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CONTEXT, PROVENANCE AND TECHNOLOGY OF A WESTERN STEMMED TRADITION ARTIFACT CACHE FROM THE COOPER’S FERRY SITE, IDAHO

Loren G. Davis, Alex J. Nyers and Samuel C. Willis

Loren G. Davis and Alex J. Nyers, Oregon State University, Department of Anthropology, 238 Waldo Hall, Corvallis, OR 97331 (loren.davis@oregonstate.edu)

Samuel C. Willis, Oregon State University, Department of Anthropology, 238 Waldo Hall, Corvallis, OR 97331 and Logan Simpson Design Inc., 8 E Broadway Suite 300, Salt Lake City, UT 84111
The discovery of an artifact cache containing Western Stemmed Tradition projectile points in a clearly defined pit feature at the Cooper’s Ferry site offers a unique perspective on early lithic technology and logistical organization in western North America. A description and analysis of the cache feature reveals several new insights, including: a rocky cairn capped the surface of the pit feature; some of the artifacts were made from cryptocrystalline silicates found 16 km away; debitage analysis, including aggregate and attribute based measures, identified two distinct lithic reduction stages present in the cache; new radiocarbon assays suggest that the cache is probably not early Holocene in age and may date to associated radiocarbon age estimates of 11,370-11,410 B.P. Unlike Clovis caches, the Pit Feature A2 cache at Cooper’s Ferry appears to be a generalized toolkit that was probably placed at the site for future use. If the 11,370-11,410 B.P. assays date the creation of the Pit Feature A2 cache, then its creators were probably not pioneers in the lower Salmon River canyon but possessed local knowledge about the landscape and raw material sources; these patterns suggest greater time depth for Western Stemmed Tradition foragers.
El descubrimiento de un depósito de artefactos conteniendo puntas de proyectil en la Tradición de Tallo Occidental (Western Stemmed Tradition) en una fosa claramente definida, en el sitio de Cooper’s Ferry, ofrece una perspectiva única sobre la tecnología lítica temprana y organización logística en el Occidente de América del Norte. La descripción y el análisis de este depósito revela nuevas manifestaciones, incluyendo: el uso de un cumulo rocoso que cubrió la superficie de la fosa; algunos de los artefactos fueron hechos de silicatos criptocristalinos que se encuentran a 16 km de distancia; análisis de los desechos de talla, incluyendo las medidas basadas en agregados y sus atributos, identificaron dos distintas etapas de reducción lítica presentes en el acopio. Nuevas fechas por radiocarbono indican que este depósito probablemente no corresponde al Holoceno temprano en antigüedad y bien puede datar a fechas por radiocarbono de entre 11,370-11,410 años AP. A diferencia de depósitos Clovis, el de la fosa A2 en Cooper’s Ferry, parece ser un conjunto de herramientas de uso general que probablemente fue colocado en el sitio para su uso a futuro. Si las fechas 11,370-11,410 AP datan la creación del depósito en la fosa A2, entonces los autores probablemente no fueron pioneros en las bajas inmediaciones del cañón del río Salmón (Salmon River canyon), pero poseían un conocimiento particular acerca del paisaje y fuentes de materia primas locales; estos patrones sugieren una mayor antigüedad para los grupos recolectores de la Tradición de Tallo Occidental.
The Western Stemmed Tradition (WST) is best known from its hallmark unfluted projectile points and has been long thought to represent an early cultural pattern in western North America that temporally overlaps but does not have a clear evolutionary relationship with the Clovis tradition (Ames et al. 1998; Bryan 1988). Study of the WST has increased in recent years, focusing on the nature of its relationship with the Clovis Paleoindian Tradition from perspectives of chronology, cultural interaction, evolutionary connections and technology (Beck and Jones 2010, 2007, 1997; Davis et al. 2012; Fiedel and Morrow 2012; Goebel and Keene 2013; Haynes 2007). The most significant advance in our understanding of the WST comes from the discovery of a WST projectile point base in good contextual association with a sagebrush twig dated to 11,070 B.P. at the Paisley Caves site (Jenkins et al. 2012, 2013). This discovery provides the earliest and best chronometrically dated evidence for a late Pleistocene-aged technological pattern in the Far West and demonstrates that the WST is contemporary with Clovis. This discovery is notable because it involves the careful recordation of diagnostic technological elements from an intact, well-dated stratigraphic context—key archaeological aspects that have been largely absent from WST sites throughout the Far West.

Although arguments made about the cultural differences between the WST and Clovis Paleoindian artifact traditions provide important perspectives that help to shape the way we think about early North American prehistory (Beck and Jones 2010, 2013; Davis et al. 2012), generating more rhetoric will not significantly advance the debate. Instead, we need to know much more about WST cultural patterns by studying artifact
assemblages recovered from intact, buried contexts that unequivocally represent temporally-limited archaeological components. Such an assemblage comes from the Cooper’s Ferry site of western Idaho where author Davis led test excavations in 1997 that discovered a buried prehistoric pit feature (designated Pit Feature A2 (PFA2)) containing 13 stone tools—including four stemmed projectile points–debitage and fragmentary faunal remains. Davis and Sisson (1998) made an initial cursory report of this discovery while the geoarchaeological aspects of the 1997 excavations were later discussed by Davis and Schweger (2004); however, neither of these accounts provide detailed information about the form of PFA2, the provenience and technological aspects of the artifacts it contained, or the provenance of its cryptocrystalline silicate (CCS) tools. Because PFA2 represents a clear association of different kinds of WST artifacts, its study can provide unique insights into the technological behaviors and patterns employed by WST peoples. In order to present a comprehensive report on PFA2, we revisit the 1997 radiocarbon chronology from Cooper’s Ferry in light of new radiocarbon assays that clarify the site’s chronostratigraphy and the antiquity of PFA2, provide a thorough description of the feature’s form based on a digital reconstruction from original photographs and field notes, and present a complete accounting and technological characterization of its artifacts. Lastly, we discuss the larger implications of PFA2 in relation to issues of site use and logistical strategies employed by WST peoples.

**Background and Setting**

The Cooper’s Ferry site is located on a small alluvial terrace elevated about 10 m above the confluence of Rock Creek and the lower Salmon River, and is positioned approximately 17 km south of the town of Cottonwood in western Idaho and 62.8 km
upstream from the Snake River (Figure 1). In the area of the Cooper’s Ferry site, the Salmon River is deeply entrenched into thick units of the Columbia River Basalt Formation (Maley 1987). The plateaus of the Camas Prairie and the Joseph and Doumeq Plains border the deeply incised canyon to the north and west, acting as divides between the Clearwater River and Snake River Canyons.

B. Robert Butler conducted the first controlled excavations at the Cooper’s Ferry site in the summers of 1961 and 1962 and later in 1964. He recovered stemmed points in a stratified sequence from four adjacent 2 x 2 m excavation units, which form Butler’s Trench A (Butler 1969). Although the stemmed point component Butler found is commonly cited as an example of early Plateau cultural manifestation (e.g., Ames 1988; Bryan 1980; Carlson 1983), the 1960s excavations produced no chronometric age estimates. In 1997, author Davis directed the excavation of a single 2 x 2 m test unit (named Unit A) at the Cooper’s Ferry site. These limited excavations encountered archaeological components in stratified deposits similar to that reported by Butler and led to the discovery of PFA2, which contained four stemmed points arranged in the same horizontal position and nine other lithic tools scattered throughout the matrix of the pit fill. Most importantly, radiocarbon-dated samples from within the pit and from the paleosurface from which the pit feature extended downward produced a series of late Pleistocene to early Holocene ages (Figure 2).

**Pit Feature A2 Morphology and Stratigraphic Context**

For a detailed treatment of the site’s stratigraphy and geoarchaeological context, the reader is directed toward the extensive description and interpretation provided by
Davis and Schweger (2004); a summary of which is provided here in Table S1. PFA2 was discovered in 1997 during the process of excavating Unit A’s southeastern 1 x 1 m quadrant first as a concentration of subrounded to subangular cobbles mixed with coarse sandy pebble gravels, which contrasted with the surrounding finer aeolian sandy loam sediments that dominated lithostratigraphic units (LU) 4 and LU3 in excavation levels 18-20 (428.38-428.08 masl; Figures 2 and 3a-c). The concentration of cobbles and pebbles disappeared in level 21 and gave way to a circular patch of darker colored, pebbly loamy sand sediments in the center of the SE quadrant, which was well expressed by level 22 (427.98-427.88 masl; Figure 3d). This visually and texturally contrasting circular patch of poorly sorted pebbly loamy sand sediment continued downward through the sandy loam of LU3, the sand of LU2 and into the basal gravels of LU1 where it ended in level 29 at 427.07 masl. The photographs in Figure 3e-g show PFA2 as it was revealed during the excavation process and clearly show the presence of a 30 cm thick concentration of cobbles, pebbles and sandy sediments piled directly on the surface of PFA2. We interpret this pile of stones and coarse sediments to represent a cairn that was purposefully created by the site’s occupants to mark the top of PFA2 (Figure 4).

The presence of the surficial cairn is taken to indicate that the pit feature was excavated, backfilled, capped with a pile of rocks and coarse sediment, and left undisturbed until we discovered it during the summer of AD 1997. The low energy deposition of the LU4 aeolian loess ensured that the cairn feature would remain intact on the surface of PFA2 during its burial. A review of excavator notes and photographs from 1997 does not show a vertical extension of PFA2’s pit above 428.08 masl. Thus, it
is clear that PFA2 was excavated only into the surface of LU3 and downward into LU2 and LU1. Because LU5 and LU6 overlaying PFA2 had not been disturbed from above, PFA2 must therefore predate the accumulation of these deposits at the site.

Thirteen lithic tools were found inside PFA2, including a large uniface, three blades, two cores, two modified flakes, a hammerstone, and four stemmed projectile points (Figure 5, Table 1). In addition, 724 pieces of debitage were recovered within PFA2 (Table 2). By material type, these included 73 pieces of basalt, 641 pieces of cryptocrystalline silicate (CCS) and 10 metamorphic flakes. Faunal remains included 65 pieces of mammal bone, 22 of which were clearly from small rodents. An artiodactyl metapodial fragment bearing a 1 cm-long linear incision that is interpreted as a butchering cutmark created by a stone tool also came from the bottom of PFA2. Efforts to obtain an AMS assay on this cutmarked bone failed due to a lack of sufficient collagen. Few fragments of freshwater mussel shell (0.3 g) and land snail shell (0.2 g) were also found.

The in situ positions of 154 objects with surface areas ≥1 cm² were recorded during the 1997 excavations (Figure 6). The formed tools are distributed throughout the vertical extent of PFA2; however the four stemmed projectile points were clustered toward the bottom of the pit feature. The deepest object found was the cutmarked artiodactyl bone fragment that was directly overlain by the four stemmed projectile points. Artifacts were concentrated into five different horizontal zones within the matrix of PFA2. The first artifact concentration was comprised of the four stemmed points at the bottom of the pit (between 427.30-427.35 masl). The second concentration consisted of a cluster of debitage, a uniface, a blade, a modified flake, and non-rodent
bone between 427.40-427.55 masl. A third concentration containing CCS and basalt
debitage, non-rodent bone, a core, and a blade was found between 427.75-427.80. A
blade, hammerstone and core were grouped between 428.00-428.10 masl and form the
fourth concentration. Lastly, the highest quantity of debitage and a single modified flake
were found between 428.20-428.40 intermixed with the rocky cairn matrix. Whether
these different concentrations were purposefully constructed by adding artifacts and
sediment to the pit in patterned amounts is unclear; however, the four stemmed points
were clearly interred together in the bottom of PFA2 and a significantly increased
quantity of debitage is present within the cairn matrix.

Based on the aforementioned facts, we reason that PFA2 functioned as a cache
for several reasons: (1) the clearly delineated circular pit feature originated and
extended downward from a paleosurface (LU3 and S1) that also included evidence of
cultural occupation, indicating stratigraphic contemporaneity with an archaeological
component; (2) thirteen lithic tools, including four WST projectile points, were distributed
within the contrasting sediments that infilled the pit feature; (3) the four stemmed points
were found in close proximity to each other; (4) the pit feature was capped by a gravelly
rock cairn that was later buried by aeolian loess sediments.

**Evaluating Hypotheses of PFA2 Age and Formation**

In their interpretation of Unit A’s geochronology, Davis and Schweger (2004)
conclude that the radiocarbon assays made on bone are probably poor measures of
time, since they were derived from collagen samples not subjected to the most stringent
purification techniques and that the radiocarbon ages from wood charcoal in and near
PFA2 are the most valid chronometric measures available from 1997. Whether these charcoal ages were derived from materials found in their primary contextual associations is another matter and the authors argue that the $7300 \pm 70$ B.P. and $8710 \pm 120$ B.P. assays are derived from charcoal that was displaced into PFA2 by burrowing rodents. They conclude that the $11,370 \pm 40$ B.P. and $11,410 \pm 130$ B.P. charcoal assays from PFA2 and LU3, respectively, are most compelling because they match ages on other similar aeolian loess deposits found elsewhere in the lower Salmon River canyon (LSRC). Three plausible hypotheses concerning the age of PFA2 can be derived from the facts reported by Davis and Schweger (2004).

**Hypothesis 1**
The $7300 \pm 70$ B.P. and $8710 \pm 120$ B.P. radiocarbon assays on charcoal samples found within PFA2 accurately date the feature. Fiedel and Morrow (2012:378) posit that an early Holocene age for PFA2 could be plausible, given the reported presence of an unconformable contact at the surface of LU3, which would diminish any depth-age effect in Unit A: “Earliest Holocene deposits-within which the pit may have originated-have been eroded away.” Their interpretation of this stratigraphic situation is wrong, as the unconformable contact between LU3 and its overlying LU4 is attributed to the previously reported presence of a buried paleosol (Davis and Schweger 2004), which marks the loss of depositional time because of surficial stability, not erosional loss. Furthermore, LU5 contains stemmed biface types that are known from the nearby Hatwai site (Ames et al. 1981) to predate the Windust and Cascade types found in LU6, suggesting considerable time elapsed during the accumulation of LU5 and LU6. The stemmed points from LU5 are distinctly different from those in PFA2, suggesting even
more archaeological and temporal separation exists among the lithostratigraphic units. To explain these facts, Davis and Schweger (2004) conclude that burrowing rodents moved the 7300 ± 70 B.P. and 8710 ± 120 B.P.-aged charcoal into PFA2.

**Hypothesis 2**

PFA2 is dated by the 11,370 ± 40 B.P. and 11,410 ± 130 B.P. radiocarbon assays on charcoal fragments found within the feature and from the LU3 surface from which the feature originated. Davis and Schweger (2004) argue that geological work conducted elsewhere in the LSRC consistently demonstrates that loess deposits, such as LU3, do not accumulate in the canyon after the Pleistocene Epoch and surmise that the 11,370 ± 40 B.P. and 11,410 ± 130 B.P. assays could actually date the timing of when PFA2 was created.

**Hypothesis 3**

The 11,370 ± 40 B.P. charcoal fragment found in the bottom of PFA2 and the piece of charcoal found in the upper part of LU3 that produced the 11,410 ± 130 B.P. radiocarbon assay are both from burned fossil wood that was present in LU3 or LU2 prior to the arrival of humans. Subsequently, the 11,370 ± 40 B.P. charcoal sample became incorporated into the matrix of PFA2 as it was constructed. Thus, these late Pleistocene-aged charcoal samples predate human occupation at the site (Goebel and Keene 2013).

Following the traditional criteria for site evaluation described and applied by Haynes (1964, 1992) Roosevelt et al. (2002) and Jenkins et al. (2013), these three
hypotheses may be tested by securing new radiocarbon assays on reliable samples found in secure associative contexts at Cooper’s Ferry. As part of a study on the timing of the Windust phase to Cascade phase transition at Cooper’s Ferry, Davis et al. (2014) report 84 new AMS radiocarbon assays from LU6 from freshwater mussel shell prismatic carbonate (aragonite), which returned age estimates ranging between 8030 ± 37 B.P. and 9138 ± 38 B.P. (Figure 2). This large number of radiocarbon assays clearly establishes the age of the upper half of LU6, which overlaps with and predates the 7300 ± 70 B.P. and 8710 ± 120 B.P. radiocarbon assays from PFA2 and invalidates Hypothesis 1. The early Holocene-aged radiocarbon assays from PFA2 probably represent charcoal fragments moved downward by burrowing rodents from upper stratigraphic units some time after the creation of PFA2 (e.g., smaller, circular and elongated tube patterns of infilled rodent burrows can be seen in Unit A profile wall stratigraphy presented in Figures 2 and 3).

Hypotheses 2 and 3 have not been adequately tested as the origin of the 11,370 ± 40 B.P. and 11,410 ± 130 B.P. wood charcoal associated with PFA2 and the upper limits of LU3 remains unresolved and could possibly have come from fossil wood. Continued strengthening of the site’s chronostratigraphy, involving the recovery and analysis of many more datable samples as we have accomplished for the upper half of LU6, should ultimately resolve the remaining two hypotheses.

**Toolstone Provenance**

Elemental geochemistry of 21 CCS artifacts from PFA2 was measured with a ThermoElectric Niton XL3t portable x-ray fluorescence device (PXRF). The resulting
elemental spectra for these PFA2 artifacts were compared against CCS sources from
the LSRC defined by Nyers (2013) who applied instrumental neutron activation and
PXRF analyses to 300 CCS samples collected from six different geologic source
localities found within 30 km of the Cooper’s Ferry site (see Nyers 2013 for a full
explanation of data collection methods, standards and analytical procedures involved in
the LSRC CCS provenance study). Of our sample, two stemmed points (73-628 and
73-629), two blades (73-631 and 73-4617) and two pieces of debitage (73-4621 and 73-
4634), were successfully assigned to a known source located approximately 16 km to
the southeast of Cooper’s Ferry near White Bird, Idaho (Figure 7). The remaining 15
CCS artifacts cluster into at least three discrete geochemical groups that probably
represent other undiscovered CCS sources in the LSRC.

Lithic Technology

Methods of Artifact Analysis

We produced 3D digital morphometric point cloud models for all 13 tools from
PFA2 using a NextEngine 3D laser scanner. The resulting 3D point clouds were further
processed with MeshLab (v1.3.2–64 bit), which is a freely-available 3D triangular mesh
processing software, in order to create digital visuals that can be used to highlight
artifact attributes with particular technological significance. Line drawings of flake scar
boundaries for each of the four stemmed projectile points were created in Adobe
Illustrator (v.14) from 2D flatbed digital scans. We measured the number of facets, the
angle, width and thickness of intact striking platforms retained on 64 pieces of debitage.
Single face flake area was measured from 2D flatbed scans of all debitage using
ImageJ (v1.47) image processing and analysis software. The resulting flake area data were subjected to a size aggregate analysis (Ahler 1989). Debitage data were subjected to cluster analyses using the JMP (v10) statistical application and the resultant data were interpreted using methods described by Cary (2012: 466-472).

**Technological Attributes**

The four stemmed points bear similar elongate blades, clear shouldering, stems with straight or slightly contracting margins, and subtle to pronounced ears (Figure 8). Such stemmed point forms are best known in Columbia River Plateau region of the Pacific Northwest from the Lind Coulee site of southeastern Washington (Daugherty 1956). Lind Coulee points are considered as part of the Windust Phase (Leonhardy and Rice 1970) by many Plateau archaeologists and the type is also commonly included as an element of the Western Stemmed Tradition in the Great Basin and throughout the Far West (e.g., Bryan 1980; Beck and Jones 2013). The PFA2 stemmed points are relatively thin and average 63.0 mm long, 19.4 mm wide, and 4.9 mm thick (Table 3). Flake scar sizes and attributes suggest an exclusive use of pressure flaking to thin and shape each projectile point (Figure S1). Asymmetry in blade shape is most pronounced in two of the stemmed points (catalog numbers 73-629 and 73-628), which retain near-constant convexities on one margin and straightened or irregular edge shapes on the opposite side. On these points, portions with straightened or irregular blade margins retain clusters of small flake scars on both blade faces, which probably reflect edge resharpening by pressure flaking. Such evidence suggests that the stemmed projectile points may have also served as knives for skinning and cutting activities; actions that required differential resharpening to rejuvenate used edges. Point 73-626 bears fine
serrations on both of its blade margins. Points 73-627 and 73-626 have beveled blade cross sections (Figure S2), which Lipo et al. (2012) suggest may be purposeful design attributes that produce in-flight rotational spin and enhance the ballistic qualities of thrown projectiles.

Digital 3D models of stemmed projectile point haft elements reveal basal faceting on three of four points (Figures S3 and S4). Specimen 73-629 has clear evidence of fracture on its base and tip. The base of this point appears to have been broken by a bending fracture, which produced an irregular facet approximating 90° articulation with the dorsal and ventral faces (Figure S3). Point 73-628 does not show basal faceting; however, a compression fracture appears to have removed a flake from its base in a direction roughly parallel with the artifact’s long axis (Figure S3). Whether this fracture is the kind that necessitates any sort of secondary modification of the base to produce a facet that would strengthen the load bearing potential of the haft is unclear. Stemmed points 73-627 and 73-626 retain near 90° basal facets that appear to have been abraded (in contrast with the angular facet seen on 73-629). The basal facet on point 73-626 extends roughly halfway across the width of the haft (Figure S4) where it appears to have been truncated by the removal of a flake that narrowed the haft’s convergent margin to a thin edge. A similar feature is present on the base of point 73-627 where a wider basal facet is truncated by the removal of a smaller flake from the facet’s edge (Figure S4).

The uniface (catalog number 73-826) was created on a large CCS flake struck from a high-angle platform core (Figures S5 and S6). Negative flake scars on its dorsal face originate beyond the uniface margin and indicate an earlier series of percussive
centripetal flake removals prior to flake blank production. These centripetal dorsal flake scars appear to have served the purpose of creating a convex surface with a central ridge that was employed during the percussive removal of the uniface flake blank. The flake blank that forms the uniface was detached from its core with a percussive blow placed 19 mm inward from the platform edge. A series of smaller flakes were pressed from the flake blank margin’s right lateral and distal margins, serving to create a regularized high angle unifacial edge. A second unifacially-flaked piece of CCS (catalog number 73-4563) is less refined than specimen 73-826 and appears to be a uniface preform (Figure S8) that broke during an early stage of production.

The larger basalt core (catalog number 73-4630) bears evidence of three unidirectional flake removals from its proximal end (Figure S7). High angle bidirectional flaking is present on the left lateral margin. A natural depression is located on its right lateral margin. Together, these features present what might be the purposeful preparation of a flake production area on the core’s dorsal surface. In this way, the basalt core might be an early preform that was left in the process of being prepared to allow the removal of large flakes in parallel with its convergent margin.

The three blades found in PFA2 were made in accordance with two different production schemes. The two larger blades (73-631 and 73-4634; Figures S9-S11) are made on a brown non-translucent CCS material and retain evidence of multiple centripetal flake scars on their dorsal surfaces, the distal margins of which create a linear ridgeline that runs parallel to the blade’s long axis. Their platforms are faceted and heavily abraded with external platform angles of 74° and 64°, respectively. Notably, when viewed from their sides, the larger blades retain a nearly flat longitudinal angle.
Unlike typical bifacial thinning flakes or flakes struck from discoidal cores, these blades were not struck from a secant angle and they lack a curved longitudinal cross section. Instead, they show detachment by a percussive blow struck in parallel with their core’s convergent margin (the plan view of 73-4634’s platform shows this best). The third, smaller blade (catalog number 73-4617; Figure S9) is made on a translucent yellowish-white CCS material and retains a near-90° platform angle. Small flake removals from the platform onto the upper limits of the dorsal face’s proximal margin indicate platform preparation before removal. The blade’s dorsal ridge retains multiple flake scar removals in parallel with its long axis, indicating recurrent unidirectional blade removal prior to the creation of this blade. Viewed from the side, the blade bears a convex-to-dorsal profile. These flaking features give the smaller CCS blade a classic prismatic form. Use-wear in the form of bifacial microfracturing and polish are evident on straight marginal sections of the larger two blades and along distal margins of the smallest blade. Two modified flakes (73-4627 and 73-4457) made on pieces of CCS debitage were also found in PFA2 (Figure S12), both of which exhibit steep angle unifacial microfracturing along their distal edges.

The single hammerstone (catalog number 73-4423) found in PFA2 is made on a rounded quartzite cobble that bears orange-colored oxide staining on its cortical surface. Small incipient cones of percussion are seen on one end and abrasive wear has removed oxide staining along one of its lateral margins (Figure S13). These surficial features indicate that the cobble was used as a hammerstone and abrader.

Results of Debitage Analysis
Size aggregate analysis of PFA2 debitage reveals that most (82%) flakes have an area smaller than 1.0 cm² (Figure S14, Table S2); however, a separate group of larger flake sizes suggests a moderate bimodality to the debitage population (Figure S15). Platform facet counts are generally low with 37.8% of flakes exhibiting a single platform and 80% of all PFA2 flakes bear ≤3 platform facets. Because low facet counts are positively correlated with core reduction and higher counts with bifacial reduction, the assemblage of platform-bearing debitage appears to primarily reflect core reduction (Tomka 1989:146; Odell 1989:183) with a smaller amount of bifacial reduction and retouch. Given the low percentage of platform-bearing flakes (N = 64, 8.8% of total) in the larger PFA2 debitage assemblage, it still appears that bifacial reduction and edge retouch via pressure flaking created the overwhelming majority of the PFA2 debitage.

Platform thicknesses average 3.9 mm (2.6 mm median) with 62.2% of platforms measuring ≤3 mm thick; however, a 17.8% increase in thickness distribution is seen between 7-8 mm, creating a weak bimodal distribution. PFA2 flake platform width and flake size show a strong covariance (Figure S16), echoing the observations of other debitage studies (Speth 1981; Dibble and Whittaker 1981; Dibble and Pelcin 1995; Pelcin 1997; Dibble and Rezek 2009). Debitage platform widths range between 3-24 mm and average 9.4 mm (median = 8.1 mm). Distributions of platform widths are weighted toward the smaller sizes with 90% of platform-bearing platforms measuring ≤15 mm in width.

Measurement of external platform angle followed Dibble’s method (1997) and revealed that the angle of PFA2 platform-bearing flakes varies between 43-89° and is nearly equally distributed across this range with a midpoint at 69°. PFA2 platform angle
values that range continuously from high to low values may be read to indicate the presence of different reduction strategies. Dibble (1997:157) states that flakes with smaller exterior platform angles should be more frequent where “raw material is abundant, then core maintenance may not be a significant consideration and smaller exterior platform angles may be employed.” Conversely, Dibble (1997:157) explains that in cases where raw materials are scarce or where greater control over flake blank production is needed, “increasing flake exterior platform angles would help both to economize cores and to produce more efficient flake blanks.” We do not expect that CCS nodules were difficult to obtain in the LSRC, given that we have recently located many sources of CCS in a 10 km radius surrounding the Cooper’s Ferry site. Thus, cores with high exterior platform angles may have been used to produce flakes with desired shapes, such as 73-631 and 73-4634 (Figures S9-S11) to serve as functional blades or blanks for the manufacture of stemmed projectile points and other tools. The morphological similarity of striking platforms on specimens 73-631 and 73-4634 to the basal facets on stemmed point specimens 73-627 and 73-626 lends support to this conclusion. The PFA2 uniface (73-826) also retains its original striking platform, which bears a 72° exterior platform angle, and may have been produced as another such controlled core flake.

In order to test whether these two inferred groups of platform bearing debitage were real, we performed Ward, Average and K-Means cluster analyses on log10 transformed data for platform angle, platform thickness, platform width, and flake area in cm². The number of clusters to be retained was determined by examining cluster stability across solutions as well as by using distance plots while cluster validity was
determined by the high degree of stability across solutions. Results of cluster analyses reveal two distinct groups in the artifact assemblage that are highly stable across multiple algorithms, with only one case being grouped differently between modes (Figures S16 and S17). Comparisons between retained clusters and artifact metrics show that these two groups differ primarily on platform width and thickness and secondarily on flake area. Platform angle did not covary with retained groups. Comparison of these groups with artifact metrics shows that one group tended to have wide, thick platforms, and the second group bearing thin, narrow platforms. Notably, PFA2 lacks debitage with platforms that measure in a middle zone between these two end-member groups—a fact that may reflect two distinctly different processes of lithic reduction: initial core reduction to produce larger flakes (e.g., blades 73-631 and 73-4634) and secondary modification of the larger flakes by pressure flaking to produce the stemmed points and larger uniface—we expect that such an operational sequence would produce few if any flakes with metric attributes in the middle size range. Although it seems logical to link the debitage and formed tools from PFA2 into a manufacturing continuum, there are alternative interpretations. Because PFA2 originates from a buried surface (LU3 and S1) that bears its own archaeological component (Davis and Schweger 2004), debitage may have arrived in PFA2 through a number of ways. The flakes may have been placed in the pit during one last repair of the cached tools—many of the smaller flakes appear to be generated from pressure flaking, which is consistent with the results of the PFA2 debitage size aggregate analysis but does not explain the presence of larger flakes. Alternatively, the debitage may have been present in LU3 sediments and disturbed during the construction of PFA2 to be ultimately returned to
PFA2 as a random debitage population within the pit’s sedimentary backfill. Given the proximity of archaeological materials in LU3, this interpretation is plausible as well and we cannot rule out the possibility that debitage arrived in PFA2 through the some combination of all processes described here. Therefore, a full interpretation of this pattern must await a more complete analysis of the LU3 lithic assemblage. Lastly, we must consider that PFA2 might have served as a trash pit for the disposal of chipping debris and food waste during an occupation on LU3’s surface. Although we remain skeptical that functionally intact, formed tools would be purposefully discarded, we can imagine that they might be opportunistically placed in an available trash pit that would later serve as a cache container.

Discussion

There are four spectacular early artifact caches in the Far West that include fluted projectile points, large bifaces and bone rods: East Wenatchee (Gramly 1993; Lyman et al. 1998; Mehringer 1988), Anzick (Jones and Bonnichsen 1994; Lahren and Bonnichsen 1974; Owsley and Hunt 2001; Wilke et al. 1991), Simon (Butler 1963; Butler and Fitzwater 1965; Muto 1971; Woods and Titmus 1985) and Fenn (Frison 1991; Frison and Bradley 1999) (Figure 1). These “Clovis caches” are considered to represent a unique aspect of the Paleoindian lifeway and have been variously interpreted to reflect ritual offerings, collections of instructional materials, or a provisioning strategy for establishing sources of high quality toolstone in material-poor or little explored landscapes (see Kilby and Huckell 2013 for a recent summary).
Outside of PFA2 at Cooper’s Ferry, we know of only one other clear example of a WST artifact cache. Amick (2004) describes a collection of large obsidian biface preforms and completed Parman type projectile points from the McNine Cache, reportedly discovered by a collector somewhere in northwestern Nevada. Amick (2004:139) lists several reasons why the McNine cache may not have been a utilitarian collection of objects:

1) none of the objects appear to have been used; even the projectile points seen (sic) to have been arrested at a penultimate stage of manufacture; 2) a diverse sequence of diagnostic late stage production forms is represented; 3) these tools are oversized and show evidence of transport wear; 4) greater-than-average skill level characterizes their manufacture; 5) several flaking platforms were carefully isolated and prepared but not removed, suggesting they may have been left intentionally to serve as static representations of the process of Parman point manufacture; and 6) many of these pieces are coated with a reddish-brown mineral film, perhaps red ochre, often associated with ritual internments.

The McNine cache bears strong similarities to other Far Western Clovis caches; however, why this is so and what these similarities mean is not clear (Amick 2004). How the PFA2 cache compares to known Clovis and WST caches in the Far West can be more fully addressed by considering some of Kilby and Huckell’s (2013:268-269) research themes related to Clovis caches, which are reworded here to better focus on our topic at hand.
The Cooper’s Ferry PFA2 Cache Provides a Unique Perspective on WST Lithic-Tool Manufacture and Maintenance

Toolstone provenance analysis reveals that some PFA2 artifacts were made from one known local CCS source and—based on their visual similarity to recently discovered but yet uncharacterized raw material sources—the remaining CCS artifacts were probably made on raw materials found at other LSRC source localities. Thus, it appears unlikely that the PFA2 cache was intended to serve as a raw material provisioning point in the LSRC for peoples unfamiliar with local toolstone source distribution. Instead of containing numerous cores and tool preforms made on exotic toolstones, the PFA2 cache shows the storage of finished tools we expect to see in a basic WST toolkit made from nearby lithic sources. We hypothesize that this pattern shows that the cache’s creators expected to return to the site to resume seasonal foraging activities at a future time.

Our analysis of the PFA2 cache adds weight to the hypothesis that WST projectile points, at least in the Columbia River Plateau region, could be made by pressure flaking flake blanks that had been struck from specially prepared cores (cf. Davis et al. 2012). Maintenance of WST points in PFA2 includes edge resharpening—producing a serrated blade in one case—while the points were in their hafts. Although not entirely clear at this time, basal faceting on stemmed points may reflect the purposeful retention of their blank’s original striking platform, an attribute manufactured by strategic reduction of the haft’s proximal edges or repair of a fractured base by pressure flaking and edge grinding. However they were created, basal facets on WST projectile point hafts may have served as functional attributes that improved the tool’s
durability and even the transmission of impact force when used as projectile weapons. Lastly, beveled blade cross sections may have been created on two stemmed projectile points to enhance their ballistic properties as thrown weapons.

*The Cooper’s Ferry PFA2 Cache Provides Insight into the WST Toolkit*

Prior to the discovery of PFA2, there were few examples of WST artifact assemblages from well-documented, intact stratigraphic contexts and PFA2 is the first early WST cache discovered in the course of professional archaeological investigation in the Far West. The PFA2 cache contains a set of previously used tools of sizes and designs that are similar to objects found in sites outside of caches, which contrasts with Clovis caches that often contain oversized, unused or unfinished bifacial tools. The PFA2 toolkit is comprised of artifacts that are commonly found in WST components throughout the Plateau and beyond. Functionally, the PFA2 cache contains a general WST toolkit used for hunting, processing, and the manufacture and maintenance of organic and inorganic tools. The pit containing the PFA2 cache seems too large to have been constructed simply to accommodate 13 stone tools and may have also included other organic items that have since decayed (e.g., craft items made of wood, leather and/or fiber); however, no stains, voids, or degraded amorphous organic materials that might signal the earlier presence of organic objects were seen during excavation. PFA2 may have initially served as a storage unit for surplus food or perhaps even to produce certain fermented foods that require aging in the ground and was only used later for equipment storage.
When Coupled with Raw Material Provenance Studies, the Location and Contents of WST Caches Inform our Understanding of WST Mobility and Land-Use Practices

Caching of equipment as a form of strategic storage for future use is associated with a collector-based foraging pattern (Binford 1980). In this manner, equipment manufactured for tasks that are specific to a particular time and place are stored in a designed holding facility. Equipment caches might also play a role as insurance or backup systems, where additional stores of tools are placed at strategic locations in the landscape as a low cost, embedded aspect of moving in a landscape (Binford 1979). In time of need, these cached tools could be retrieved to replace or supplement a toolkit. Overall, the creation and use of equipment caches is intended to help to solve problems of logistical mobility and improve efficiency in resource exploitation. The choice to create PFA2 at Cooper’s Ferry was probably partly related to the site’s position in the LSRC landscape. The confluence of Rock Creek and the lower Salmon River marks a major tributary canyon junction in the LSRC. Major tributary canyons are irregularly distributed in the LSRC, primarily controlled by faulting and lithological boundaries between bedrock types. While it is not impossible to climb out of the canyon from nearly any point along the Salmon River, major tributary canyons like that of Rock Creek offer the easiest access to adjacent uplands. Moreover, large tributary canyons in the Salmon River basin provide the best access to the most extensive riparian ecosystems and grassland-forest ecotones and the economic resources they support. The Rice Creek canyon is located two kilometers downstream from Cooper’s Ferry and provides access to the eastern side of the LSRC, the adjacent uplands of Joseph Plains and Doumeq Plains and the western slope of Hells Canyon. From the Rock Creek-
Rice Creek locality, the next major tributary canyon junctions are located 26.5 km downstream at Deep Creek and 23 km upstream at White Bird Creek. How PFA2 reflects a larger regional pattern of WST behavior is difficult to know at this time, given the paucity of other WST caches. That the PFA2 cache does not appear to reflect ritual behavior or an effort to strategically provision the LSRC with tools made from high-quality, exotic raw materials is remarkable as it stands in contrast with all fluted point caches in the Far West. If the PFA2 cache was indeed created between 11,370-11,410 B.P., then the fact that WST peoples made an cache of tools manufactured from local toolstones in order to establish a technological safety net in the LSRC speaks to a deep familiarity with the region possibly at a time when Clovis peoples appear elsewhere as pioneering peoples in North America. Of course, the simplest explanation is that WST peoples built the PFA2 equipment cache at Cooper’s Ferry because they intended to return to the site to perform foraging activities at a future time and decided to store extra tools rather than carry them elsewhere. This interpretation is equally remarkable since it supports the assertion that early WST peoples utilized collector-style logistical strategies as part of their adaptive lifeways (cf. Ames 1988; Davis et al. 2012).

*WST Caches May Provide Unique Insights into WST Ideology and Social Behavior*

Amick (2004:139) considers “unfinished tools of extraordinary size, which are made from exceptional raw materials, stained with red ochre…” as key criteria for defining an artifact cache’s function as ritualistic. To this, we might add the presence of associated human remains within the feature or in its adjacent sediments, as seen at the Anzick site. Because it lacks these kinds of elements, we do not consider the PFA2 cache as a ritual or mortuary construction and therefore pivot our discussion to
utilitarian caches and their social implications. Schiffer (1987:78) describes the creation of a utilitarian “banking cache” as a process in which equipment or other materials were placed within an above or belowground hiding place. Such caches of equipment differ from food caches or burials as they are culturally created repositories typically containing “highly specialized and maintained personal equipment” (Wilke and McDonald (1989:55)) to be recovered from a hidden location by their creators and used at a future time and lack foodstuffs, human remains, or religious items. Equipment caches would enter the archaeological record upon the death of their owner (Wilke and McDonald 1989:55) or if their location is forgotten or difficult to revisit. Depending on the nature of the materials stored, and whether the items are for public or private use, equipment caches take various forms and may or may not be concealed. For best preservation, organic items would be stored in various chambers, pits, and/or containers away from dampness, insects, and animals (e.g., Frison et al. 1986; Loud and Harrington 1929; Wilke and McDonald 1989). In addition to these storage options, inorganic items could be preserved in unlined pits dug into the sediment of open sites. Although we can only speculate on the social structure of WST peoples, the creation of utilitarian equipment caches in the LSRC might signal the operation of a logistical support network intended to enhance the fitness of members of social groups who knew about the existence of such caches or knew to look for such equipment storage facilities at key locations in the LSRC, such as at the junction of large tributary canyons with the main Salmon River canyon. Thus, PFA2 may represent one instance in a larger network of logistical support stations established by WST peoples to extend their abilities to forage within the canyonlands of the southern Columbia River Plateau region.
Individuals familiar with the equipment cache network could access stored equipment in times of emergency or in order to lengthen the time they could have spent hunting before having to obtain new tools. By creating caches of stone tools that could be used for hunting or for making other kinds of tools the WST peoples who made PFA2 appear to have been practicing a form of bulk acquisition for delayed consumption and in this way, working to mitigate their ability to deal with the uncertainty of future conditions and situations.

**Conclusions**

The discovery of a cache of WST projectile points and other lithic tools at the Cooper’s Ferry site has several implications for early Far Western prehistory. This is the first comprehensive description of what is probably a utilitarian cache of tools placed at a key point in the LSRC landscape in order to provide a node of technological support for WST peoples. Although WST artifacts are known from other sites throughout the Far West, PFA2 provides a unique view of what a complete version of a WST toolkit looked like, at least from the perspective of its lithic technology. Analysis of the cached tools and associated debitage provides empirical evidence that supports the technological operational sequence associated with WST projectile point manufacture as described by Davis et al. (2012). A new set of radiocarbon assays from one of the site’s upper deposits leads us to reject the $7300 \pm 70$ B.P. and $8710 \pm 120$ B.P. age estimates from PFA2 that were originally suspected by Davis and Schweger (2004) to be secondarily displaced in the site’s stratigraphic sequence. A hypothesis that PFA2
was created between 11,410 ± 110 B.P. and 11,370 ± 40 B.P. remains viable but requires additional verification.

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Roosevelt, A.C., J. Douglas and L. Brown


Schiffer, M.B.

Speth, John D.

Tomka, Steven A.

Wilke, P.J., J. Flenniken and T.L. Ozbun

Wilke, Philip J. and M. McDonald

Woods, J. C. and G. L. Titmus
Notes

1Student t-test results show significant differences in flake area (group 1 (M = 0.132, SD = 0.239), group 2 (M = 0.448, SD = 0.362) conditions; t (23.4) = 3.2, p = 0.004), platform thickness (group 1 (M = 0.274, SD = 0.164), group 2 (M = 0.855, SD = 0.147) conditions; t (28.4) = 11.8, p <0.0001), and platform width (group 1 (M = 0.822, SD = 0.147), group 2 (M = 1.14, SD = 0.122) conditions; t (30.4) = 7.6, p <0.0001).
El descubrimiento de un depósito de artefactos conteniendo puntas de proyectil en la Tradición de Tallo Occidental (Western Stemmed Tradition) en una fosa claramente definida, en el sitio de Cooper’s Ferry, ofrece una perspectiva única sobre la tecnología lítica temprana y organización logística en el Occidente de América del Norte. La descripción y el análisis de este depósito revela nuevas manifestaciones, incluyendo: el uso de un cumulo rocoso que cubrió la superficie de la fosa; algunos de los artefactos fueron hechos de silicatos criptocristalinos que se encuentran a 16 km de distancia; análisis de los desechos de talla, incluyendo las medidas basadas en agregados y sus atributos, identificaron dos distintas etapas de reducción lítica presentes en el acopio. Nuevas fechas por radiocarbono indican que este depósito probablemente no corresponde al Holoceno temprano y bien puede datar a fechas por radiocarbono de entre 11,370-11,410 años AP. A diferencia de depósitos Clovis, el de la fosa A2 en Cooper’s Ferry, parece ser un conjunto de herramientas de uso general que probablemente fue colocado en el sitio para su uso a futuro. Si las fechas 11,370-11,410 AP datan la creación del depósito en la fosa A2, entonces los autores probablemente no fueron pioneros en las bajas inmediaciones del cañón del río Salmón (Salmon River canyon), pero poseían un conocimiento particular acerca del paisaje y fuentes de materia primas locales; estos patrones sugieren una mayor antigüedad para los grupos recolectores de la Tradición de Tallo Occidental.
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Figure S4
Click here to download high resolution image
Figure S14
Click here to download high resolution image
Table 1. Raw material types, basic morphometric measures, and provenience of formed artifacts found in PFA2 at the Cooper’s Ferry site. PPT refers to projectile point. Catalog # refers to the unique artifact catalog number assigned to each object. CCS = cryptocrystalline silicate. Meta = metamorphic rock. ML = maximum length (mm). MW = maximum width (mm). MT = maximum thickness (mm). Wgt (g) = weight in grams. N = northing. E = easting. Elev. = elevation in meters above mean sea level.

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Table 2. Artifacts and faunal materials found within PFA2, Cooper’s Ferry site. CCS = cryptocrystalline silicate.

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<tr>
<th>TOOLS</th>
<th>Biface</th>
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<th>Core</th>
<th>Debitage</th>
<th>Hammerstone</th>
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<th>Uniface</th>
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<th>CCS</th>
<th>Metamorphic</th>
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<td>641</td>
<td>10</td>
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<table>
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<tr>
<th>FAUNAL</th>
<th>Bone (NISP)</th>
<th>Bone (g)</th>
<th>Mussel Shell (g)</th>
<th>Snail Shell (g)</th>
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<tr>
<td></td>
<td>65</td>
<td>19.8</td>
<td>0.3</td>
<td>0.2</td>
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Table 3. Basic description of stemmed projectile points from PFA2. CCS refers to cryptocrystalline silicate raw material. Cat# refers to unique artifact catalog number assigned to each object.

Cat#: 73-626; Material: CCS; Condition: complete; Weight: 5.8 g; Max Length: 65.2 mm; Max Width: 18.9 mm; Max Thickness: 4.9 mm. Notes: stem has slightly contracting straight-sided margins with irregular, slanted base. Oblique, moderately defined shoulder with slight earing seen on one side only, which extends up to regular convex blade that tapers toward sharp tip; other side lacks well-defined shoulder and blade margin is angled but nearly straight, tapering sharply near tip. Flaking is invasive with a weakly developed collateral pattern; secondary removal of small flakes seen along margins.

Cat#: 73-627; Material: CCS; Condition: complete; Weight: 6.3 g; Max Length: 60.2 mm; Max Width: 21.7 mm; Max Thickness 4.7 mm. Notes: stem has slightly contracting straight-sided margins with irregular, slanted base. Oblique angled, strongly eared shoulders seen; blade is nearly parallel with convex edges that taper gradually toward sharp tip. Flaking pattern is invasive and somewhat irregular, although some flakes extend perpendicularly from the blade edge and terminate at the midline; secondary edge trimming seen in removal of small flakes from both margins.

Cat#: 73-628; Material: CCS; Condition: complete; Weight: 5.2 g; Max Length: 63.6 mm; Max Width: 17.8 mm; Max Thickness: 4.5 mm. Notes: stem has slightly convex margins, which sharply taper to flat base. Oblique angled, slightly eared shoulder seen on one side only, which extends up to convex blade that tapers sharply toward a sharp tip; opposite blade edge is uneven, and lacks well-defined shoulder. Flaking pattern is invasive and weakly collateral; secondary edge trimming seen in removal of small flakes from both margins.

Cat#: 73-629; Material: CCS; Condition: broken; Weight: 4.2 g; Max Length: 40.7 mm; Max Width: 19.0 mm; Max Thickness: 5.3 mm. Notes: remainder of stem appears to show slightly contracting margins. Oblique, prominent eared shoulder seen one margin, extending upwards to convex blade that medial tapers toward distal end. Opposite blade edge is angled with nearly straight margin that may have fragment tapered sharply near tip; also retains weak, poorly defined shoulder. Flaking is invasive, producing collateral pattern in mid-section of specimen; flaking is irregular towards distal end; secondary edge trimming seen in removal of small flakes from both margins.
Table S1. Description of lithostratigraphic units (LU) and pedostratigraphic units (corresponding pedostratigraphic unit put into parentheses, e.g., S2) encountered at 10IH73, Unit A (from Davis and Schweger 2004).

LU1: Rounded to subrounded basalt clasts of fine pebble to medium cobble size with no apparent bedding structure in a relatively poorly sorted, clast-supported matrix. Carbonates coat and cement clasts together in some areas. Lower boundary was not observed.

LU2: A yellowish brown (10YR 5/4), massive, moderately well-sorted sand. Calcium carbonate is dispersed throughout the sediment matrix. This lowermost sand has a sharp irregular basal boundary that appears to be conformable.

LU3 (S1): A brown (10YR 5/3), massive, fine sandy loam bounded below by a gradual smooth conformable boundary. Calcium carbonate is present as fine filaments throughout the deposit.

LU4: A yellowish brown (10YR 5/4), massive, fine loamy sand with a clear wavy conformable lower boundary. Calcium carbonate is seen as fine filaments and diffuse concentrations.

LU5: A horizontal deposit of brown (10YR 5/4), massive, moderately well-sorted sand without visible structures. Mica flakes and biotite accompany a large percentage of quartzitic and plagioclase sands. The lower boundary of this unit is sharp, conformable, and retains several irregular lobate structures, suggesting soft sediment deformation, similar to those seen in the immediately overlying unit.

LU6 (S2): Brown (10YR 4/3), massive, loamy sand. The percentage of grain sizes greater than coarse sand increases in this unit. The lower boundary of the unit is conformable with a sharp and irregular form. Lobate extensions of sediment reaching down into the underlying geologic unit are interpreted as evidence of soft sediment deformation during alluvial deposition. Prehistoric site occupation appears to have contributed to some sediment disturbance here as well.

LU7: A thin deposit of dark grayish-brown (10YR 4/2), massive, fine loamy sand, which retains a sharp, wavy lower boundary that dips slightly to the west.

LU 8a and LU 8b: A grayish-brown (10YR 5/2), massive, medium sand, with poorly preserved evidence of horizontal bedding in few places. The unit is dominated by quartz and plagioclase sands and includes biotite, mica flakes, and a small percentage of silt. A sharp bedding line is seen in all walls of Unit A, dipping downward to the northwest corner. This sharp, wavy bedding line is composed of a fine silt with some carbonate accumulation, and is thought to represent an erosional unconformity and a brief change in depositional energy. Although LU 8 is divided into two units on the basis of the erosional unconformity, LU 8a and LU 8b appear identical in nature. LU 8a shares a sharp, wavy boundary with LU7.

Fill (S3): Composed of a dark brown (7.5YR 3/2), massive, medium to fine loamy sand with occasional gravels. Thin, horizontal layers of compacted sediment were observed in some areas of the unit, corresponding to old road surfaces. Historic and modern debris was recovered from these sediments. The lower boundary of the unit is clear and irregular, and is unconformable due to cultural disturbance. This deposit relates to local accounts of fill disposal during historic road-building activities.
Table S2. Surface area measures and cumulative frequencies for debitage from PFA2.

<table>
<thead>
<tr>
<th>Surface Area (square mm)</th>
<th>N</th>
<th>Cumulative Frequency (N)</th>
<th>Cumulative Frequency (%)</th>
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<td>185</td>
<td>28.2</td>
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<tr>
<td>0.21-0.4</td>
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<td>55.7</td>
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