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BERKELEY ROCKSHELTER LITHICS: UNDERSTANDING THE LATE HOLOCENE USE OF THE MOUNT RAINIER AREA

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ABSTRACT

Berkeley Rockshelter is a Late Holocene period (2500 B.P. to contact) shelter located in the northeast quadrant of Mount Rainier National Park. This article applies the site-type classification used in Binford's (1980) forager-collector model to infer the function of Berkeley Rockshelter. The debitage and projectile points support the inference that late-stage flaking for shaping and reworking projectile points and preforms was a prominent activity at the site. Evidence also indicates the reduction of a local, poor quality source of jasper, which made it an even more attractive stop for mobile hunter-gatherers. These interpretations suggest that, consistent with Binford's model, this site functioned primarily as a hunting field camp.

Introduction

Reconstructing the nature and temporal dynamics of prehistoric settlement and subsistence in the Pacific Northwest has been a longstanding research issue (Schalk 1978, 1981, 1988; Baxter 1986; Mierendorf 1986; Uebelacker 1986; Burtchard 1987, 1998). The use of high elevation areas in the region, however, has only recently been widely acknowledged (Reimer 2000; Burtchard 2007:3). The present article contributes to this research by exploring the function of the Berkeley Rockshelter (45-PI-0303), a Late Holocene period (2500 B.P. to contact) site located at 5,640 ft. in the northeast quadrant of Mount Rainier National Park in Washington State. To this end, the article applies the theoretical framework of Lewis Binford's (1980) forager-collector model to infer how the site functioned as part of an overall settlement and subsistence system.

In this study, besides the general topographic setting of the site, the site's function is inferred based on our analysis of its flaked stone artifact assemblage (N = 1,709). These data are analyzed and interpreted using the analytical approach of lithic technology (Sheets 1975), which enables the reconstruction of tool production and consumption activities that can then be used to support inferences about prehistoric socioeconomic behavior (Sheets 1975; Flenniken 1989; Hirth, Andrews, and Flenniken 2006).

The following discussion is divided into six sections. The first section describes Berkeley Rockshelter and the archaeological work that has been done at the site. The second section reviews Binford's (1980) forager-collector model and how it is applied to evaluate the prehistory of the region in general and the use of Berkeley Rockshelter in particular; this section outlines what the assemblage should look like given different site types in Binford's model. The third section describes the methods used to analyze the debitage and the flaked stone tools. The fourth section describes the data, which are subsequently interpreted and discussed in the fifth section. The concluding section summarizes the results and implications of the study for understanding Late Holocene use of the Mount Rainer area.

The Berkeley Rockshelter

Berkeley Rockshelter is situated in the subalpine parkland of Berkeley Park on the northern flank of Mount Rainier (locational information is intentionally vague to protect the site; Fig. 1). It consists of two sheltered areas underneath three massive blocks of diorite situated at the base of a large scree slope (Bergland 1988:2). These diorite blocks were dislodged from their original proveniences above the site as a result of a post-Pleistocene seismic event. The site is strategically located at the ecotone between closed forest and the upper alpine parkland, a zone characterized as one of patchy subalpine meadows interspersed with small stands of trees. Hence, its location is ecologically optimal in that it provides shelter and easy access to two major eco-zones; the upper subalpine parkland zone is the most resource rich (principally ungulates and a broader array of economically useful plant and animal species), at least during the summer months.

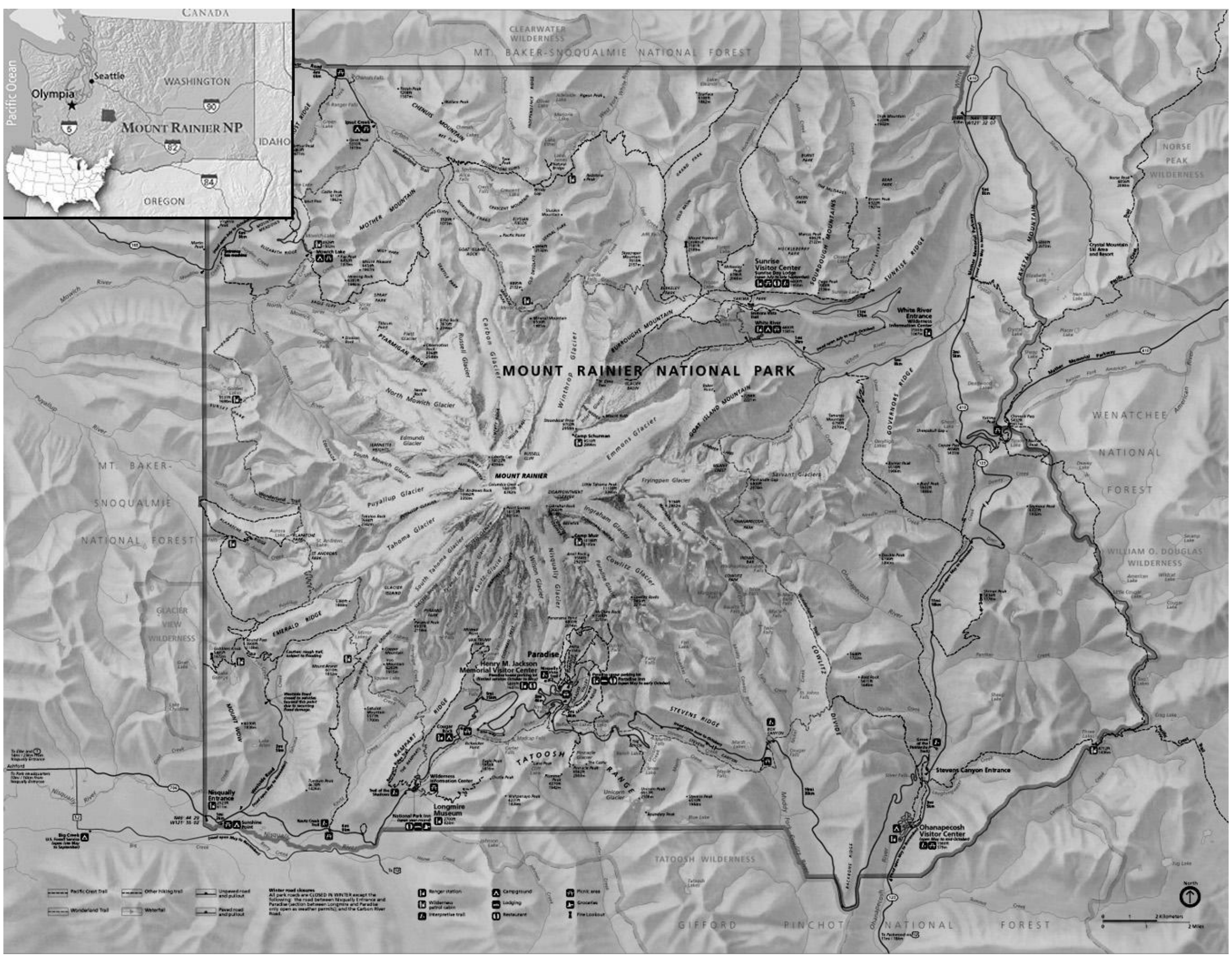

Fig. 1. Map showing location of Mount Rainier National Park in Washington State.

The two shelters, one slightly higher in elevation than the other, have roughly parallel, north-south trending interiors, and are referred to as the lower and upper shelters (Figs. 2 and 3). Although the lower shelter has slightly more overhanging cover than its upper counterpart, the useable interior space of each shelter does not exceed 20 m^2. Archaeological work at the site consists of test excavations conducted by Eric Bergland and Greg Burtchard. Bergland in 1987 excavated a 1 x 1 m unit to a depth of 60 cm in the lower shelter and a 0.5 x 0.5 m unit to a depth of 40 cm in the upper shelter (Bergland 1988). In 2002, Burtchard and seasonal archaeologist Adam Nickels, excavated an additional 1 x 0.5 m unit in the lower shelter, flush with the eastern extent of Bergland's original unit. Bergland screened test excavated fill through 1/4 inch hardware cloth. Burtchard used 1/8 inch mesh.

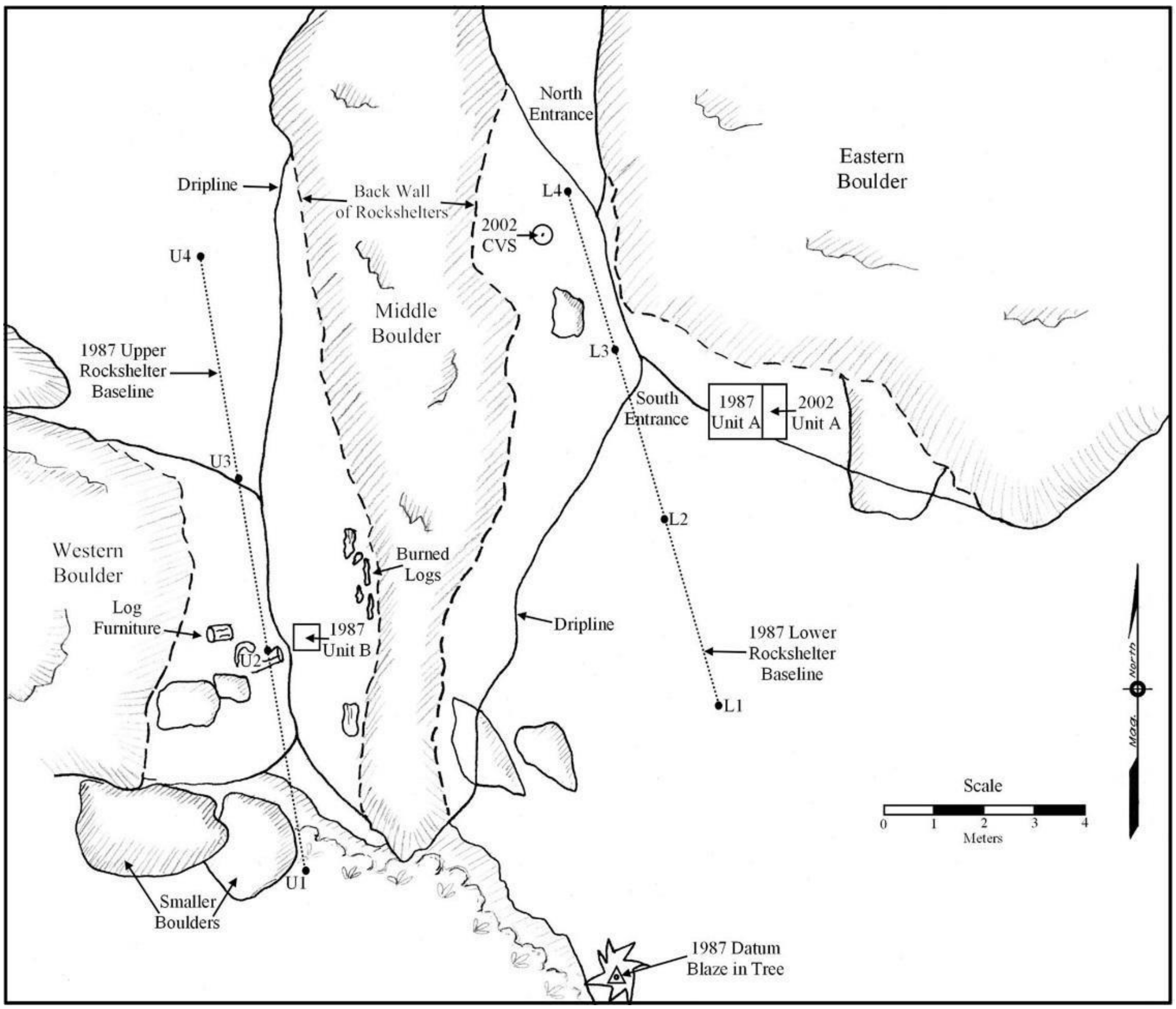

Fig. 2. Map of the Berkeley Rockshelter and location of the excavation units. (Map drawn by Greg Burtchard; drafted by Eric Gleason and Jacqueline Cheung)

Besides the flaked stone artifacts, historic trash (mostly on the surface), large mammal bone, charcoal, and macro-botanical remains were recovered (Bergland 1988). The large mammal bone was highly fragmented and degraded, and therefore, unidentifiable to specific genera or species (Bergland 1988:57–59). The macrobotanical remains indicated a limited, although significant amount of charred geophyte material suggesting that plant foods may have been consumed at the site (Gahr 2015). Unfortunately, it is unclear whether these remains were from edible plants because, similar to the mammal bone, they are taxonomically unidentifiable. All of the cultural materials were found overlying the Mount Rainier C tephra, a volcanic ash layer that was deposited when the mountain erupted ca. 2300 radiocarbon years B.P. Three charcoal samples from Unit A (see Fig. 2) in the lower rockshelter provided dates consistent with this stratigraphic observation. The deepest sample was retrieved from a charcoal lens immediately atop the Mount Rainier C tephra layer, another from the lowest cultural stratum in the unit (ca. 39 cm), and the third was a composite sample recovered between 0–10 cm below the surface. Collectively, these samples indicate that the Berkeley Rockshelter was intermittently occupied during the Late Holocene, specifically between 1970 B.P. and 290 B.P. (Burtchard 2007).

Fig. 3. Photograph of the lower Berkeley Rockshelter overhang. (Photo by Laura Johnson, 2008)

Forager-Collector Model

The Berkeley Rockshelter data, in addition to the site's setting and temporal affiliation, are evaluated to infer how it fits into Binford's forager-collector model. Representing a general model for understanding hunter-gather organizational variation, Binford's (1980) seminal article *Willow Smoke and Dogs Tails* characterizes two contrasting settlement/subsistence patterns—*foragers* and *collectors*—as systems exhibiting a combination of five different site types. It is important to acknowledge that these site types are ideal, and that real sites rarely fit neatly into the model as theoretically derived (i.e., some sites have overlapping functions). This model, developed a number of years ago, logically assumes that human groups interact with their environments and respond to, or are constrained by, local ecological variables (Burtchard 1998). Its explanatory power also lies in its ability to account for the basic organizational variability evident in ethnographically documented hunting and gathering societies, and its predictions are amenable to archaeological testing (Burtchard 1998:128).

Binford (1980) originally formulated the model to highlight the basic organizational contrast between hunter-gatherer groups in low versus high latitudinal regions. In both forager and collector systems, the two main site types consist of the *residential base* and the *location*. The *residential base* is the center of subsistence activities for a group; in contrast, the *location* is where extractive tasks for acquiring food and other necessary resources occur. Residential sites are often located near critical resources, such as water, from which group members daily set out to exploit resources at task-specific locations elsewhere. Essentially, in the more mobile forager system, consumers move to resources; as such, they frequently relocate their residential bases when they decide that declining nearby resources can no longer reliably support the group. Binford (1980:15–17) argued that the forager settlement/subsistence pattern is most likely associated with an environmental context characterized by a widely homogenous resource base, making a highly mobile foraging strategy a successful adaptive response to such an environment.

Collector groups also use residential bases and locations, but in addition they use Binford's other three site types, the *field camp, station*, and *cache* (1980:10–12). Binford argued that collector systems are better adapted to a more heterogeneous, or patchy, resource base. As such, collectors typically are found in temperate regions (as opposed to a tendency for foragers in equatorial settings) where pronounced seasonality makes resource availability heterogeneous. With higher population densities and more sedentary *residential* sites (usually winter and summer camps), collectors typically rely on more complex strategies for bringing resources to the residential base for storage and redistribution. *Field camps* facilitate long distance overnight procurement of specific resources for collector groups, *stations* provide lookouts for acquiring mobile food resources, and *caches* are temporary storage sites. Central to this logistical system, collectors move resources to consumers, relying more on mass-harvest and storage. Moreover, their residential moves are less frequent than their foraging counterparts.

Building on a proposition first proposed by Schalk and Cleveland (1983), Burtchard (1998) suggests that the forager-collector model can be applied in a temporal fashion to heterogeneous resource areas, such as mountainous landscapes in the Pacific Northwest. As such, this iteration does not characterize hunter-gatherers in terms of their latitudinal context, but rather uses both types of groups (foragers and collectors) to model changing subsistence and settlement patterns over time. This revision suggests that early to middle Holocene populations exploiting Mount Rainier in a context of generally low regional population density would have been most effectively served by, and hence generally characterized by, a foraging mode of production. However, as population increased, it became harder to maintain a highly mobile settlement strategy. Regional population increase resulted in a decrease in the capacity of foraging groups to minimize competition with other foraging groups by moving to new, previously unexploited resource acquisition areas. This process created a selective context favoring a shift to a collector subsistence mode whereby groups began sending out overnight task groups from semi-sedentary residential sites in the lowlands to acquire distant resources located elsewhere. Given the relatively recent Late Holocene dates for use of the Berkeley Rockshelter (1,970 and 290 radiocarbon years B.P.), the site was most likely used by hunters and gatherers employing a collector-type settlement and subsistence system.

Theoretical Expectations of the Study

Assuming that the Berkeley Rockshelter was occupied by hunter and gatherers tethered to logistically complex, collector-based systems, which site type does it best fit given Binford's (1980) model? It is improbable that it functioned as a *location* or a *station*. According to the model, a *location* would tend to have little material evidence, being a spot where resources were acquired and taken to another site for further processing. A *station* should also exhibit very little material evidence because of its function as a lookout; it might contain a few small retouch flakes or biface fragments consistent with tool curation activities. The Berkeley Rockshelter assemblage, however, contains a notable quantity of flaked stone debitage and a diversity of tool types (see below), a characteristic not consistent with a typical location or station. Moreover, the shelter sits in a low spot relative to its surrounding topography, making it an unlikely place for a lookout. The Berkeley Rockshelter, therefore, best fits Binford's *summer residential base* or *field camp/cache* collector site types.

Geographic context and the extent of interior space in the Berkeley shelters would suggest that it was used as a field camp. However, there is a relatively amplified amount of external open space in front of both overhangs that also could have been occupied, especially given the assumption that these sites were only used in the summer. As such, the site area could have supported larger groups than those typically associated with a field camp. Consequently, our objective was to evaluate the function of the site by looking at its flaked stone artifact assemblage. At a *residential base*, we would expect the flaked stone data to reflect relatively long-term occupations characteristic of seasonally sedentary residences. This evidence would be consistent with processing and manufacturing of all goods utilized by the society for daily activities (Binford 1980:9), including tools used on-site as well as those shaped for use elsewhere (Table 1). The range of tool types might include both expedient implements, such as retouched flakes, and more formal tools, such as biface cores and bifaces (knives, projectile points, etc.). Expedient tools can be used for many on-site domestic activities, whereas formal tools typically fulfill more specialized functions. The onsite manufacture of a range of tool types should result in a requisite range of debitage reflecting their production and maintenance. In essence, the assemblage should be relatively diverse, indicating the on-site activities of men, women, and children. Finally, such seasonal residential sites might tend to have a relatively high density of lithic remains if they were used repetitively over a lengthy period of time.

In contrast, a *field camp* should reflect a much more limited range of activities, being those focused on a specific extractive task (i.e., deer, elk, goat, or other specific resource procurements). For flaked stone tools, such expectations could range from local expedient tool manufacture for field processing needs (e.g., huckleberry harvest or other floral resources) to nearly finished tools, that were brought to the site to be used for specific purposes (e.g., projectile points for hunting).

As such, debitage and tool diversity should be less than that associated with seasonal residential bases. Moreover, a site with fewer tool types may also be associated with debitage representing a narrower range of the reduction process. Finally, *field camps* might be expected to have lower lithic densities because their occupations were relatively short. In short, a seasonal summer *residential base* should have an assemblage reflecting multiple activities, whereas a field camp should have an assemblage reflecting a more focused function.

TABLE 1. EXPECTED FLAKE STONE ASSEMBLAGES FOR A RESIDENTIAL SITE TYPE VERSUS A FIELD CAMP

Residential Base	Field Camp
Diversity of expedient and formal tools	Relatively low tool diversity
Debitage representing a wider range of the lithic reduction sequence	Debitage representing a narrow range of lithic reduction sequence
Relatively high lithic densities	Relatively low lithic densities

Methods

The lithic technology approach used in this study permits inferences about prehistoric behavior from flaked stone artifacts (Flenniken 1981). Flaked stone artifacts separate into two major categories: 1) debitage (flakes) produced during tool production, and 2) tools and cores. As for debitage, there are many methods used for classification. Here, a six-stage system developed by Jeffrey Flenniken (1981) was applied, which represents a general sequence of lithic reduction (Andrews, Tofte, and Huelsbeck 2008). Tools were classified according to basic morphological and functional attributes following a similar study (Andrews and Greubel 2008).

Debitage

Any sequence of flaked stone tool production begins at the quarry or other secondary source areas where raw material is acquired. Initial shaping of raw material starts with decortication, or the removal of the weathered surface of a stone. Stage 1 represents primary decortication; primary flakes tend to be relatively large and have cortex covering their entire dorsal surfaces. Stage 2 represents the removal of secondary flakes, defined as those with cortex covering less than one-hundred percent of their dorsal surfaces (Fig. 4a). These initial stages are used to prepare raw material for subsequent reduction and to produce flake tools for expedient uses.

Stages 3 and 4 represent early and late core flakes, respectively. These flakes are removed to further shape a core, to use immediately as expedient tools, or to make “blanks” that can be shaped into formal tools. Early core flakes have few dorsal flake scars, often have relatively thick cross-sections, and have platform-to-dorsal surface angles between 90 and 70 degrees (Fig. 4b). In contrast, late core flakes can have several dorsal flake scars, and generally have a lower thickness to width ratio than their stage 3 counterparts (Fig. 4c).

Stage 5 corresponds to early and late percussion bifacial thinning, and is represented by several distinct flake types. These flakes are removed to shape bifacial and unifacial artifacts into more formal tool types. Early biface thinning flakes are removed during the initial process of

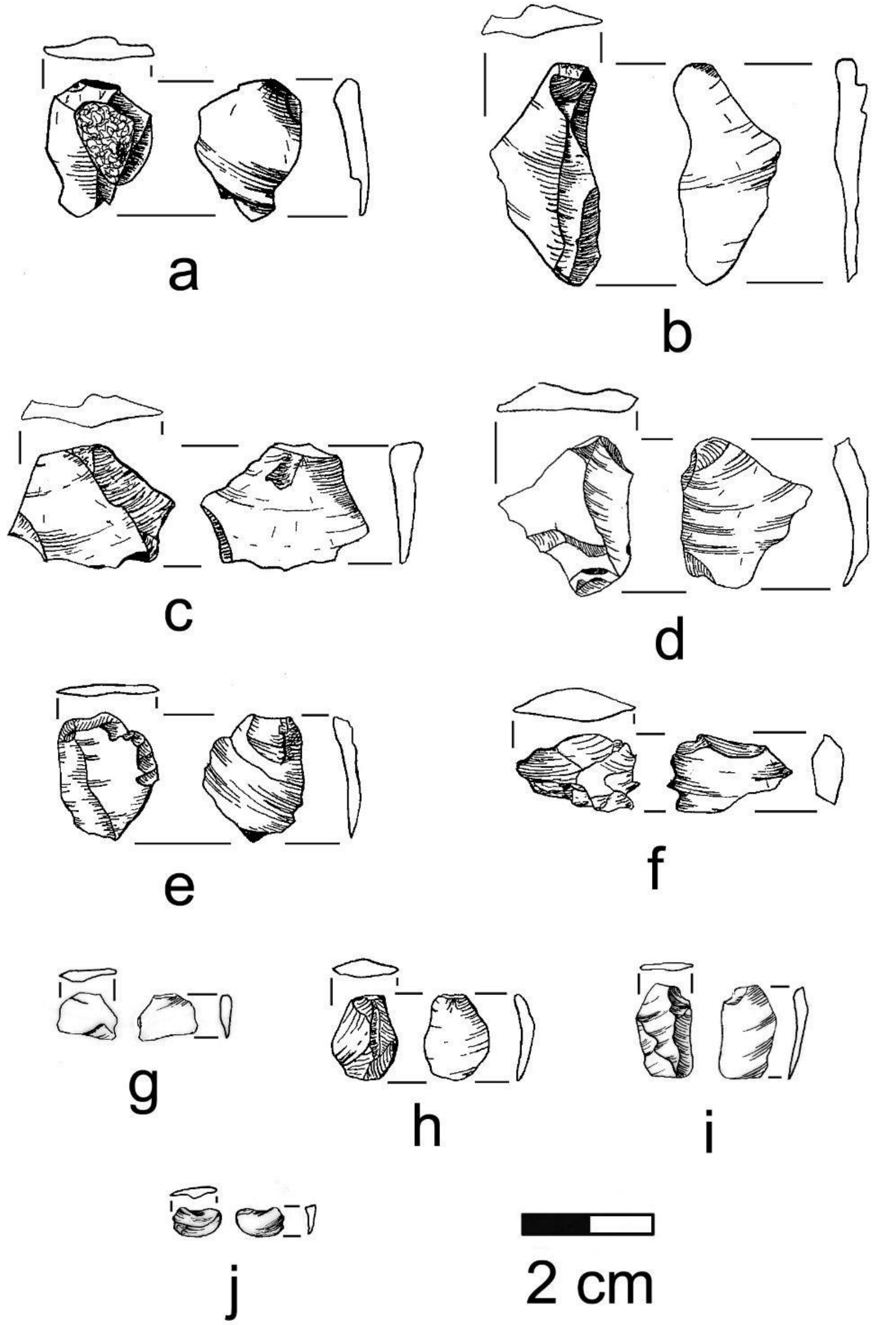

Fig. 4. Technologically diagnostic flakes: stage 2 secondary decortication flake (a); stage 2 early core flake (b); stage 3 late core flake (c); stage 5 early biface thinning flake (d), late biface thinning flake (e), margin removal flake (f), platform preparation flake (g); stage 6 early biface pressure flake (h), late biface pressure flake (i), notch flake (j). (Illustrations by Stephanie Steinke and Bradford Andrews).

shaping formal tools and tend to have curved longitudinal cross-sections (Fig. 4d). In contrast, late biface thinning flakes are removed later in the reduction sequence, have platform-to-dorsal face angles less than 70 degrees, multiple dorsal scars, and are flatter and less curved in longitudinal cross-section than their early counterparts (Fig. 4e). They can exhibit ground platforms as a result of careful platform preparation, and often have relatively thin distal ends. Two additional stage 5 flake types include margin removal and edge preparation flakes (Figs. 4f and 4g). Margin removal flakes (Fig. 4f) remove a relatively excessive amount of the edge of a biface/flake blank. These flakes are the result of excessive force applied too far from the margin, and are therefore often regarded as errors. Edge preparation flakes (Fig. 4g) are those intentionally removed from the edge of a flake blank to impart curvature to its ventral surface (detachment scar). Imparting curvature to this surface is important because it helps to facilitate subsequent flake removals, which can be difficult to perform if the detachment scar is relatively flat.

Stage 6 represents early and late pressure flakes. Overall, compared to flake-types removed in the earlier stages, pressure flakes are more standardized in form and have distal terminations that tend to swing either to the right or left of their platforms. Early pressure flakes are the less standardized of the two varieties because they are removed during the transition from percussion to pressure reduction; as such, they exhibit percussion flake scars on their dorsal surfaces (Fig. 4h). In contrast, late pressure flakes are often more parallel-sided and regularized in shape, and have dorsal pressure flake scars resulting from the removal of previous early pressure flakes (Fig. 4i). Notch flakes are a morphologically unique stage 6 flake type removed to make notches for the purpose of hafting formal implements such as projectile points (Fig. 4j).

Several other categories of debitage created during lithic reduction include flake fragments, chunks, and shatter. Flake fragments are defined as flakes lacking their proximal, platform bearing ends. Chunks and shatter represent the miscellany of large to small bits of debris created during flaked stone tool production. Contrary to the views of some researchers (Sullivan and Rozen 1985), these items provide limited or ambiguous technological information, and therefore, they receive no additional discussion here.

Tools

The Berkeley Rockshelter assemblage also contains several types of tools. These artifacts include intentionally shaped items such as projectile points, as well as informal tools made for expedient purposes. Columbia Plateau projectile point types described by Lohse and Schou (2008) were used to classify the projectile points.

The tools were classified according to their morphology and inferred function, which implies how they were made and/or hypothetically used (Figs. 5, 6, and 7). Tool categories include projectile points, projectile point preforms, bifacial and unifacial scrapers, and flake and scalar cores. These artifacts are referred to as formal implements because they represent the shaping of flakes, spalls, or cores for specific purposes. In contrast to formal tools, retouched and utilized flakes represent a variety of expedient tools (Figs. 6e–6h). These implements were identified on the basis of their edge characteristics, generally informal shape, and a lack of evidence indicating that they were further shaped with flaking. The flake cores (Fig. 7) were classified according to the direction and nature of flake removals (multidirectional, and bipolar; all tools are discussed in greater detail below).

The Data

The 1,709 artifacts recovered from the Berkeley Rockshelter consist of 1,656 flakes and 53 tools. The majority of these artifacts are chert (N = 785, 45%), with jasper (N = 552, 33%) and chalcedony (N = 367, 21%) composing most of the remainder of the assemblage (Table 2). Other minor material types included andesite (N = 2), dacite (N = 1), siltstone (N = 1), and pumice (N = 1). Based on what is known of quarry sites in Mount Rainier National Park, most of the chert and chalcedony in the assemblage were probably not available on the mountain. The jasper, however, is locally available in the scree deposits upslope of the site itself. It should be noted that the non-local chert and chalcedony are generally good quality, whereas the local jasper is predominantly poor material with low silica content.

Debitage

Of the 1,656 pieces of debitage, most (N = 1,071, 64.7%) were flakes and flake fragments lacking clear technologically diagnostic traits (Table 3). Accordingly, this analysis focused on the technologically diagnostic flakes (N = 585, 35.3%; Table 4) because the present intent is to infer the kind of flaked stone tool technology performed at the shelter.

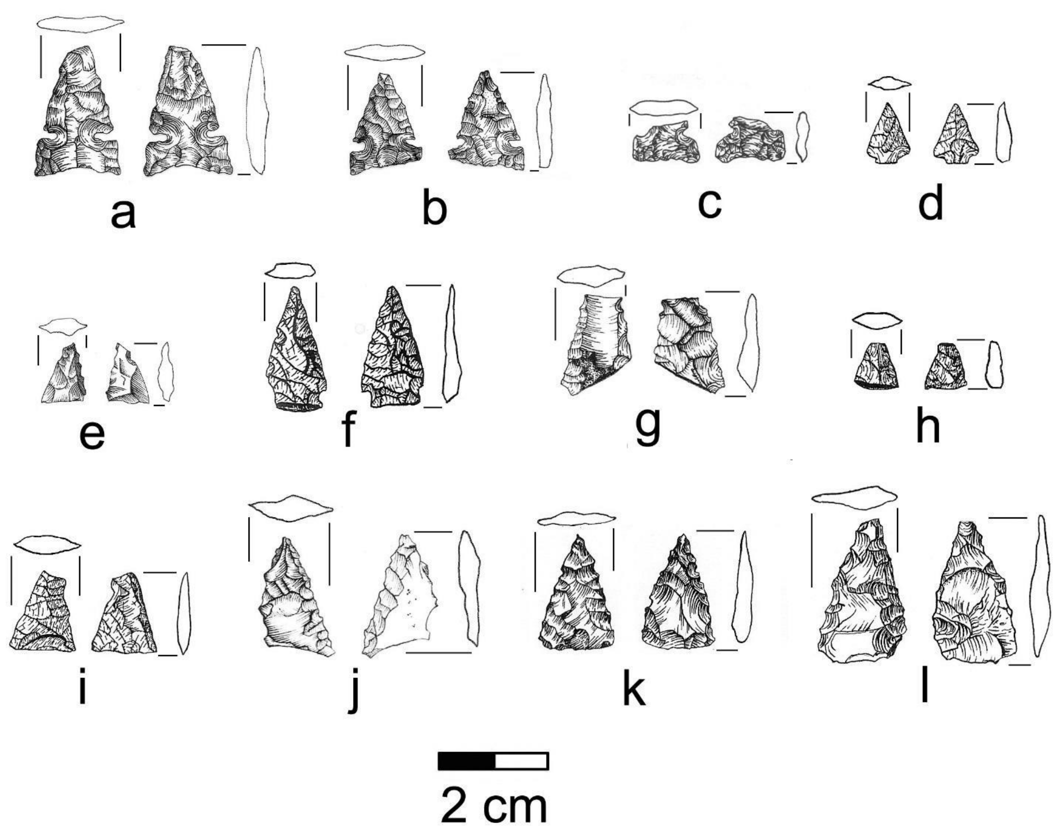

Fig. 5. The projectile point artifacts recovered at the Berkeley Rockshelter: complete Plateau Side-notched points (a and b); probable point fragments (c–j); probable projectile point preforms (k and l). (Illustrations by Kathryn Hunt, Kipp Godfrey and Laura Johnson)

Considering the flake classification system outlined above, stages 1 through 4 are not well represented (Table 4, Fig. 8). These stages collectively make up only 5.3% of the technologically diagnostic flakes. As such, initial flake reduction activities largely appear to have taken place elsewhere. In contrast, flakes reflecting bifacial thinning activities are comparatively better represented. Stage 5 comprises 7.7% of the diagnostic sample (Table 4), suggesting that percussion biface thinning activities were a limited focus of activities at the site.

The majority (87%) of the diagnostic sample is comprised of stage 6 pressure bifacial thinning flakes (Table 4). As such, these data indicate that late-stage biface reduction related to the final shaping of formal implements such as projectile points and the sharpening or maintenance of tool edges were the primary focus of flaked stone tool production and use at the site.

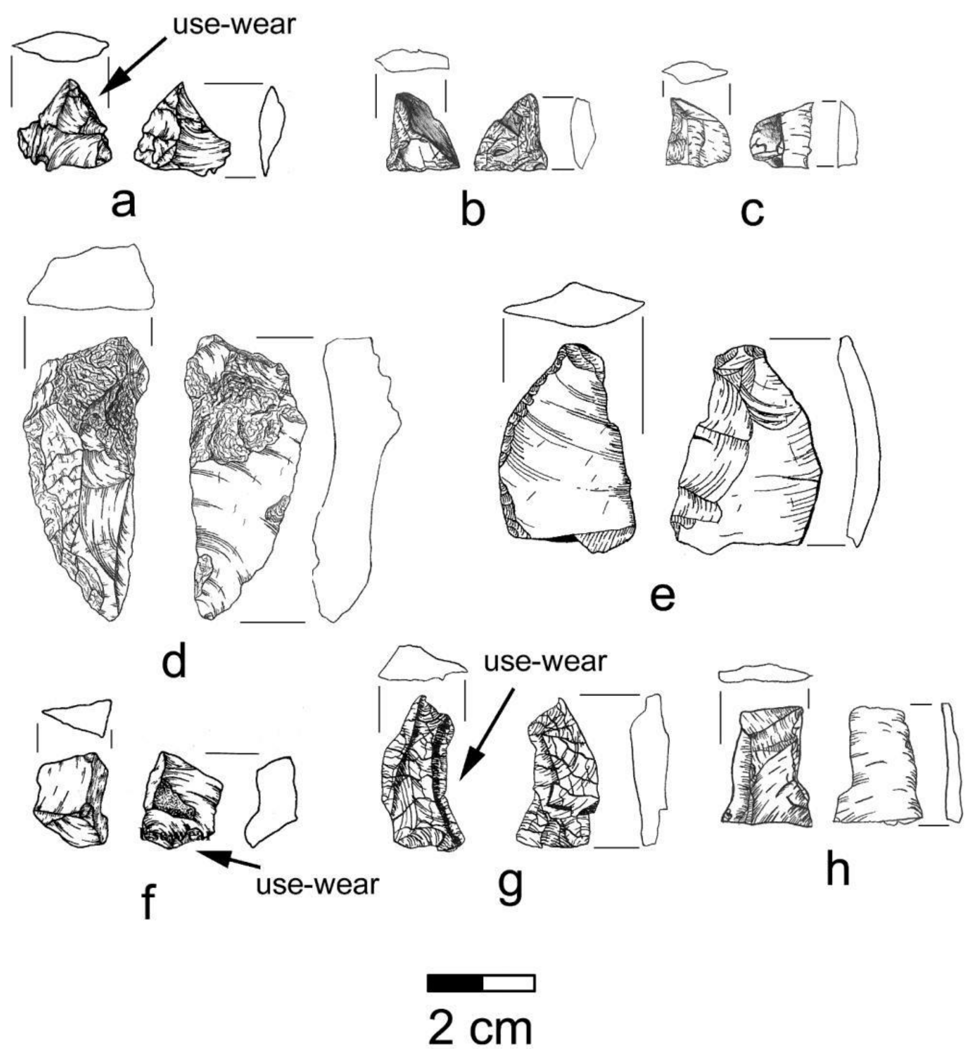

Fig. 6. Non-point flaked stone implements recovered at the Berkeley Rockshelter: bifacial scrapers (a and b); unifacial scraper fragment (c); unifacial scraper (d); utilized flake scraper (e); utilized flakes (f–h). Two of the utilized flakes are possible “spoke shaves” given their edge morphology and the location of use-wear (f and g). (Illustrations by Kipp Godfrey, Emma Holm, and Bradford Andrews)

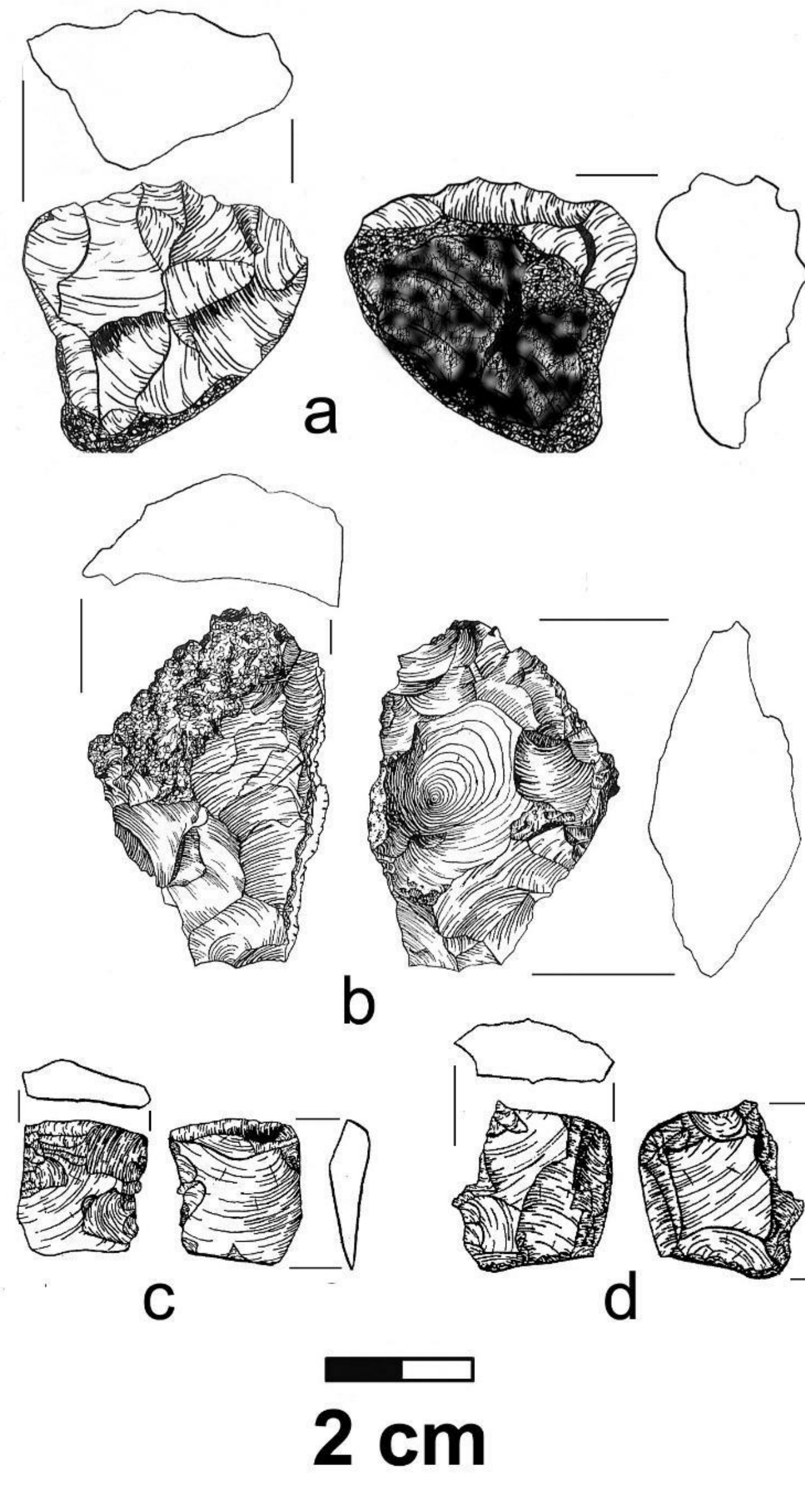

Fig. 7. Core artifacts recovered at the Berkeley Rockshelter: multi-directional flake core (a), heat damaged bipolar flake core (b); scalar bipolar cores (c and d). (Illustrations by Kathryn Hunt and Kipp Godfrey)

TABLE 2. ARTIFACT BREAKDOWNS BY MATERIAL TYPE

Classification	N (%)
Chert	785 (46%)
Jasper	552 (32%)
Chalcedony	367 (21%)
Andesite	2 (<1%)
Dacite	1 (<1%)
Siltstone	1 (<1%)
Pumice	1 (<1%)
Total	1709 (100%)

TABLE 3. DEBITAGE BREAKDOWNS BY REDUCTION STAGE

Classification	N (%)
Undiagnostic	1071 (64.7%)
Stage 1	3 (0.2%)
Stage 2	9 (0.5%)
Stage 3	11 (0.7%)
Stage 4	8 (0.5%)
Stage 5	45 (2.7%)
Stage 6	509 (30.7%)
Total	1656 (100%)

TABLE 4. TECHNOLOGICALLY DIAGNOSTIC DEBITAGE BREAKDOWNS BY REDUCTION STAGE

Classification	N (%)
Stage 1	3 (0.5%)
Stage 2	9 (1.5%)
Stage 3	11 (1.9%)
Stage 4	8 (1.4%)
Stage 5	45 (7.7%)
Stage 6	509 (87.0%)
Total	585 (100%)

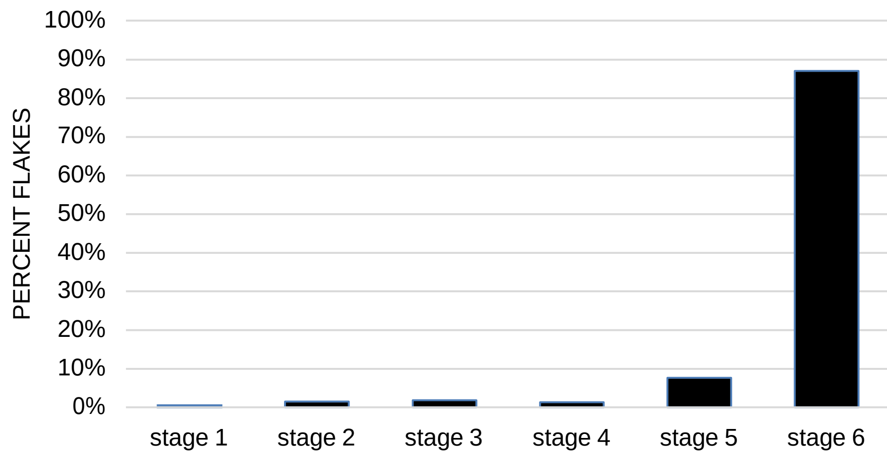

Fig. 8. Histogram of the diagnostic flake sample showing stage breakdowns.

Tools

There are 53 formal and informal tools in the Berkeley Rockshelter sample (Table 5). Among the formal tools, most (N = 21, 40%) are nearly complete projectile points and projectile point fragments (Tables 5 and 6). Based on their size and form, it is likely that they were used to tip arrow shafts. The next most prevalent tool type includes bifacial scrapers (N = 8, 15%) and biface fragments (N = 5, 9.3%). Of note, although these implements are flaked on two faces, they do not have formal bifacial plan views (Figs. 6a and 6b). Other implements include unifacial scrapers (N = 4, 7.5%, Figs. 6c and 6d) and flake cores (N = 2, 3.8%, Figs. 7a and 7b). One of the cores is classified as a multi-directional core (Fig. 7a), whereas the other has rather severe heat treatment damage (pot-lids and crazing fractures) and flaking scars with opposing ripples of force morphologically consistent with bipolar reduction (Fig. 7b). With the exception of the projectile point artifacts, it is important to point out that even though these implements are referred to here as “formal,” they generally lack typical formal characteristics, appearing instead to be largely expedient in nature.

TABLE 5. FLAKED STONE TOOLS RECOVERED AT THE BERKELEY ROCKSHELTER

Formal Tool Types	N (%)
Projectile points	21 (39.6%)
Bifacial scrapers	8 (15.1%)
Biface fragments	5 (9.3%)
Unifacial scrapers	4 (7.6%)
Flake cores	2 (3.8%)
Scalar flake cores	2 (3.8%)
Pumice abrader	1 (1.9%)

TABLE 5. FLAKED STONE TOOLS RECOVERED AT THE BERKELEY ROCKSHELTER (CONT.)

Informal Tool Types	N (%)
Utilized flake scrapers	4 (7.6%)
Utilized flakes	6 (11.3%)
Total	53 (100%)

TABLE 6. PROJECTILE POINT ARTIFACTS RECOVERED AT THE BERKELEY ROCKSHELTER

Formal Tool Types	N (%)
Projectile points	2 (9.5%)
Projectile point fragments	12 (57.1%)
Preforms	7 (33.4%)
Total	21 (100%)

In addition, the assemblage has two scalar cores (N = 2, 3.8%; Figs. 7c and 7d). These types of cores are relatively thin, have V-shaped longitudinal profiles giving them a wedge-shaped appearance, and reflect flaking patterns consistent with bipolar reduction. Another interesting find was a cylindrical pumice abrader (1.9%, Fig. 9). Although this implement is not a flaked stone tool, we believe its presence in the assemblage is consistent with the primary focus of prehistoric activities that took place at the site (see below).

The informal tools include flakes that were not systematically shaped with flaking, but exhibit edge use-wear and/or retouch. These artifacts include utilized flake scrapers (N = 4, 7.5%, Fig. 6e) and utilized flakes with unknown, probably varying functions (N = 6, 11.3%; Figs. 6f–6h). Four of the utilized flakes have use-wear evident on one or more concave-shaped edges, suggesting a possible function as “spoke shaves” for shaping arrow shafts (Figs. 6f and 6g). The use-wear on most of these tools is limited indicating they were used briefly and then discarded.

Discussion

The abundance of stage 6 flakes in the Berkeley Rockshelter assemblage (Fig. 8) is consistent with its high number of small, fragmented projectile points (Table 6). Specifically, we think that the site was primarily a place where arrow shafts and other hunting-related equipment were refurbished/maintained during hunting forays. According to Binford's model, such a specific activity focus is consistent with the use of the site as a hunting field camp, repeatedly occupied for relatively short periods of time.

The projectile point artifacts are nearly complete, or are fragments with characteristics supporting the inference that most were broken during use and then discarded when their arrow shafts were refurbished. The two nearly complete projectile points have a clear stylistic affinity for the “Plateau Side-Notched” point type, as described by Lohse (1985; Lohse and Schou 2008). Although one is slightly fractured at the tip due to impact, these points have intact bases and tipped blades separated by parallel side notches (Figs. 5a and 5b). This point type is highly variable, but its side-notched, straight-to-concave base is usually wider than its blade. The notches on some Plateau Side-Notched points, including those discussed here, are highly pronounced. This point type is temporally affiliated with the period 1500–200 B.P. (Lohse and Schou 2008), which is consistent with the radiocarbon dates for the Berkeley Rockshelter.

The projectile point artifacts are dominated by projectile point fragments. One fragment has similar diagnostic qualities to the two Plateau Side-Notched points discussed above (Fig. 5c). It is a finished, pressure-flaked projectile point base with a transverse fracture that occurred just above its notches. Acknowledging the dangers of typing points that are incomplete (Flenniken 1986), this artifact also may have been the base of a discarded Plateau Side-Notched style point.

Other projectile point artifacts are classified by the portions of the points they probably represent. One fragment was probably a point tip/body (Fig. 5d). It exhibits pressure flake scars, and appears to have fractured where it was formerly side-notched. Given its size, this artifact was probably the blade of a larger broken point that was reworked and used again. Also, it too was likely a Plateau Side-Notched point given its dimensions and fracture characteristics. Another artifact was probably a point tip judging from its small size and the relative symmetry in the angle of its edges (Fig. 5e).

Several artifacts in the collection are probably discarded projectile point midsections. These artifacts represent points fractured at their tips and probably immediately above their notches. One midsection has a perpendicular transverse fracture near its tip and a diagonal transverse fracture across its blade (Fig. 5g). It appears to have been notched where the fracture terminates. Two other projectile point fragments exhibit fractures that originated where they were notched (Figs. 5f and 5j). One of them has a perpendicular fracture that straddles its former notches; it has late stage reduction flake scars that clearly indicate it was notched where it subsequently fractured (Fig. 5f).

Many of the projectile point artifacts also have attributes consistent with unique fractures associated with impact, indicating that they were used, and then were re-worked and/or discarded. This evidence further supports our interpretation that refurbishing hunting kits was an important activity at the site. A number of archaeologists have done experimental research on impact fractures typically found on used projectile points (Flenniken 1986; Titmus and Woods 1986; Kelterborn 2001). For these experiments, replicas of prehistoric projectile points were knapped and then hafted to arrow shafts with sinew and mastic or resin, which was usually a combination of pitch and charcoal (Titmus and Woods 1986:38). Various types of materials were used as targets (animal flesh, tree trunks, soil, etc.) to determine whether damage varied accordingly. Regardless of target medium, not surprisingly, most impact fractures affected the base and the tip of projectile points (Flenniken 1986).

One fracture pattern recognized by Kelterborn (2001) is the “bending break.” Titmus and Woods (1986) also describe this break as a transverse fracture across a projectile point, usually at the tip and/or base near the notches (Titmus and Woods 1986:fig. 4). This fracture type is evident on many of the Berkeley Rockshelter projectile point artifacts, with breaks at the tip (Figs. 5a, 5g, 5h, and 5i) and breaks at the base (Figs. 5d, 5f, 5g, and 5j). Again, those with basal fractures broke close to the narrowest point of the blade where they were probably notched.

Kelterborn (2001) refers to another type of impact fracture that occurs on some Berkeley Rockshelter artifacts as “facial flaking.” What makes these flake scars distinct is the direction of force that produced them. Normal, late stage pressure flake scars resulting from production tend to reflect flaking force originating from the lateral edges of the blade. In contrast, facial flaking is the result of force coming from the tip of the blade. This force is usually rather substantial compared to that needed during point production because it is generated during use when the point tip strikes a hard surface. Hence, these impact fracture scars are distinct compared to most of the flaking scars on these artifacts (Figs. 5a, 5g, 5i, and 5j). The most obvious example of this attribute exhibits a flake scar 6 mm wide that extends 13 mm down the length of one of its faces (Fig. 5g). Another artifact has a prominent facial flake scar extending 10 mm down one blade face that is 4 mm wide (Fig. 5i). One example is less distinct but shows a few scars originating at the tip, running down the face of the blade (Fig. 5j). Still another artifact exhibits flake scars originating at the tip of the blade, extending down the middle of one blade face (Fig. 5a).

The collection also has artifacts classified as preforms (Figs. 5k and 5l). Preforms are artifacts that were reduced to the basic triangular shape of a projectile point, but were never notched. It is likely that these items would have been carried on hunting trips rather than transporting more delicate finished, notched points, which would have had a greater probability of breaking prior to being hafted. Also, finishing preforms in the field ensures the use of projectile points with newly sharpened edges, which would make them more effective at penetrating game. The presence of preforms is consistent with the specific use of the site as an overnight hunting camp. Preforms optimize the efficiency of a mobile toolkit because they are more durable and light weight than raw material in less processed form, and they can be easily notched during refurbishing. Preforms were most likely shaped elsewhere at sites such as longer-term residences or quarries. They were then taken on hunting forays to replace points broken beyond repair.

Seven artifacts were identified as preforms. Three lines of evidence support this inference. First, the lateral edges of these artifacts are symmetrical and they are not notched. Second, all of them were finished with pressure bifacial thinning. Finally, at least two preforms have a basic size and shape consistent with preforms that could be easily notched to make Plateau Side-Notched points (Figs. 5k and 5l).

Collectively, the debitage and projectile point data support the inference that bifacial flaking used to shape and rework projectile points was a prominent activity at Berkeley Rockshelter. The abundance of late-stage pressure and notch flakes is also consistent with the presence of preforms, suggesting that such items were brought to the site and then finished into projectile points during refurbishing activities. Arrow refurbishing, primarily involving the final shaping of preforms, is also consistent with the quality of the non-projectile point implements, many of which are expedient in form. For example, except for the projectile point artifacts, there are no well-shaped bifaces that could be reasonably typed using Callahan's (1979) biface classification system. Callahan (1979:10–11) distinguishes five biface stages beginning with stage 1, which is defined as a usable blank. Stage 2 results from the initial edging of a blank, which is then transformed into a stage 3 implement by removing middle biface thinning flakes. The subsequent stage 4 category is the result of secondary thinning activities involving the removal of late biface thinning flakes. Stages 1 through 4 are generally regarded as bifaces that were thinned with percussion flaking techniques. The final stage 5 bifaces are refined, well-shaped implements, usually produced by removing late biface thinning flakes with pressure techniques (not to be confused with stage 5 bifacial thinning flakes as defined in this study). The debitage and tools from the Berkeley Rockshelter, therefore, indicate that bifacial thinning activities were largely restricted to the late-stage pressure flaking of stage 5 bifaces (i.e., points and preforms).

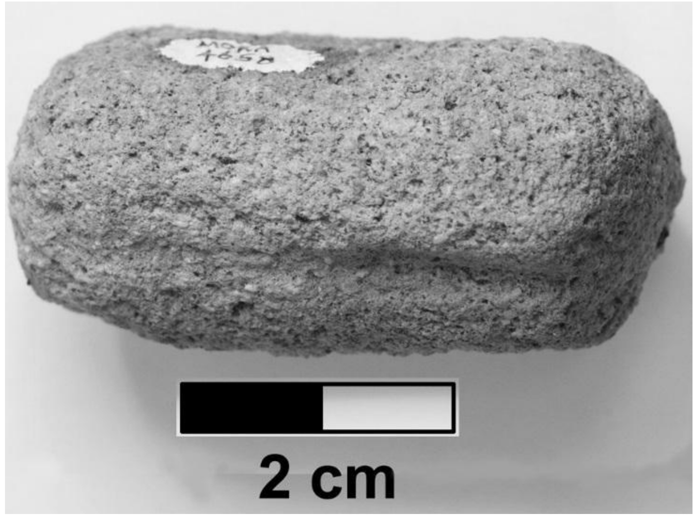

Fig. 9. Possible pumice “arrow shaft” abrader recovered at the Berkeley Rockshelter.

Finally, many of the non-point tools (N = 19, 36%) are made of the poor quality local jasper available immediately upslope of the site. These tools are predominantly utilized flakes and informally shaped biface fragments (N = 12, Figs. 6a, 6c, 6e, 6f, 6h). The nature of the toolkit, therefore, indicates the onsite manufacture of largely expedient scraping and cutting tools. These items would have been useful for doing various processing and whittling tasks associated with arrow shaft maintenance and the re-hafting of new points. Both flake cores are jasper (Figs. 7a and 7b), and likely provided flakes for these types of tools.

As discussed, the local jasper from the Berkeley Rockshelter vicinity is poor quality material that occurs no larger than small fist-sized sub-angular and rounded nodules. Bipolar techniques provided one means for flaking raw material of this quality all over the world (Le Blanc 1992; Close 2006; De León 2008). The bipolar flake core in the assemblage (Fig. 7b) indicates that this was also the case at the Berkeley Rockshelter. The interpretation here is that bipolar and bifacial percussion techniques were used to initially process the jasper nodules, resulting in a miscellany of small flakes and tablets that could be immediately used, or further shaped with pressure bifacial thinning.

It is clear that the local jasper was an important toolstone at the site because it comprises 32% of the flaked stone artifacts (Table 2). The assemblage has both jasper flakes and tools, but only a single projectile point artifact was made of this material (Fig. 5h). Hence, it appears that only the occasional piece was found that could be knapped into a point; it was a useful local toolstone for largely expedient tasks related to arrow refurbishing, but not for making new points. Without a doubt, the Berkeley Rockshelter was a particularly attractive over-night field camp because those hunters who reused the site could plan on having local toolstone, albeit poor quality, to use for refurbishing tasks. Except for points, the exploitation of this jasper relieved the need to carry extra non-local toolstone on logistical forays. Surely, prehistoric peoples were fully aware of their regional lithic landscapes and took full advantage of using poorer quality sources of stone when it was convenient (Ozbun 2015).

Other tools that are consistent with the inference that arrow refurbishing was the primary activity at the site include the bipolar scalar cores (Figs. 7c and 7d) and the pumice abrader (Fig. 9). The scalar cores are made of good quality non-local chert. This type of artifact has been found worldwide in association with bipolar industries, and the question of whether it functioned as a “core” or a tool is the subject of intense debate (Hayden 1980; Parry 1987; Shott 1989; Le Blanc 1992; De León 2008). These artifacts could provide useable bipolar flakes early in their use-lives, only to be used as a tool when they became too small. Realistically, the scalar cores in the Berkeley Rockshelter assemblage were too small to have been viable cores in “their” core-stage. Instead, their thin, V-shaped longitudinal profiles would have made them good wedge-type tools for splitting and/or whittling wood. As such, these implements also would have been particularly useful for shaping arrow shafts. Finally, the pumice abrader, a purposely shaped cylinder with a clear longitudinal groove on one face, could have been used to sand arrow shafts (Fig. 9).

Conclusion

Taken together, the overall characteristics of the Berkeley Rockshelter assemblage support previous interpretations that the site functioned as a hunting *field camp* (sensu Binford 1980) during the Late Holocene (Bergland 1988; Burtchard 1998:114). If the Berkeley Rockshelter was used more as a *residential base* it should have evidence for activities related to a broader range of food procurement activities. Such activities could have included berry harvesting, food processing and consumption, and tools associated with a miscellany of other daily productive tasks (e.g., making baskets and/or clothing). However, the Berkeley Rockshelter assemblage does not reflect a wide range of activities.

The data indicate that the site was visited during summer forays when hunters were a long way from residential summer camps, most likely located in Puget Trough lowland settings. Specifically, the evidence indicates that hunters staying at the site repaired their tool kits by re-working damaged projectile points, and/or making new points to replace those that had been severely broken during earlier hunting episodes (Fig. 10). Such activities also would have required arrow shaft maintenance, including arrow shaft reshaping and/or complete arrow shaft replacement. The recovery of large mammal bone (unfortunately unidentifiable) associated with these artifacts suggests that the hunters who used the Berkeley Rockshelter were indeed successful.

The analysis on which these conclusions are based has clarified how these activities were carried out. Burtchard (1998:92) stated a number of years ago that prehistoric exploitation of the Mount Rainier uplands involved a combined use of local and non-local sources of toolstone. The present analysis indicates that most projectile points were probably imported. Many of them may have been carried to the mountain as preforms. The overwhelming dominance of late-stage, pressure bifacial thinning flakes (87%) and projectile point artifacts, including preforms, support this interpretation. If larger bifaces were a more common import to the site, there would be more debitage reflecting percussion reduction.

The poorer quality jasper available immediately upslope of the site appears to have been largely reduced onsite to make various tools for refurbishing activities. The smallish nodules of this material were initially “cracked” open with percussion or bipolar techniques—any subsequent flaking applied to further shape jasper tools was largely done with pressure. As such, this material was transformed into functional, largely expedient implements at its source (Burtchard 1998:93).

The importation of toolstone in highly processed form (e.g., preforms) and the use of poorer quality local sources for expedient uses is a pattern that may be evident at other Late Holocene sites on Mount Rainier. For example, the Frozen Lake (45-PI-407) site is dominated by jasper similar to that from the Berkeley Rockshelter source (Burtchard 1998:93). One possible travel route to Frozen Lake went up Lodi Creek to the north. If used, this route would have allowed convenient access to the Berkeley Rockshelter jasper source along the way. Therefore, Frozen Lake jasper may in fact have originated from this source, or from a reported source on the upper eastern flank of Mt. Freemont near Sunrise Ridge (Burtchard 1998:167). It may be that the jasper from both sources is chemically comparable because they occur in the same geologically identical Tatoosh Pluton. Future research should attempt to clarify how widespread the distribution of the Berkeley Rockshelter (or Tatoosh Pluton) jasper is on the mountain.

Fig. 10. Artistic rendition of prehistoric arrow shaft refurbishing at the Berkeley Rockshelter. (Artwork by Michael Stasinos)

Continuing comparative research aimed at defining the function of sites in Mount Rainer National Park will further broaden what is known about the Holocene occupation of the region. Conceptually modified to assess temporal trends (sensu Schalk and Cleveland 1983; Burtchard 1998), Binford's (1980) forager-collector model provides a solid theoretical basis for examining how local hunter-gatherer organization varied over time. This revised model posits a Late Holocene shift to a collector strategy, which would have been primarily associated with the short-term use of high elevation areas by small task groups targeting specific resources. The Berkeley

Rockshelter fits this expectation because it dates to the Late Holocene and its artifact assemblage indicates a hunting focus.

The Binford (1980) model also implies archaeologically testable expectations about the character of archaeological assemblages associated with different site types. At present, there is a particular need for more firmly dated sites with data supporting reasonable inferences of site function, especially those from the Early and Middle Holocene periods. Such efforts will undoubtedly lead to a more informed and sophisticated understanding of prehistoric hunter-gatherer life in the southern Washington Cascades and how it changed over time.

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