the debitage recovered from 5GN149 is broken. This suggests that hard-hammer and/or direct percussion (and a great deal of force) was used to remove most of the flakes, at least those greater than 2 cm in size. Hard-hammer percussion may have been necessary to fracture the quartzite cores because the material is very hard (Andrefsky 1998). Taphonomic factors such as trampling by ungulates or freeze-thaw fracturing may have also contributed to the fragmentary state of the assemblage, though these factors are most likely not solely responsible for the pattern. It is also possible that the prehistoric flintknappers removed complete flakes from the site to be used elsewhere as tool blanks, leaving behind only the broken specimens. Because broken flakes also make suitable tools (as evidenced by the numerous expedient tools and scrapers made on broken flakes at the site), it is unlikely that only complete flakes were preferentially removed. Therefore, we suggest that the fragmentary nature of the assemblage results primarily from the manufacture techniques employed at the site.

Flintknappers at 5GN149 ground their platforms as well: 20.43 percent of all proximal or complete flakes have ground platforms, while 52.55 percent of the proximal or complete biface thinning flakes have ground platforms. Heavily ground biface thinning flake platforms can serve as a diagnostic trait of Clovis technology (Bradley 1991).

We now turn to specific comments on the major tool and artifact classes recovered at the site.

Projectile Points

A total of 17 **projectile points** and **point preforms** (as well as fragments thereof) were recovered at 5GN149 (selected specimens, Figure 5). Of the points and preforms, seven (39 percent) are unifacial and were manufactured on flakes. The presence of projectile points resembling a variety of types spanning a wide time range indicates there were multiple occupations at 5GN149, dating from the Late Paleoindian to Protohistoric. The specimens are described in greater detail in Table 2.

Three projectile points (I23-6-191, S3173, and S3016) resemble Late Paleoindian forms, though their fragmentary nature makes it difficult to conclusively determine cultural affinity. The thin, square base of I23-6-191 resembles that of a Scottsbluff stem or possibly the base of a Cody knife. The absence of obvious grinding on the lateral edge of the specimen suggests it might be an unused, unhafted specimen broken during late stages of manufacture. Specimen S3173, a medial point fragment, is difficult to identify to type due to its size, but given the perfectly straight blade edges, narrow width, and lenticular cross-section, the fragment might have belonged to an Eden point. Both specimen types are diagnostic of the late Paleoindian Cody complex (ca. 9500–8200 B.P.; Pitblado 2003). Specimen S3016 is a concave base of a small, thick, lanceolate projectile point and resembles most closely the point type of the Foothill–Mountain tradition (ca. 9700–7550 B.P.; Pitblado 2003), although it could also be a projectile point base belonging to the Archaic Pinto Basin series (Ireland 1986).

Four projectile points (FF-A-1, FF-A-3, FF-A-6, and G27-14-117) probably date to the Archaic period. These are stemmed and/or corner-notched dart points. Specimen FF-A-1 has a distinctively long, slightly expanding, square-based stem and resembles a Calf Creek projectile point in which the pronounced barbs have been broken and removed through reworking. Retouch on the distal

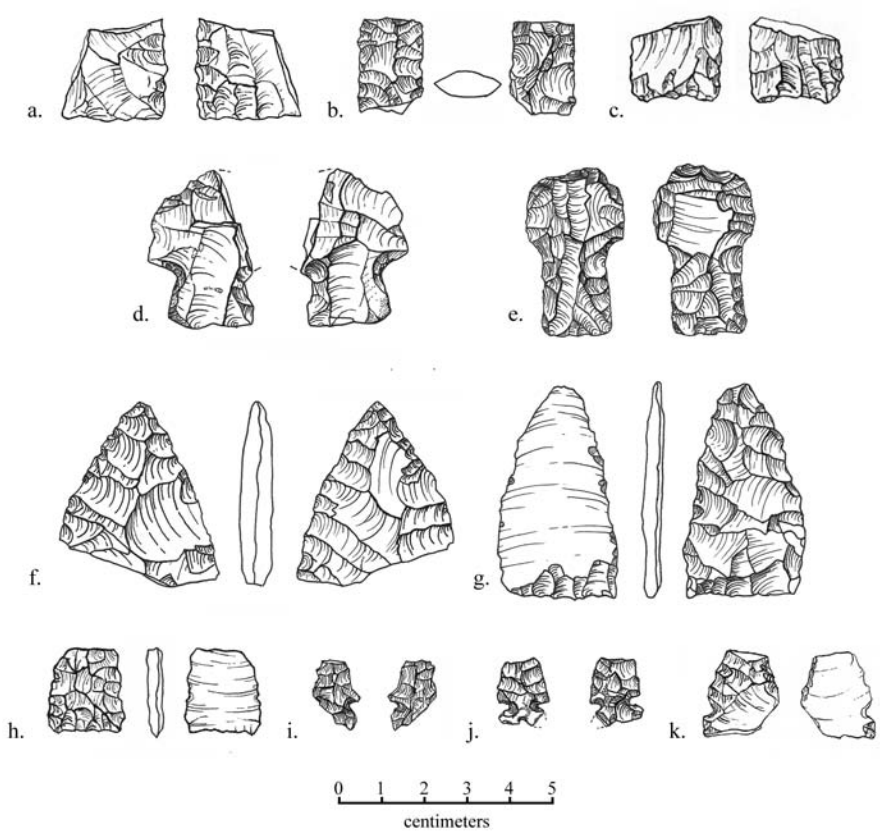

FIGURE 5. 5GN149 projectile points:
a. I23-6-191 (possible Scottsbluff or Cody knife);
b. S3173 (possible Eden/Firstview);
c. S3016 (Foothill–Mountain tradition);
d. FF-A-6 (unknown Archaic);
e. FF-A-1 (unknown Archaic);
f. G27-14-117 (unknown Archaic);
g. S137 (unknown Archaic);
h. 3139 (Cottonwood Triangular);
i. I23-6-465 (Desert Side-notched);
j. F24-2-123 (Desert Side-notched);
k. S5172 (Desert Side-notched).

TABLE 2. Projectile point and preform descriptions.

Specimen	Description
Late Paleoindian	
I23-6-191	Projectile point base fragment; fine-grained gray quartzite; fractured on latitudinal and longitudinal axes; thin, plano-convex cross-section; straight blade edge; straight base; resembles base of Scottsbluff point type or Cody knife, both of the Cody complex (9500–8200 B.P.*).
S3173	Projectile point midsection; tip and base missing; medium-grained red quartzite; straight, parallel blade edge; lenticular cross-section; resembles Eden/Firstview point type of Cody complex (9500–8200 B.P.*).
S3016	Lanceolate projectile point base; medium-grained pinkish-white quartzite; fractured on longitudinal axis; plano-convex cross-section; convex blade edge; concave base; resembles point types of the Foothill-Mountain tradition (9700–7550 B.P.*).
Archaic	
FF-A-6	Stemmed dart point fragment, broken lateral edge; medium-grained pink quartzite; fractured on latitudinal axis; thick, lenticular cross-section; straight blade edge; abrupt shoulder; slightly expanding stem and notched base; unknown Archaic type.
FF-A-1	Stemmed projectile point; impact fractured tip; heavily reworked, possibly used as a scraper; medium-grained pinkish-white quartzite; plano-convex cross-section; slight shoulder; straight, long stem; unknown Archaic type.
FF-A-3	Stemmed projectile point; reworked tip; medium-grained pinkish-white quartzite; thick, lenticular cross-section; convex blade; sloping shoulder; straight to contracting stem; rounded base; unknown Archaic type.
G27-14-117	Dart point/knife tip; fine-grained red quartzite; slightly convex blade edge; unknown type, probably Archaic.
Late Prehistoric / Protohistoric	
S3139	Triangular arrow point base; unifacial retouch; small ears; tip missing; fine-grained beige quartzite; thin cross-section; straight blade edge; concave base; possible side-notch attempt; resembles Cottonwood Triangular points (1000 B.P. to Historic**).
S1035	Triangular arrow point; made on flake; unifacial retouch; broken ear; fine-grained beige quartzite; thin cross-section; slightly convex blade edge; concave base; resembles Cottonwood Triangular points (1000 B.P. to Historic**).
S3165	Triangular arrow point, possibly unfinished; unifacial retouch; narrow; tip missing; slight ears; fine-grained beige quartzite; thin cross-section; straight blade edge; concave base; resembles Cottonwood Triangular points (1000 B.P. to Historic**).
I23-6-465	Side-notched arrow point fragment; broken base and tip; fine-grained light brown quartzite; thin cross-section; concave blade edge; pronounced shoulder; large stem area with slight ears; resembles Desert Side-Notched points (750 B.P. to Historic**).
F24-2-123	Side-notched arrow point; broken ear and tip; fine-grained pinkish-gray quartzite; thin cross-section; straight blade edge; notched base; rounded ears; resembles Desert Side-Notched points (750 B.P. to Historic**).
S5172	Side-notched arrow point; unifacial retouch; broken ear and tip; fine-grained red quartzite; thin cross-section; straight blade edge; straight base; square ears; resembles Desert Side-Notched points (750 B.P. to Historic**).
Unknown	
I23-2-222	Projectile point tip; fine-grained dark gray quartzite; fractured on latitudinal axis; thin in cross-section; unknown type, possible Late Prehistoric arrow fragment.
S5321	Preform; base missing; made on flake; partial unifacial retouch; fine-grained red quartzite; thin in cross-section; unknown type, possible Late Prehistoric arrow preform.
S137	Triangular projectile point/preform; only minimal retouch on ventral face; thin in cross-section; fine-grained red quartzite; convex blade edge; small ear; straight base; unknown type.
S46	Projectile point midsection; tip and base missing; medium-grained tan quartzite; straight blade edge; unknown type.

* projectile point type age range from Pitblado (2003)
**projectile point type age range from Ireland (1986)

end of the specimen suggests it was used as a scraper after its tip or barbs were broken. Given the degree of breakage and reuse of these specimens, it is difficult to assign a specific type or temporal affinity to these projectile points, and therefore, we simply note an Archaic presence at 5GN149.

There is also a Late Prehistoric or Protohistoric component at 5GN149 as indicated by the presence of six arrow points and point fragments (S1035, S3139, S3165, S5172, F24-2-123, and I23-6-465). Three of these resemble Cottonwood Triangular points which date from ~1000 B.P. to the Historic period. Three others closely resemble Desert Side-Notched points and date from ~1250 B.P. to the Historic period (Ireland 1986). Two additional specimens (I23-2-222 and S5321) are the size of arrow points but are too fragmentary and lack morphological characteristics diagnostic of a specific projectile point type.

Scrapers, Bifaces, and Other Tools

5GN149 yielded a total of 41 ***scrapers*** (selected specimens, Figure 6), defined here as a lithic specimen with intentional unifacial retouch on one or more edges. Three general categories of scrapers can be identified at the site: small, thumbnail scrapers; large, discoid scrapers; and long, steep-sided scrapers. The scrapers exhibit end-retouch and side-retouch; some specimens exhibit both forms of retouch (Table 1). In fact, several are characterized by substantial retouch, steep edge angles, and relatively small size, suggesting long term curation of

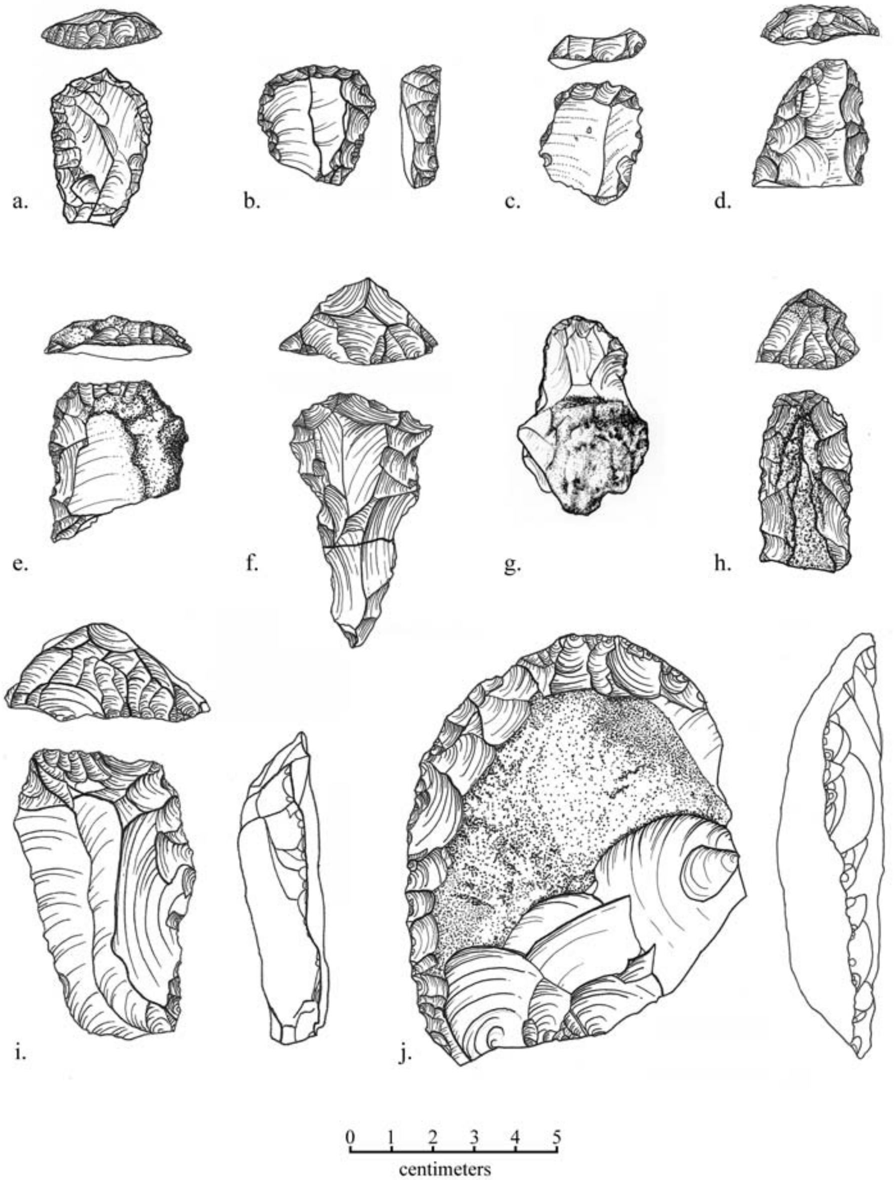

FIGURE 6. 5GN149 scrapers: a. S111; b. S1011; c. S1044; d.G27-14-102; e. S1976; f. Refit S5128-G27-14-101; g. G27-14-245; h. G27-14-1; i. S158; j. S3151.

tools that were heavily used and frequently reworked prior to arriving at 5GN149. The range of sizes, shapes, and retouch patterns on the scrapers may reflect the different time periods of occupation and multiple technologies represented at the site. Or, the variety of scrapers may indicate that a wide range of subsistence activities took place at 5GN149. The latter is more probable, given that scrapers as a tool class are not especially diagnostic of a temporal period—certain styles persist through time. Although not incorporated into the present analysis, examination of the use-wear patterns on the tools may help answer these questions.

Bifaces comprise the dominant tool class at 5GN149 (*n* = 159) and suggest a focus on biface production at the site (selected specimens, Figure 7). These vary greatly in size, shape, and thickness, ranging from biface cores to finished biface tools. Of these, only 14 (8.8 percent) are complete; the remainder were broken and discarded during manufacture or use. For the complete specimens and those that were sufficiently intact that their manufacturing stage (sensu Callahan 1979; also Bamforth and Becker 2000) could be reliably discerned (*n* = 39), 8 are Stage 2 bifaces ("initial edging," in Callahan's [1979:10] terms), 9 are Stage 3 bifaces ("primary thinning"), and 21 are Stage 4 bifaces ("secondary thinning"). This tally does not include projectile points; basic metric data are provided in Table 3. These reveal, not surprisingly, that both width and thickness become more "standardized" through the manufacturing process (note the declining coefficients of variation in those measures), and that reduction aimed for bifaces that were both wider and thinner. Length values are more varied, which is not surprising given that these are the specimens that broke longitudinally, and were discarded on site.

That the majority of the bifaces fall into Stage 4 might appear to be unexpected, but it is not inexplicable. A disproportionate number of the Stage 4 bifaces (16/21) are broken, and hence had been discarded on site. Presumably, the Stage 4 bifaces that were successfully manufactured here were transported off site, and all that

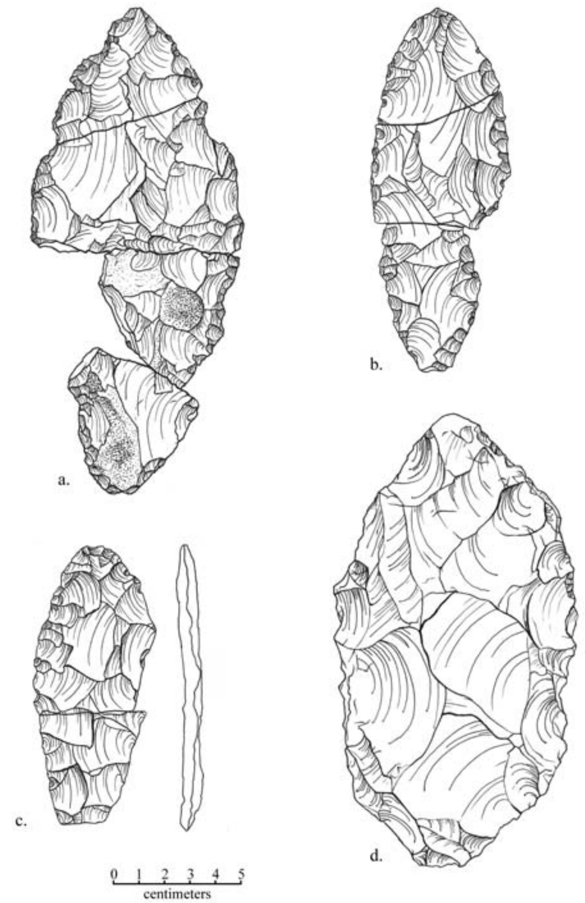

FIGURE 7. 5GN149 bifaces and biface refits: a. Refit S2-S3-S796-S2019; b. S108-S3042-S138; c. FF-A-5; d. FF-A.

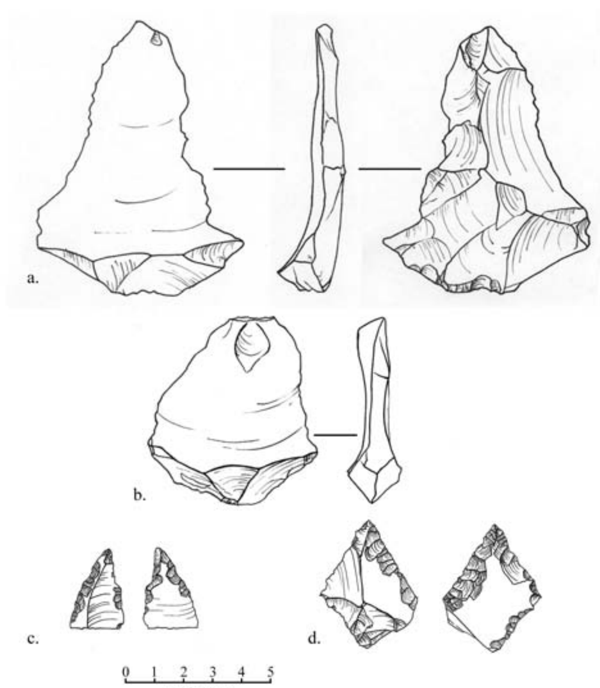

FIGURE 8. 5GN149 overshot flakes (a-b), drill or perforator (c), and heavily retouched flake (d): a. S81, b. S106, c. FF-S, and d. FF-A-12.

TABLE 3. Descriptive statistics on measurable bifaces (complete specimens, plus fragments where reliable measurements can be obtained).

	Stage 2	Stage 3	Stage 4
Length			
Mean	103.58	115.88	111.00
SD	37.07	26.88	39.13
CV	0.358	0.232	0.353
n	6	4	11
Width			
Mean	60.12	63.71	66.59
SD	20.46	16.79	16.98
CV	0.340	0.264	0.255
n	8	9	21
Thickness			
Mean	25.00	18.09	12.29
SD	7.58	4.90	3.21
CV	0.303	0.271	0.261
n	8	9	21

remains of their one-time presence are biface thinning flakes.

Of the complete or refit bifaces, the average length is 109.81 mm and the average width is 64.54 mm. However, given the size of some of the broken bifaces (one especially large base is 99.22 mm wide), we suspect the mean length and width of bifaces made or taken off site may have been even larger. Likewise, the 379 biface thinning flakes that were recovered testify to biface size: their average length is 51.55 mm, suggesting removal from fairly large bifaces. At least seven of these biface thinning flakes are thought to be overshot flakes (selected specimens, Figure 8).

As with the assemblage as a whole, quartzite (91.72 percent) is the dominant raw material used in biface manufacture, though welded tuff (7.0 percent) comprises a greater percentage of the biface assemblage than the raw material does the overall assemblage. This could indicate a preference for welded tuff in manufacturing bifaces over other artifact classes, or, more likely, indicates our inability in the field to differentiate between non-cultural tuff fragments and cultural unmodified debitage.

Based on the use of biface thinning flakes to produce flake tools, it would appear some of the bifaces in this category served as cores as well as having been prepared as tools. However, for analytical purposes we tallied them solely in the biface category (and not with the cores), in recognition of the challenge or arbitrariness of differentiating between a biface that was used as a core, one used as a tool, or one that served (or was intended to serve) both purposes, and thus to avoid any statistical complications of double counting.

Additional miscellaneous tools recovered at 5GN149 (*n* = 6) include two ***drills***, two ***gravers***, a ***perforator***-type tool, and a ***spokeshave*** (selected specimens, Figure 8).

Cores

Fifty-four ***cores*** were recovered from 5GN149 (excluding biface cores). This class was further sub-divided into multidirectional cores (*n* = 51), blade cores (*n* = 2), and one anomalous core we describe below. The multidirectional cores vary greatly in size and shape. The majority of these are made of quartzite (88.69 percent), while four are of chert (7.41 percent), and two made of welded tuff (3.70 percent). The two blade cores are both made of quartzite and have blade scars only on a single face (Figure 9). The other faces contain multidirectional flake removals, not consistent with traditional blade cores. But, given the presence of blades and blade core trimming flakes at the site, these cores are assumed to have been a component of the blade technology at 5GN149.

One core made of quartzite is unique among the site specimens (Figure 10). It is discoidal and bifacially worked, and both faces have a large flake removal reminiscent of Levallois technology (we, of course, do not imply any historical relationship in this observation). The flake scars extend the length of each face and were struck from opposite ends of the core. In the second flake removal, the flake overshot the core edge, apparently removing the proximal portion of the scar bed on the opposite face. Stiger (2001:8) cites Levallois reduction technology as a common facet of Folsom assemblages and notes the presence of Levallois reduction debris at a Paleoindian-aged firepit in the Curecanti area (Euler and Stiger 1981).

The relative proportion of multidirectional or amorphous cores to bifaces has been used as a rough measure of settlement mobility, on the assumption that mobile populations more often used bifaces, owing to their portability, available cutting edge, and flexibility of use (Bamforth and Becker 2000; Kelly 1988; Parry and Kelly 1987; cf. Prasciunas 2007). In contrast, multidirectional or amorphous cores (in which the form of flakes removed and the shape of the core are not as well controlled) are generally more characteristic of less mobile populations, or at least ones with reliable access to (or stockpiles of) raw materials. By this reasoning, the ratio of amorphous cores to bifaces offers a means of gauging a population's mobility (Bamforth and Becker 2000; Parry and Kelly 1987). In this regard, it is noteworthy that the core:biface ratio at 5GN149 (0.34), is identical to the median value for more mobile populations (data from Bamforth and Becker 2000; Parry and Kelly 1987). Taking the low core:biface ratio overall at face value, the dominant signal from 5GN149 is one of mobility.

Of course, we must offer the caveat that 5GN149

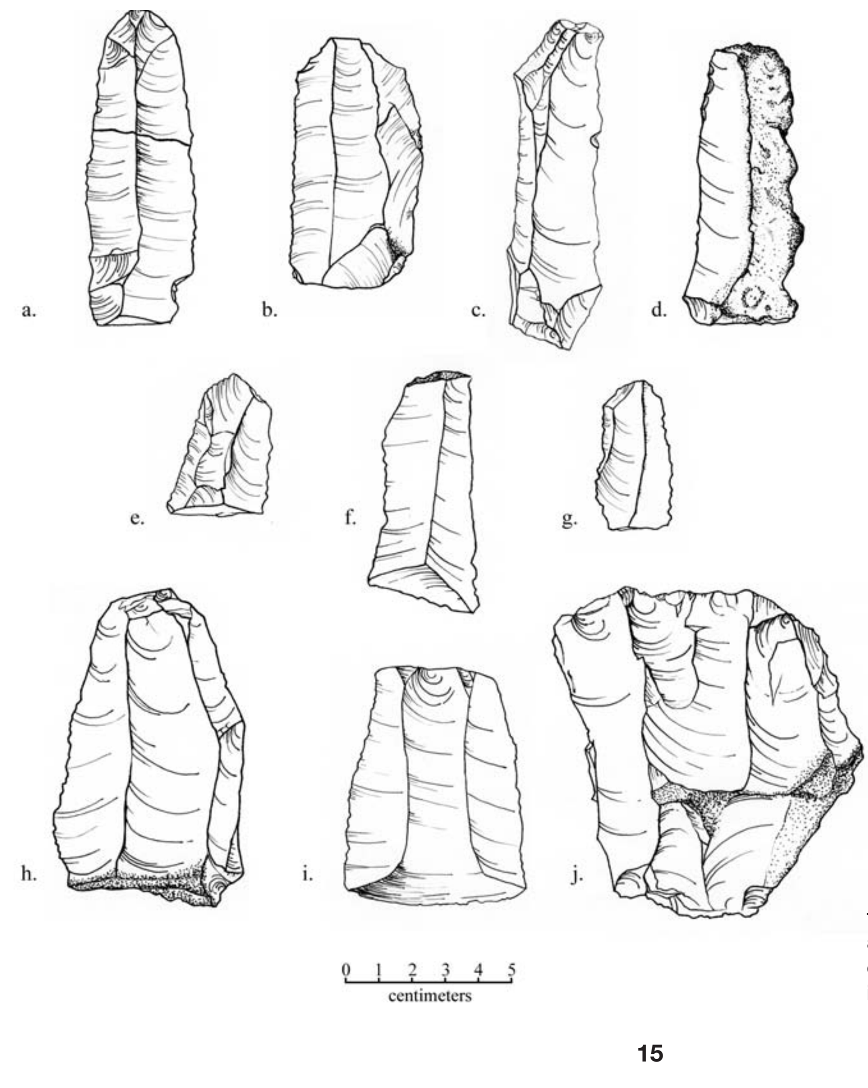

FIGURE 9. 5GN149 blades (a-g), blade core trimming flakes (h-i), and blade core (j): a. I23-6-356; b. S66; c. S99; d. S90; e. S5184; f. I23-6-294; g. S1027; h. S92; i. S82; j. S125.

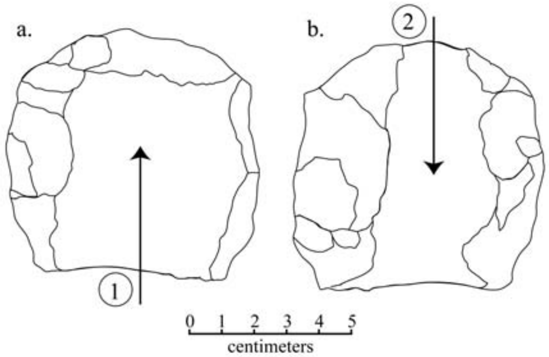

FIGURE 10. "Levallois-like" core recovered from 5GN149. Both faces shown. Arrows and numbers denote the direction and sequence of the flake removals from both faces of the core. The second flake removal overshot the biface end, removing the striking platform and bulb scar of the first flake removal.

seems to have been occupied on more than one occasion, and this ratio is a site-wide value, and one that lumps all cores and bifaces together. It is difficult to determine if each individual component at 5GN149 would have conformed to the median value for the more mobile sample. It is perhaps telling that the multidirectional cores and biface cores are part of different technologies, and do not overlap in their distribution on site (Figure 11), further pointing to multiple and distinct occupations at 5GN149.

Moreover, it is not altogether clear that all bifaces were intended for use (or actually used) as cores, though certainly the size of the bifaces being manufactured on site (cf. Bamforth and Becker 2000), and the fact that flake tools made on biface thinning flakes have been recovered on site indicates some were. Given the incidence of large biface production on site, it seems reasonable to conclude that bifaces taken off site may have been so used as well, though we would hasten to add this does not preclude the possibility that bifaces were also used as tools, or for purposes other than providing flakes to make tools.

Blades

5GN149 also yielded a total of 176 ***blades*** and ***blade core trimming flakes*** (selected specimens, Figure 9). The blades are exclusively manufactured from quartzite. Because the majority (69 percent) are fragments, average metrics are meaningless, but of the complete blades the

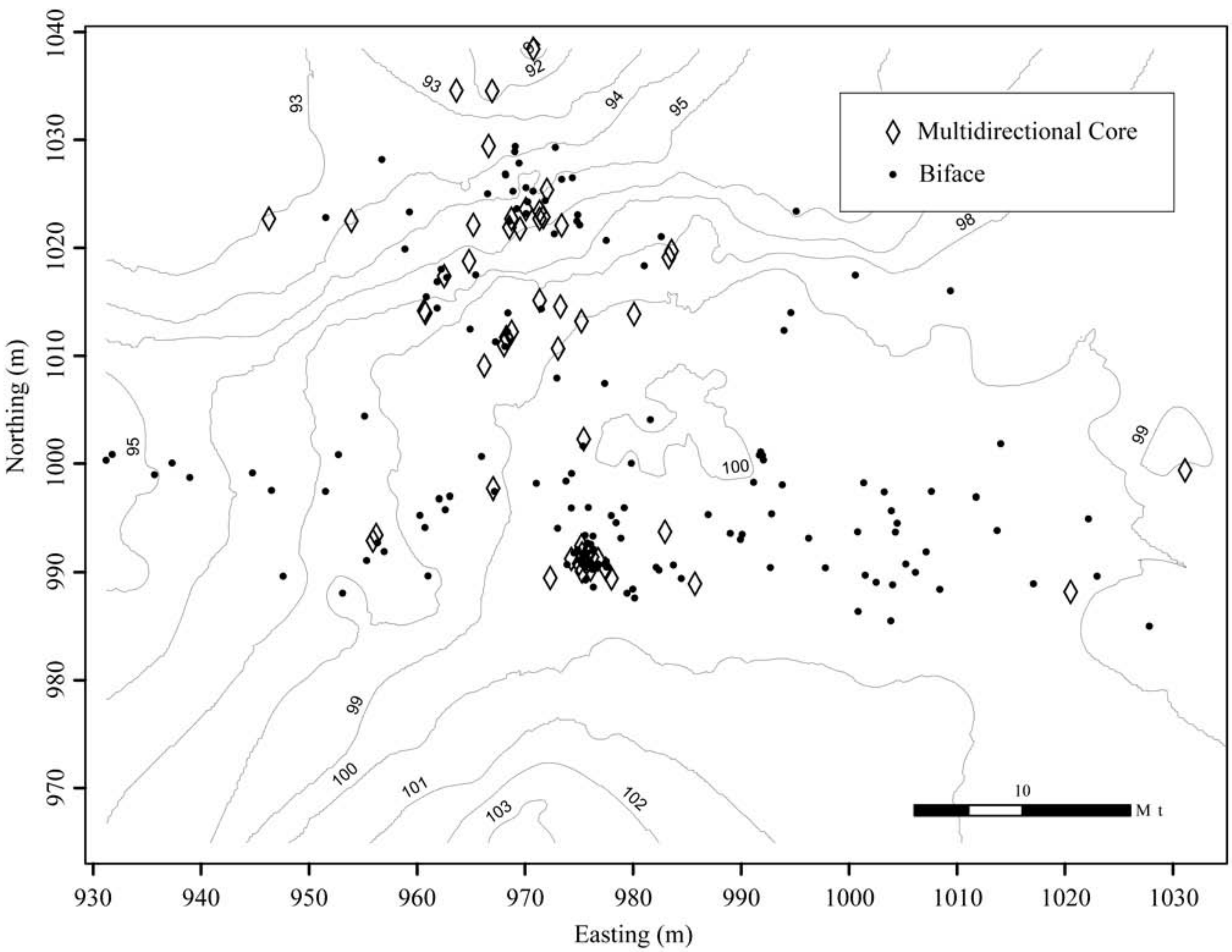

FIGURE 11. Map of multidirectional cores and bifaces. Note the ubiquitous distribution of bifaces and the concentration of multidirectional cores in the northern portion of the site.

average length is 74.13 mm, the average width 34.67 mm, for an average length:width ratio of 2.21. A number of other broken flakes displayed blade-like attributes, but their fragmentary nature made it impossible to classify them as blades. Again, the high blade fracture rate is attributed to the use of hard hammer percussion during manufacture.

In an effort to determine if the blades at 5GN149 were Clovis in shape and size, we compared them with blades from other assemblages of known age using the statistical technique of discriminant function analysis (Meltzer and Cooper 2006; cf. Collins 1999). This method was used to quantitatively classify blade specimens of known ages from other sites and then, by comparing the blades of unknown age from 5GN149 to these groups, attempt to assign the 5GN149 into qualitatively similar age groups. The results, unfortunately, were inconclusive. On the basis of their morphometrics, the 5GN149 specimens were mostly classified with Archaic blades, a result that must be tempered with the fact that the 5GN149 sample is dominated by early-stage forms, discarded blades, and manufacturing failures. The assemblage has fragments of later stage, more "Clovis-like" blades (in curvature and other non-metric attributes), but for lack of completeness these were not included in this analysis. In addition, it is unclear whether the quality and fracture mechanics of quartzite required alterations in the blade technology and contributed to morphometric differences from Clovis-age blades made of high-quality chert (Meltzer and Cooper 2006).

Ground Stone

While our investigations at 5GN149 did not yield any ***ground stone*** specimens, Stiger (1980) reports finding a felsite mano during the 1976 Curecanti survey project. The exact location of this specimen within the site is unclear, but suggests some plant processing might have occurred here.

MINIMUM ANALYTICAL NODULES

Artifacts from Cluster 1 were subjected to minimum analytical nodule analysis. This is a method by which artifacts are subdivided into nodule groupings based on "intra-raw material similarity" (Larson and Kornfeld 1997:4). It offers a way of sub-dividing artifacts of the same raw material, which is especially useful at a site like 5GN149 where the assemblage is dominated by a single material. Variables that can be used for grouping artifacts into nodules include visual characteristics such as color, texture, grain size, banding, inclusions, patina, heat treatment, and more. Other methods such as microscopic material analysis or UV fluorescence also can be used to differentiate materials. In this analysis, only macroscopic visual characteristics that were perceptible without additional instruments were used.

Artifacts derived from Cluster 1 that were greater than 2 cm in size were sorted into minimum analytical nodules (MANs) based on visual characteristics. Color, texture, inclusions, and banding were the most distinguishing traits used to qualitatively differentiate nodules from 5GN149. Of the artifacts evaluated from Cluster 1 (n = 2018), 997 artifacts were placed into a total of 19 MANs. The remaining artifacts did not exhibit visual characteristics distinct enough to assign to a single grouping. The number of artifacts included within each group varied from as little as a dozen to more than 200 artifacts. However, these groups should not be assumed to directly correspond to actual stone nodules. One of the MANs, a light, gray quartzite (Group E) contains 231 artifacts, some of considerable size. It is unlikely that all artifacts were derived from the same nodule, but instead likely came from multiple nodules of similar raw material. Gray quartzite is exceedingly common in the area. Nonetheless, these could not be analytically differentiated into multiple nodules.

Artifacts in Cluster 1 were mapped according to MAN in order to assess the movement or spatial patterning of single nodule groups within the cluster. To detect clustering by MAN type within the larger scatter, nearest neighbor analyses were performed on each material group using a cluster analysis software (CrimeStat II). This method is used to determine if a single MAN is clustered, evenly dispersed, or scattered within the boundaries of Cluster 1, thus informing on spatial orientation of activities within the cluster boundaries as well as possible post-depositional impacts to the surface assemblage. The following equations were used to calculate the nearest neighbor index (R):

Artifact density: ρ = (n-1)/Area
Observed mean neighbor distance: $r_o = \Sigma r/n$
Expected mean neighbor distance: $r_e = ½ \sqrt{\rho}$
Nearest Neighbor Index: $R = r_o/r_e$

The results of the nearest neighbor analysis of the Cluster 1 MANs showed that 17 of the 19 nodule groups are non-randomly clustered (R < 1.0), meaning that artifacts from the same nodule are found closer to each other than would be expected if they were randomly distributed throughout the cluster area (Figure 12, Table 4). Only two of the nodules were dispersed more than would be expected if they were randomly distributed (R > 1.0). This suggests that the deposit has not been significantly disturbed post-depositionally. If it were, we would expect the nodules to be more dispersed and intermixed throughout the cluster area. It appears Cluster 1 may represent multiple individual chipping events, where the flintknapper was either sitting in a slightly different spot or oriented in a different direction between nodule reduction events. The absence of artifacts in the north-central portion of the cluster (Figure 3) suggests the presence of a rock or some other object that may have served as a seat. Clearly, something drew a single or multiple flintknapper(s) to that specific location, because Cluster 1 has the highest density of artifacts of all of the surface clusters.

TABLE 4. Cluster 1 nearest neighbors.

Raw Material Code	Sample Size (n)	Observed Mean Nearest Neighbor Distance (r_o)	Density (p)	Expected Mean Random Distance (r_e)	Nearest Neighbor Index (R)	Difference (r_o–r_e)
A	25	0.37	2.0000	0.35	1.0758	0.02
B	74	0.16	6.0833	0.20	0.8012	–0.04
C	58	0.18	4.7500	0.23	0.7962	–0.05
D	44	0.17	3.5833	0.26	0.6676	–0.09
E	231	0.08	19.1667	0.11	0.6960	–0.03
F	47	0.16	3.8333	0.25	0.6371	–0.09
G	18	0.32	1.4167	0.41	0.7844	–0.09
H	62	0.18	5.0833	0.22	0.8335	–0.04
I	61	0.17	5.0000	0.22	0.7443	–0.05
J	49	0.22	4.0000	0.25	0.8984	–0.03
K	65	0.17	5.3333	0.21	0.7764	–0.04
L	16	0.35	1.2500	0.43	0.8005	–0.08
M	58	0.17	4.7500	0.23	0.7439	–0.06
N	53	0.16	4.3333	0.24	0.6755	–0.08
O	12	0.51	0.9167	0.50	1.0296	0.01
P	12	0.37	0.9167	0.50	0.7434	–0.13
Q	16	0.13	1.2500	0.43	0.2957	–0.30
R	44	0.23	3.5833	0.26	0.8742	–0.03
S	32	0.25	2.5833	0.31	0.8136	–0.06

Refitting

Lithic refitting was attempted on the 5GN149 assemblage to reveal the horizontal movement of artifacts across space. Refitting was performed on a sample of artifacts from the Cluster 1 assemblage. These included artifacts greater than 2 cm in size and classifiable into one of the 19 distinguishable MAN groups (n = 997). Lithic refitting was conducted after MANs were established, under the assumption that grouping artifacts by raw material might facilitate refitting (Hofman 1991; Larson and Kornfeld 1997). All artifacts from each MAN were grouped and stored in separate trays and refits were attempted within each.

Refits were attempted on artifacts within a MAN group based on visual similarities between two items. Therefore, it is highly probable that some artifact combinations were never attempted. Though this approach may seem incomprehensive, this is not unlike the majority of refitting analyses performed by others. It is important to be explicit about one's refitting approach because the results of refitting, usually reflected in a success rate,

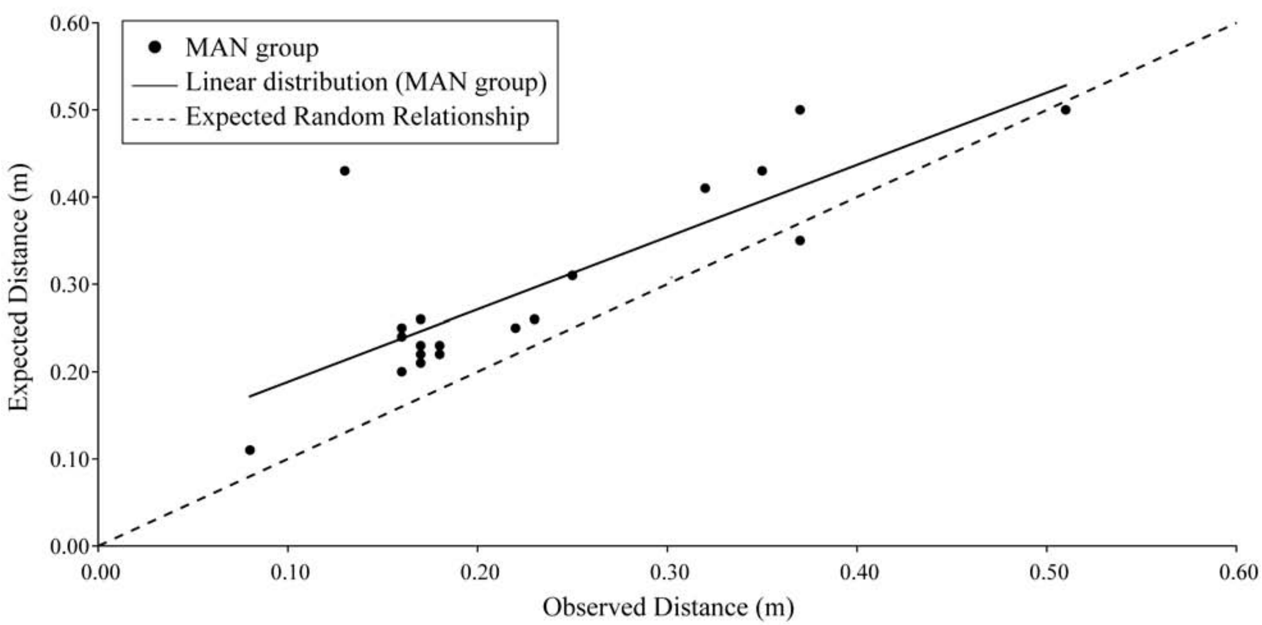

FIGURE 12. Plot of observed versus expected nearest neighbor distances by MAN groups in Cluster 1.

are used to make further assumptions about an assemblage or site as a whole (Cooper and Qiu 2006). If a refitting project generates few refits, it might reflect real archaeological patterns or instead the structure of the refitting methods.

The assemblage contains a number of complete and fragmented bifaces. The biface fragments from the entire assemblage (*n* = 137), not limited to Cluster 1, were also subjected to refitting. Again, biface refits were attempted based on visual similarities (e.g., raw material, biface width and thickness, etc.). Given the relatively small sample of biface fragments, all biface fragment combinations were attempted.

Attempts to refit flakes to bifaces were made only when a flake and biface possessed obviously similar diagnostic characteristics. This resulted in the identification of a few flake-to-biface surface mends. It is highly probable that more refits of this type would have resulted had this task been undertaken systematically. This is a project that can be approached in the future.

The majority of the refitting was conducted by Cooper, though the artifacts were left out on a table and others occupying the lab were encouraged to seek refits. In order to track refits, a form was provided for other individuals to complete. Upon finding a refit, individuals were asked to list the artifacts involved in the refit, to identify the type of refit (surface- or end-mend), and to determine if cortex was present on either artifacts involved in the refit.

As a result of this effort, 109 refit groups were identified, consisting of 168 refit pairs. A total of 272 individual artifacts were involved in refits. Therefore, of the 1,134 artifacts subjected to refitting (biface fragments and artifacts assigned to MANs), approximately 24 percent of the refitting sample was involved in a refit. This refitting success rate is higher than the average of 15 percent reported by Cziesla (1990) in a survey of refitting projects.

The largest refit group consisted of 12 separate artifacts, though the majority of the refit groups comprised only two artifacts. The latter groupings provide limited technological information, but the refit clusters containing numerous artifacts shed some light on the reduction strategies used at 5GN149. For example, a series of four large biface thinning flakes were refit, probably deriving from an early stage biface. That one of the biface thinning flakes was then heavily retouched to create a serrated edged side scraper indicates that bifaces were being used to produce flakes usable as tools. In another example, a refit group included what originally appeared to be a multidirectional core. Through refitting, we determined that the items removed from the core had been classified blades. Though the core does not conform to typical blade core technology, nonetheless, the flintknapper was removing flakes with all of the morphological characteristics of blades. The production of blades could be incidental; or it could represent a variation on the traditional blade core, perhaps to accommodate challenges associated with knapping an extremely hard material like quartzite.

An analysis of the spatial relationships between refits also speaks to site use and taphonomy. Figure 13 shows a map of all artifacts involved in refits at the site. The close-up in Figure 13a shows Cluster 1, from which the majority of the refits in the sample derive. Figure 13b shows a close-up of refits from the north area of the site. The median distance separating all refits was 0.71 m (the median was used instead of the mean because the data distribution was skewed by a few long distances). When evaluating the specific types of refits (end-break vs. face mend), the distance separating refits varied. The median distance separating end-break refits, in which a single broken artifact is mended together, was 0.63 m. For face mends, in which the ventral surface of an artifact refits onto the dorsal surface of another, the median distance separating refits was slightly larger, at 0.86 m. Biface refits were separated by the greatest distance (median distance = 2.00 m).

First, that the median distance separating refits does not exceed 1 m suggests that the site has not undergone significant post-depositional transformation. In flintknapping experiments using hard-hammer percussion, artifacts generally do not disperse more than 1 m from the percussion source, suggesting that artifacts broken during refitting should not be found too far from their mates (Kvamme 1997; Newcomer and Sieveking 1980). In both end-break and face refits, artifacts, on average, were found less than 1 m from the artifact to which they refit. The non-biface refits that exceed 1 m were primarily found in the northern portion of the site (Figure 13b). Excluding the long-distance east-west refits in the center of Figure 13b, the remainder of the refit pairs are oriented north-south and follow the topography. It appears that the longer distances separating refits were caused by down-slope movement of the artifacts due to erosion, and suggests that the refit pairs were probably originally deposited closer to each other.

It is not surprising that bifaces were separated by longer distances. Bifaces that were used in processing tasks or for the production of flakes were probably moved around the site more than unmodified debitage. They are less likely to have been deposited at their place of manufacture, unless they were broken during biface reduction. Several biface refits provide interesting glimpses into past activity on the site.

- Biface FF-A (Figure 7d) is a large Stage 2 bifacial core from which several large flakes were removed. As shown in Figure 12b, FF-A is separated from the flakes to which it refits by over 22 m. It appears that the flakes were removed in the western portion of the site and then biface FF-A was transported eastward. Whether this was done at the time of manufacture or sometime later by another site inhabitant or by a recent artifact collector is unknown.

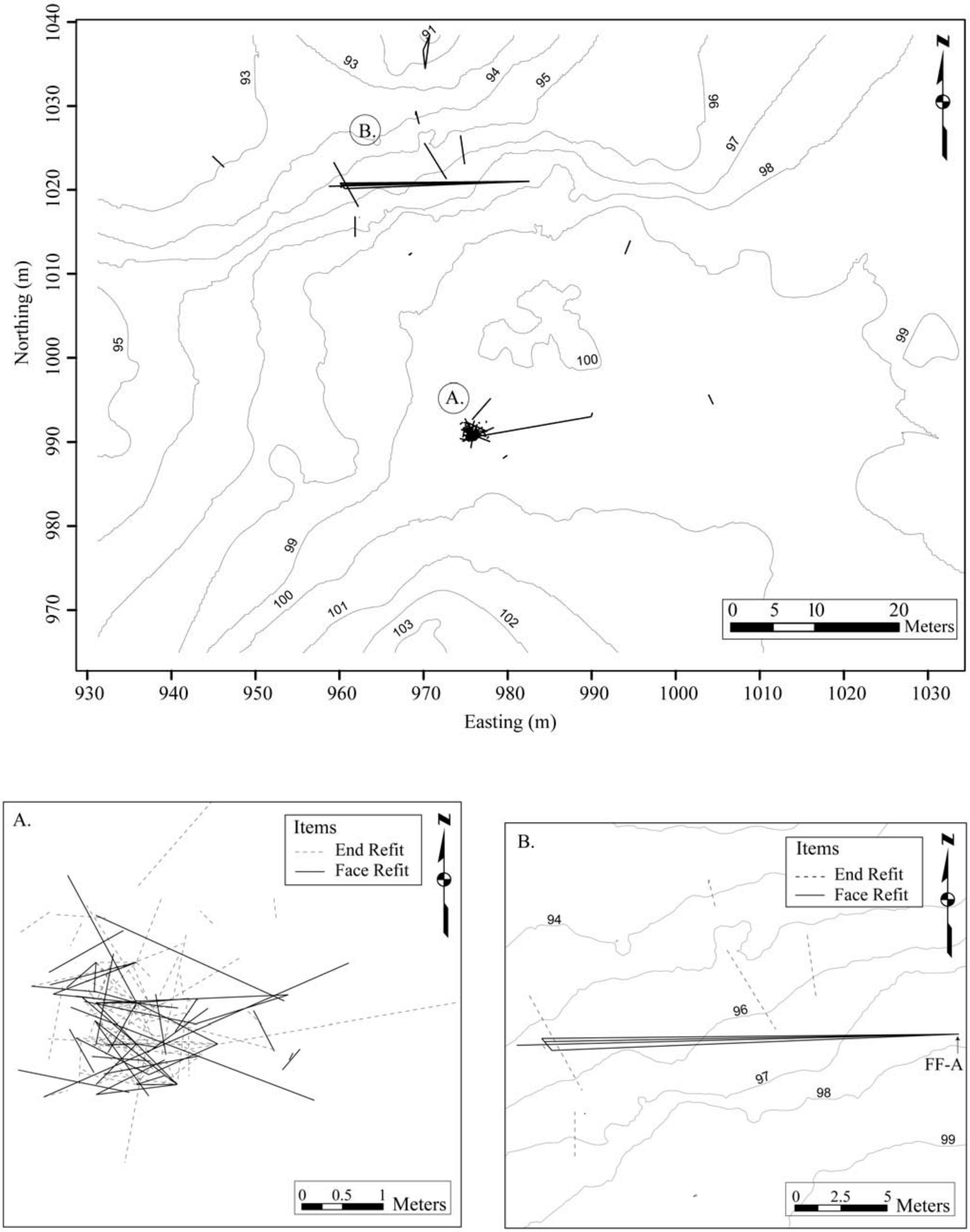

FIGURE 13. Top map shows all artifact refits identified at 5GN149. Lower-left map (a) shows Cluster 1 refits and lower-right map (b) shows refits in northern portion of site.

- A biface refit from several fragments (S2/S3/S796/S2019) was found within and near Cluster 1 (Figure 7a). This large Stage 4 biface was broken into at least four separate fragments. Two of these were found closely spaced within Cluster 1; the two other fragments were found closely spaced, but over 14 m away. It is assumed this biface originated in Cluster 1 because there is debitage of a similar raw material in the cluster. How or why the other fragments got moved 14 m east is unclear.
- Finally, there is a long, thin Stage 4 biface that was broken into at least three fragments (S108/S138/S3042) (Figure 7b). The pieces were found less than 2 m apart but were not recognized to refit on original inspection because the basal portion (S3042) was significantly retouched after it was broken from the rest of the biface. It appears that either the person who broke the biface or another individual who later scavenged the portion tried to salvage the piece by reshaping it into a smaller biface. The base of the smaller biface where it fractured from the larger specimen was not retouched, suggesting that the effort to salvage the biface was abandoned before its completion.

When focusing on the spatial distribution of the biface refits, it is also interesting to note that the majority of the biface refits occurred in the northern portion of the site, with the exception of the biface refits associated with Cluster 1. This pattern suggests that there was little movement of artifacts between the northern and southern portions of the site, suggesting that these areas might have been used at different time periods by different people.

Spatial Analysis

The spatial distribution of 5GN149 artifacts was analyzed using GIS software (ArcView 9.0). The X, Y, and Z coordinate locations of artifacts, which had been collected on a Sokkia SDR33 data collector in the field, were downloaded into a spreadsheet data format. These data were then transformed into a database format compatible with ArcGIS. The spatial data was mapped in ArcView and then subjected to a series of analyses, including spatial statistical analyses.

The spatial distribution of various artifact types and raw material types was also evaluated. First, locations of bifaces were plotted according to raw material type to determine if bifaces of different raw materials were clustering in different areas of the site. Next, the distribution of blades was plotted across the site to see if blade production was occurring in all parts of the site or was restricted to certain areas.

In order to determine if the different areas of the site were being used to perform different activities, we calculated the mean center of the distribution for various artifact types (projectile points, utilized flakes, scrapers, cores, and bifaces). A single sigma standard deviation

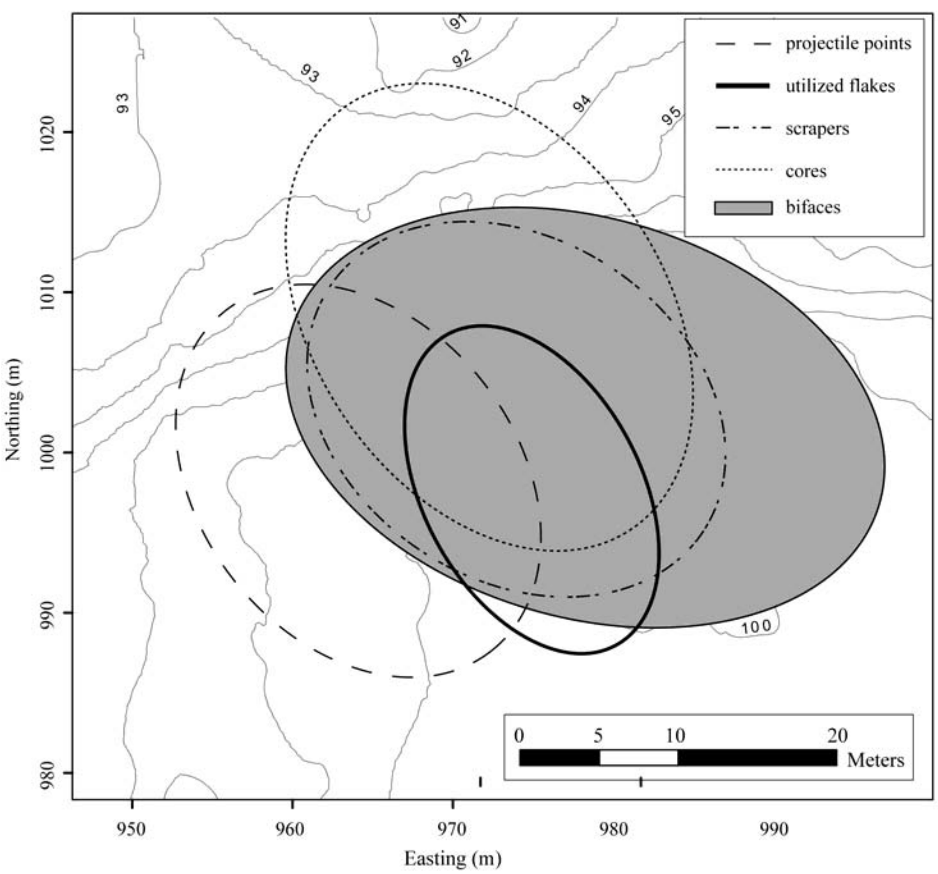

FIGURE 14. Map shows the mean center of the distribution of projectile points, utilized flakes, scrapers, cores, and bifaces. A single sigma standard deviation ellipse was calculated around the mean center.

ellipse was calculated around the mean centers to produce a graphical representation of where each artifact type was concentrated and the orientation of each distribution (Figure 14). Several interesting patterns emerge.

First, bifaces have the largest distribution and are found ubiquitously across the entire site. Bifaces were produced or used in all areas of the site, even in the eastern portion of the site, outside of the chipping clusters. Utilized flakes, on the other hand, have a much tighter distribution and cluster in the south-central portion of the site. This suggests that activities in which utilized flakes were used were performed within a smaller area of the site, perhaps focused around Cluster 1. Projectile points are likewise concentrated in the western portion of the site, which might indicate an area of point production or an area of discard associated with an animal processing area. But, given that the points span multiple time periods, the former explanation is favored. This distribution of projectile points in the western portion of the site probably corresponds to the location of the chipping clusters, also concentrated in the western portion of the site. The projectile points were probably produced and discarded within or near the chipping clusters, perhaps as manufacture failures.

Figure 15 shows the distribution of projectile points by temporal affiliation. The possible Late Paleoindian points are distributed east-west, following the general topography of the bench. That a broken Late Paleoindian projectile point was found in Cluster 1 might suggest this chipping cluster (or portions of it) was produced during the Late Paleoindian period. The Archaic projectile points are dispersed across the site and, with the exception of the projectile point found in Cluster 4, do not occur within chipping clusters. This could indicate that the Archaic projectile points were not manufactured on site, but were instead discarded as exhausted tools or deposited as a result of hunting or processing activities. This might indicate that the Archaic component resulted from a different behavioral use of the site, not exclusively associated with lithic reduction activities. Finally, the Late Prehistoric/Protohistoric arrow point types are distributed in a north-south orientation across the western portion of the site and, curiously, in four of the chipping clusters (Clusters 1, 2, 4, and 7). Half of the arrow points (n = 3), in fact, were found within Cluster 4.

Were all the chipping clusters the same (Late Prehistoric/Protohistoric) age, or at the very least indicative of the same technological/functional activities? To

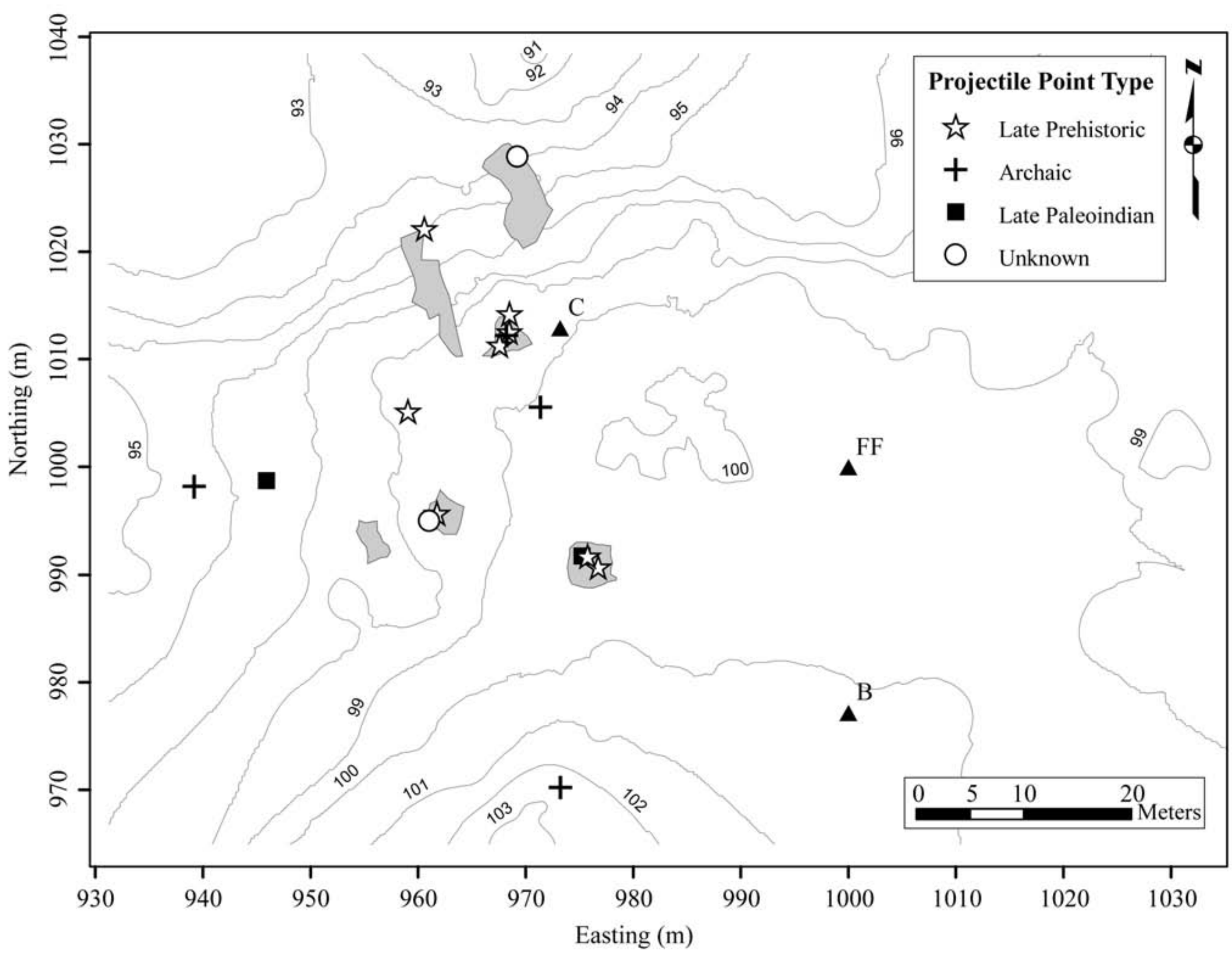

FIGURE 15. Distribution of projectile points at 5GN149 by temporal affiliation.

explore that possibility, we compared the frequencies of tools versus debitage within the chipping clusters using a likelihood ratio chi-square statistic (G), to test the null hypothesis that different clusters are comparable in these elements of assemblage composition. That analysis demonstrates that the clusters are not alike (G = 11.698, $p = .02$). Examining the associated Freeman–Tukey deviates (which identify the cells in the contingency table in order to identify items occuring at frequencies significantly higher or lower than would be expected—in effect, identify which cells are "driving" a significant G statistic), we observe that Clusters 2 and 7 were found to have significantly more tools than expected, and Cluster 4 fewer tools than expected (Table 5a).

Parsing those data further (Table 5b) by examining specific artifact classes, we can see (in the Freeman–Tukey deviates) that Cluster 4 is unusual compared to the others, in its significant dearth of bifaces, biface thinning flakes, and blades. Likewise, all of the clusters—again except for Cluster 4—appear to encompass later stages of reduction, and have fewer than expected cortical flakes and a significantly higher than expected frequency of

Table 5. Distribution of surface and near-surface items at 5GN149.

a. Debitage vs. tools, by cluster

Observed frequencies	Cluster					Total
	C1	C2	C3	C4	C7	
Debitage	2,108	177	100	958	457	**3,800**
Tools	67	10	3	16	19	**115**
Total	**2,175**	**187**	**103**	**974**	**476**	**3,915**

Freeman-Tukey deviates*	Cluster				
	C1	C2	C3	C4	C7
Debitage	-0.06	-0.32	0.03	0.42	-0.22
Tools	0.41	**1.69**	0.11	**-2.62**	**1.29**

*all cell values are significant at the $p = .05$ [± 1.240]

b. Artifact type, by cluster

Observed frequencies	Cluster					Total
	C1	C2	C3	C4	C7	
Unmodified flakes (>2 cm)	1,869	145	77	865	354	**3,310**
Cores	2	0	0	1	6	**9**
Bifaces	25	5	3	4	13	**50**
Biface thinning flakes	147	20	18	60	75	**320**
Projectile points	3	2	0	1	0	**6**
Scrapers	9	3	9	8	3	**32**
Utilized flakes	36	0	0	11	3	**50**
Blades	78	10	4	21	25	**138**
Total	**2,168**	**185**	**111**	**971**	**479**	**3,915**

Freeman-Tukey deviates*	Cluster				
	C1	C2	C3	C4	C7
Unmodified flakes (> 2 cm)	0.82	-0.91	**-1.79**	1.53	**-2.60**
Cores	-1.43	-0.64	-0.42	-0.74	**2.77**
Bifaces	-0.47	1.45	1.15	**-2.88**	**2.30**
Biface thinning flakes	**-2.36**	1.21	**2.49**	**-2.29**	**4.82**
Projectile points	-0.05	**1.69**	-0.30	-0.22	-0.98
Scrapers	**-2.32**	1.08	**4.01**	0.11	-0.35
Utilized flakes	1.51	**-2.23**	-1.58	-0.33	-1.32
Blades	0.21	1.27	0.16	**-2.47**	**1.82**

*all cell values are significant at the $p = .05$ [± 1.640]

c. Percent cortex on dorsal surface, by cluster

Observed frequencies	Cluster					Total
	C1	C2	C3	C4	C7	
0 cortex	1,394	158	79	516	347	**2,494**
1–49% cortex	588	16	17	292	89	**1,002**
50–99% cortex	161	10	3	131	37	**342**
100% cortex	42	3	4	40	9	**98**
Total	**2,185**	**187**	**103**	**979**	**482**	**3,936**

Freeman-Tukey deviates*	Cluster				
	C1	C2	C3	C4	C7
0 cortex	0.26	**3.39**	**1.64**	**-4.37**	**2.32**
1–49% cortex	1.34	**-5.71**	**-1.92**	**2.62**	**-3.26**
50–99% cortex	**-2.16**	**-1.64**	**-2.33**	**4.46**	-0.73
100% cortex	**-1.75**	-0.70	0.88	**2.80**	-0.84

*all cell values are significant at the $p = .05$ [± 1.518]

d. Flake scar count on dorsal surface, by cluster

Observed frequencies	Cluster					Total
	C1	C2	C3	C4	C7	
0 scars	67	3	4	39	8	**121**
1 scar	367	23	13	159	50	**612**
2 scars	678	65	18	250	87	**1,098**
3 or more scars	1,020	89	65	513	313	**2,000**
Total	**2,132**	**180**	**100**	**961**	**458**	**3,831**

Freeman-Tukey deviates*	Cluster				
	C1	C2	C3	C4	C7
0 scars	-0.01	-1.14	0.54	1.51	**-1.84**
1 scar	1.42	-1.08	-0.71	0.46	**-2.92**
2 scars	**2.65**	**1.79**	**-2.15**	**-1.55**	**-4.23**
3 or more scars	**-2.84**	-0.49	**1.70**	0.51	**4.47**

*all cell values are significant at the $p = .05$ [± 1.518]

e. Raw material, by cluster

Observed frequencies	Cluster					Total
	C1	C2	C3	C4	C7	
Quartzite	2,169	186	102	926	477	**3,860**
Welded tuff	4	1	0	39	4	**48**
Chert	6	0	0	2	1	**9**
Total	**2,179**	**187**	**102**	**967**	**482**	**3,917**

Freeman-Tukey deviates*	Cluster				
	C1	C2	C3	C4	C7
Quartzite	0.47	0.14	0.17	-0.87	0.10
Welded tuff	**-6.15**	-0.77	**-1.45**	**5.61**	-0.73
Chert	0.51	-0.65	-0.39	0.00	0.08

*all cell values are significant at the $p = .05$ [± 1.431] interior, non-cortical flakes (Table 5c). In contrast, Cluster 4 has a significantly greater amount of artifacts still in their early stages of reduction. This is further substantiated by flake scar counts (Table 5d), which indicate Cluster 4 has significantly fewer artifacts with multiple dorsal flake scars than expected, along with more artifacts with no dorsal flake scars than expected. Finally, Cluster 4 differs from the rest of the clusters in raw material type (Table 5e). It has a much higher than expected frequency of welded tuff, suggesting that Cluster 4 flintknappers had different technological strategies or goals than did the producers of the other chipping clusters.

Together these differences suggest a different technology was in use in Cluster 4. Combining that with the observation of the greater number of arrow points in Cluster 4 suggests it—unlike the others—might be the result of Late Prehistoric or Protohistoric activity on site. That the other clusters have significantly different patterns of artifact classes, though occasional arrow points within them, raises the possibility that these later groups might have selected suitable blanks from the numerous flakes already present in those clusters, and retouched those flakes on the spot to produce arrow points (arrow points being easily manufactured from flakes, and not requiring larger biface reduction).

Leaving Cluster 4 aside, the other chipping clusters demonstrate somewhat similar, though not identical characteristics. Cluster 3, for example, has significantly more scrapers and biface thinning flakes than expected, and are dominated by interior flakes, suggesting this area might be associated with some type of material processing in addition to later stage tool production—though admittedly the small sample from this cluster might be driving this result.

In contrast, Cluster 1 has significantly fewer scrapers and bifaces thinning flakes than expected given the size of the assemblage. Again that might be a byproduct of the collection strategy, which in this cluster was comprehensive, and thus included a broader range of artifacts of all sizes making for a more representative but statistically less-equivalent sample to compare to the other clusters (in effect, the sheer number of unmodified flakes may be "washing out" the signal of the other classes). When the spatial patterning in Cluster 1 is examined (Figure 16), it is of interest to note the location of scrapers within and around the cluster, the latter including an arc of scrapers approximately 1–2 m west of the cluster edge. This could represent a toss zone where people who were working around a hearth or some other central feature tossed the scrapers behind them, perhaps akin to Binford's (1978) men's outside hearth model. However, Binford's model assumes that it is bothersome debris tossed backward to clear the area, not tools. Alternatively, the arc of scrapers could represent several individuals sitting in a semi-circular configuration working on scraping activities. The relationship of the arc to Cluster 1 could suggest that the individuals were focused around some central feature in Cluster 1, like another person or a hearth (though no evidence of a hearth was found during Cluster 1 test excavation); or, the arc and the cluster could be the result of unrelated events.

Cluster 7 has significantly more cores, bifaces, biface thinning flakes, and blades than expected. However, since fewer unmodified flakes than expected were found in this cluster, the pattern might be a function of sampling bias. Cluster 7 was not as intensively collected by us and therefore may appear unduly loaded with larger tools and cores (those over our 7 cm cutoff), leaving the greater proportion of unmodified debitage uncollected.

Finally, the raw materials at the site demonstrate some spatial patterning as well (Figure 17). Welded tuff is distributed throughout the entire site, but in low densities; it is abundant only in Cluster 4 (as noted), but also in the eastern corner of the site, where a number of welded tuff bifaces were recovered (Figure 18). This is the most level area of the site and sits at a slightly higher elevation, and might correspond to a specific activity area. One might take this a step further and suggest that these welded tuff bifaces were manufactured in Cluster 4, where the highest concentration of welded tuff debitage is found, and transported to this area of the site for use. In fact, the welded tuff biface concentration is located approximately 15 m from the possible collapsed wickiup, perhaps suggesting a connection between the wickiup, the welded tuff biface concentration, and Cluster 4, the inferred Late Prehistoric/Protohistoric chipping cluster. Likewise, chert is also scattered lightly throughout, but is abundant only in Cluster 1. Quartzite is essentially ubiquitous.

SUMMARY AND CONCLUSIONS

It is clear from our analysis that 5GN149 served as a location of tool manufacture, use, and discard, primarily of locally occurring quartzite. But in regard to the question we sought to answer at the outset, namely, what group(s) may have used the site, we are less certain. We initiated fieldwork at 5GN149 because certain artifact types reminiscent of a Clovis technology—large, thin bifaces, large biface thinning flakes with heavily ground platforms, overshot flakes, as well as blades and blade manufacturing debris—were present. We hoped that upon completion of our archaeological investigations and analyses we could determine whether or not the site was used by Clovis groups. Unfortunately, we cannot. The site remains radiometrically undated and there are no diagnostic Clovis forms. While technologies reminiscent of Clovis are certainly present, not least large bifaces, overshot flakes, and blades and blade cores, these are not unequivocal markers of Clovis technology (Cooper 2006), and, as noted, our analysis of the blade morphometrics proved inconclusive (Meltzer and Cooper 2006). Likewise, there are other artifacts and technologies that are obviously not Clovis (including projectile points diagnostic of later time periods).

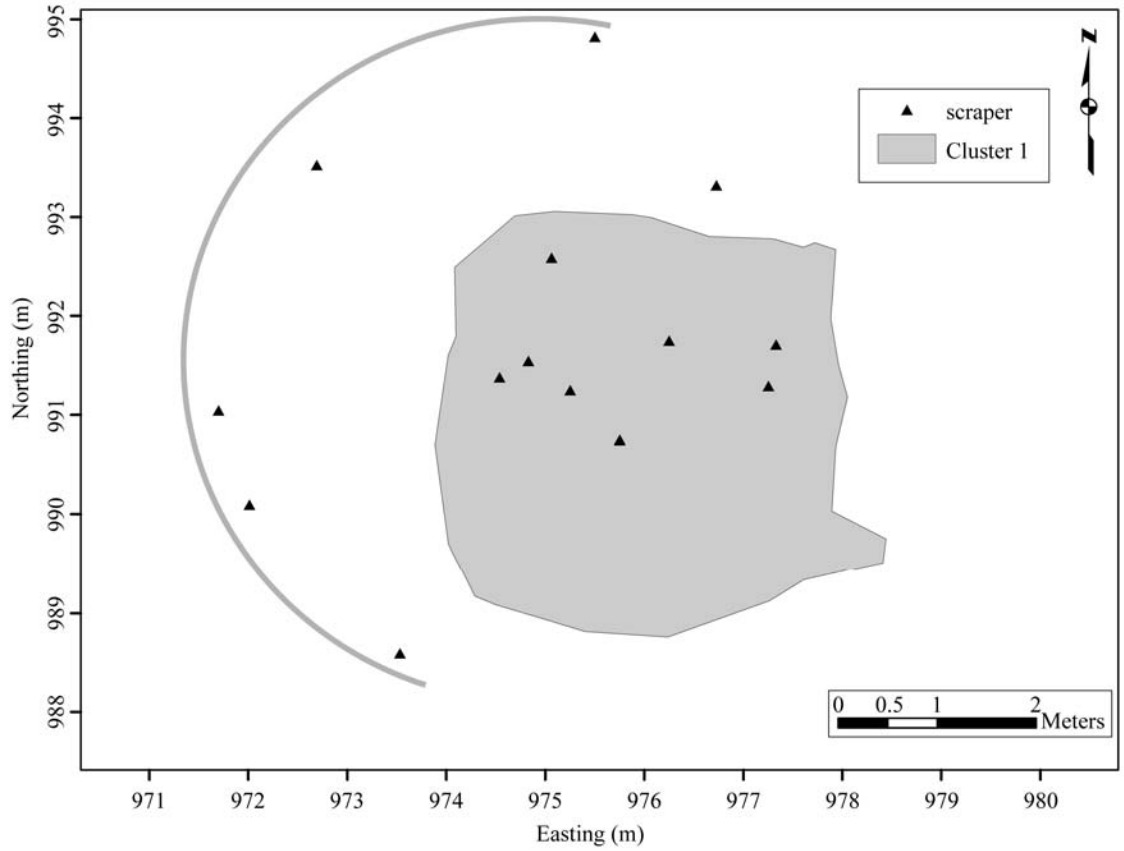

FIGURE 16. Distribution of scrapers in and around Cluster 1. Note the arc of scrapers on the west side of the cluster.

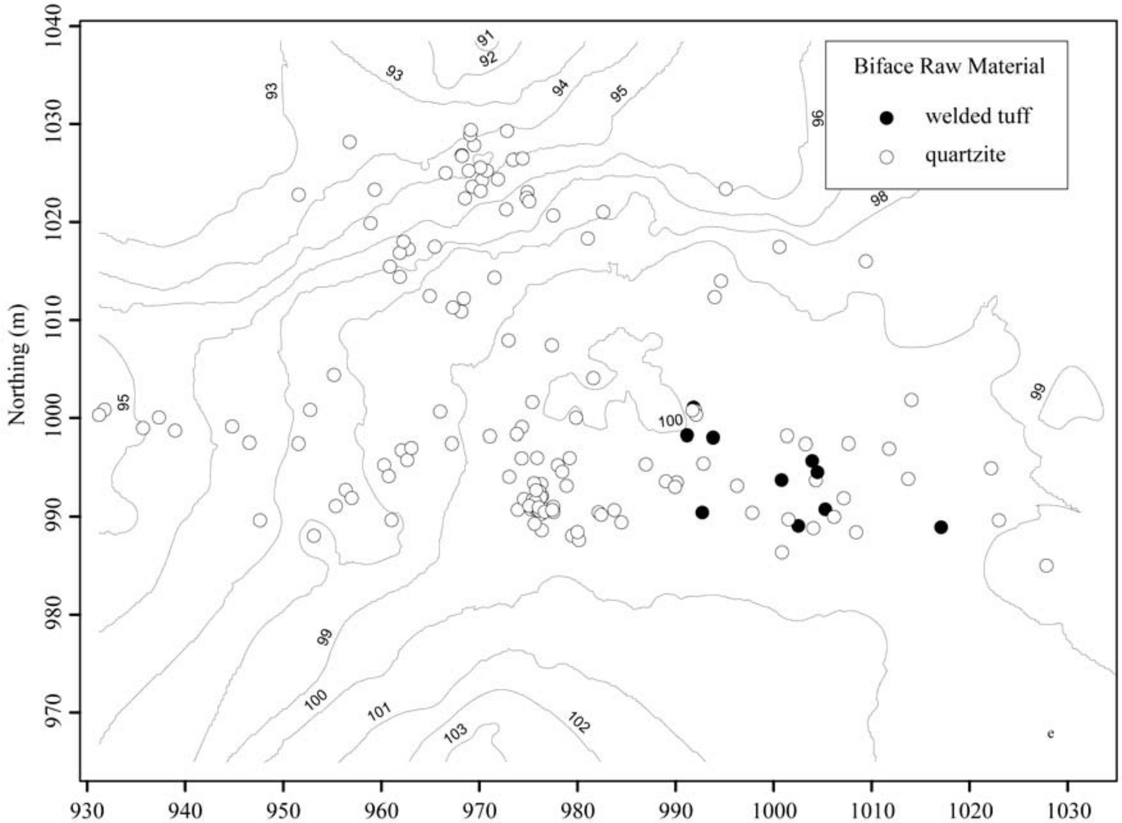

FIGURE 17. Map of select raw material types at 5GN149, excluding quartzite. Includes all artifact classes.

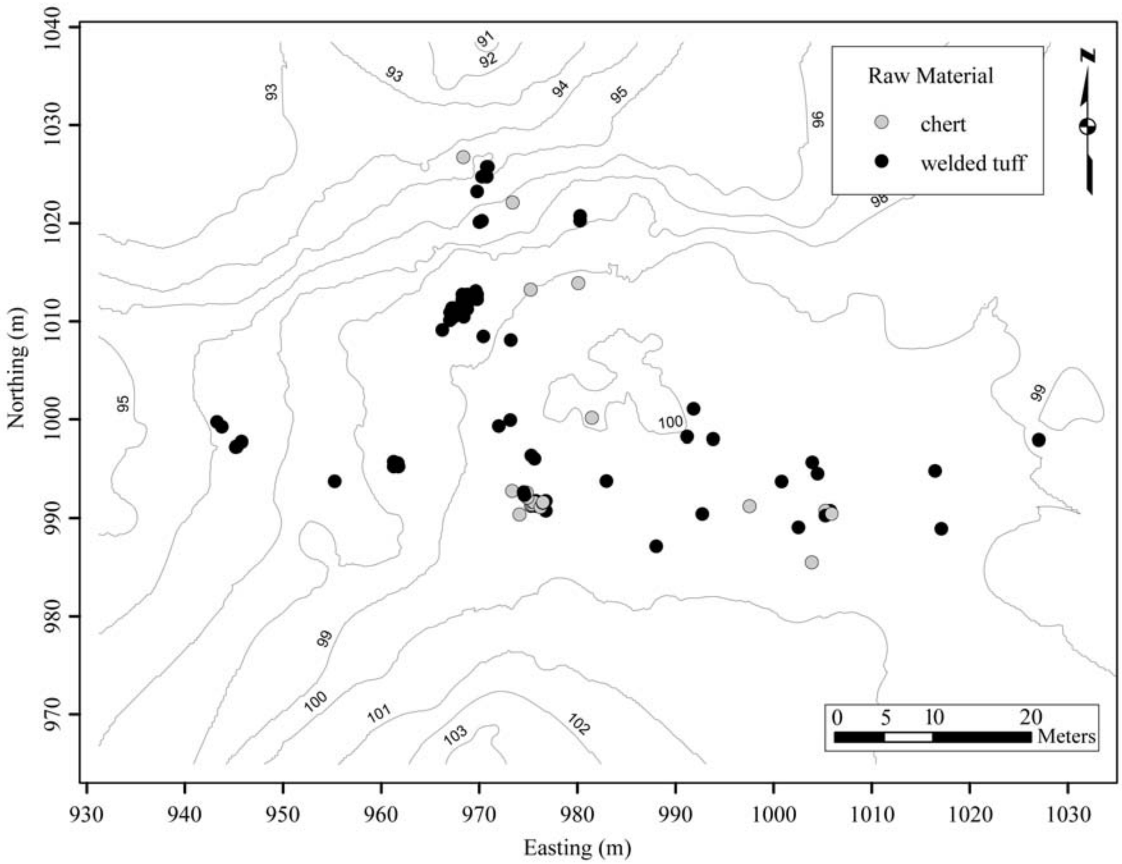

FIGURE 18. Map of 5GN149 bifaces by raw material.

As to what ages might be represented, Stiger (2006) reports blades at the Folsom-age Mountaineer site, suggesting that blades were a part of Folsom technology in the Upper Gunnison Basin, and might account for the 5GN149 blade assemblage. A Folsom projectile point isolate was recorded on the mesa top directly above the bench on which 5GN149 sits. While a steep slope separates 5GN149 from the Folsom isolate (giving no reason to assume direct association), it is clear that Folsom people were in the immediate vicinity. Perhaps many of the artifacts initially attributed to Clovis at 5GN149 were in fact Folsom. But, again, in the absence of diagnostic projectile points, it is difficult to determine. Another reliable indicator of Folsom technology is the channel flake; however, no channel flakes were identified in the 5GN149 assemblage. We concede that our site-wide collection bias (>7 cm in size) might have selected against the identification of channel flakes in non-cluster contexts. In the future, it would be useful to return to the site to 100 percent collect additional units in non-cluster areas with the purpose of identifying potentially diagnostic Folsom manufacture debris, such as channel flakes. Furthermore, an analysis of the channel flakes recovered from the Mountaineer site, produced on similar quartzite material, might provide guidance in identifying potential channel flakes from 5GN149, if present.

The diagnostic projectile point forms that have been recovered here range in age from Late Paleoindian to Late Prehistoric. These, and the absence of metal and/or European trade goods, would seem to indicate 5GN149 is prehistoric in age. However, we need to be wary of assigning ages based on the absence of material at what was evidently a non-residential site devoted to a specialized activity such as tool production.

There are, as noted, differences in artifacts, including temporally-diagnostic projectile points that occur in the different clusters, suggesting—in answer to another of our analytical questions—that this was not a single, intense occupation. Instead it appears that multiple groups at different times might have taken advantage of the abundant and often high-quality quartzite cobbles on and near 5GN149, or even the piles of quartzite debitage left by prior visitors to this spot. The debitage at 5GN149 spans the full range of manufacture stages, from acquiring raw material in cobble, core, or large biface blank form, to tool-finishing or removing those materials for further reduction elsewhere, accounting for the abundance of small, interior flakes and broken tools. Although some of these tools might be manufacturing failures or exhausted and discarded tools, that is not true of all of the chipped stone tools recovered.

The occurrence of scrapers and other chipped stone tools suggest that a variety of activities took place at 5GN149, though precisely what those other activities might have been is difficult to discern, given the absence of features, hearths or middens. In any case 5GN149, though not a long-term residential encampment, was apparently used for more than merely the collection of raw material nodules for the production of chipped stone tools.

But tool production was certainly the dominant activity. Here, heavily worn and exhausted tools often made of chert and petrified wood (which appear to be exotic) were discarded, presumably replaced by newly fashioned specimens made of the local quartzite—and subsequently taken off site. Whether tools made of chert and petrified wood were preferred over the locally available quartzite for their knappability or tool edge sharpness cannot be determined. It is perhaps telling, however, that there are relatively fewer heavily worn discarded tools of quartzite. The virtue of this material to groups seasonally occupying the Upper Gunnison Basin might have been its local availability and abundance, rather than the ease and efficiency with which it could be flaked or curated (we remain impressed, nonetheless, by the finely crafted Folsom points made of local quartzite recovered at the Mountaineer site [Meltzer 2007]).

Upland surface sites like 5GN149 pose a variety of challenges to archaeologists. While a wide variety of activities might have occurred at 5GN149, only the stone artifacts remain, necessarily biasing our interpretations of past behaviors towards those relating to the production and maintenance of stone tools. Had other activities such as food preparation or wood working occurred (particularly if it involved perishable technologies), its evidence has a negligible chance of preserving in the surface context. Furthermore, unlike more homogenous, cryptocrystalline tool stone, use-wear analysis is difficult on quartzite, making identification of tool-use or specific processing activities at 5GN149 problematic. It is probable that the shallowly buried materials recovered during near-surface excavation have constantly been churned and mixed through processes of bioturbation and cryoturbation over the millennia, meaning that even the buried artifacts were exposed to the surface elements in the past. Naturally, such sites have a much lower likelihood of containing radiometrically datable materials, and this one did not.

Another challenge of working at surface sites such as 5GN149 is that cultural materials from multiple time periods are conflated onto a single surface, resulting in a palimpsest. It is difficult (in some cases, impossible) to tease apart individual events within the scatter of cultural material, without benefit of stratigraphic separation. However, in this analysis we demonstrate methodological approaches that can be used to record, analyze, and interpret palimpsest deposits. We feel reasonably confident in our conclusion that the site was visited on multiple occasions by different groups over a long span of time—having multiple diagnostic projectile points, and evidence of different technologies and activities indicates as much. But just how early that process began at 5GN149 we cannot say.

ACKNOWLEDGEMENTS

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