ISSN 0893-2271

Idaho Archæological Society
SINCE 1971

Volume 43, Number 1

IAS

IDAHO ARCHAEOLOGIST

Journal of the Idaho Archaeological Society

THE IDAHO ARCHAEOLOGIST

Scope

The *Idaho Archaeologist* publishes peer reviewed articles, reports, and book reviews. Though the journal's primary focus is the archeology of Idaho, technical and more theoretical papers having relevance to issues in Idaho and surrounding areas will be considered. The *Idaho Archaeologist* is published semi-annually in cooperation with the College of Arts and Sciences, Boise State University as the journal of the Idaho Archaeological Society.

Submissions

Articles should be submitted online to the Editor at mplew@boisestate.edu. Upon review and acceptance authors are required to electronically submit their manuscripts in Microsoft Word. It is the responsibility of authors to insert illustrative materials and tables into texts. Titles and headings should be formatted in Calibri, Bold, 12 pt. The body of the text should be Cambria, 11 pt.

Style Sheet

The *Idaho Archaeologist* generally conforms to the style sheet of *Plains Anthropologist.*

Subscriptions

Subscriptions may be obtained by writing the *Idaho Archaeologist*, Department of Anthropology, Boise State University, 1910 University Drive, Boise, Idaho 83725-1950. To subscribe, change an address, or order back issues, please write to the address above or send an email to anthropology@boisestate.edu.

Idaho

ARCHAEOLOGIST

Journal of the Idaho Archaeological Society

Volume 43, Number 1 Spring 2020

CONTENTS

Article

Cover Photo: A dusting of snow on the Boise foothills. Hart Images Photography. Copyright Smugmug, Inc.

IDAHO ARCHAEOLOGIST, Vol. 43, No. 1 Spring 2020, 4-36

ARTICLE

Quarrying Chert and Quartzite in an Obsidian-Rich Landscape: Recent Investigations at Hidden Springs in Eastern Idaho

BROOKE S. ARKUSH

Weber State University

Abstract

The Hidden Springs locality (site 10-BT-1972) in the Lemhi Range of far eastern Idaho consists of a tool stone quarry, a lithic workshop, and two seasonal camps dating primarily between 4200 B.C. and A.D. 1700. Archaeological investigations of this complex by both the U.S. Forest Service and Weber State University resulted in the recovery of some unusual artifacts, including two Scottsbluff projectile points, three overface thinning flakes, and a microcore. This paper focuses on these specimens and several other notable artifacts within the site assemblage, and what they can tell us about prehistoric cultural traditions, settlement practices, and technological organization in the Birch Creek Valley region.

KEYWORDS: Tool Stone Quarries, Scottsbluff Projectile Points, Microblade Technology, Overface Flaking, Embedded Strategies

Introduction

During the summers of 2017 and 2018, the Weber State University (WSU) Archaeology Program conducted test excavations at Hidden Springs (site 10-BT-1972) a large open-air prehistoric camp associated with two fresh water springs and a chert and quartzite/orthoquartzite tool stone source in the Pass Creek drainage of Birch Creek Valley, east central Idaho (Figure 1). Relatively few prehistoric sites in this part of the upper Snake River region have been professionally studied since the early-to-mid 1960s, when what was then Idaho State College (ISC) conducted the earliest field work in Birch Creek Valley (Swanson et al. 1964), most notably the excavations at Veratic (10-CL-3) and Bison (10-CL-10) rockshelters (Swanson 1972) (Figure 1). Both sites proved to contain relatively deep cultural deposits associated with long-term, ephemeral human occupation, with initial use of Bison Shelter dating as early as 10,000 B.C., and that of adjacent Veratic Shelter beginning around 7800 B.C. (Keene 2018). Investigations at 10-BT-1972 were part of a larger WSU Field School-affiliated project concerning the prehistory of Birch Creek Valley that began in 2012, and is focused on reconstructing ancient subsistence and settlement practices, as well as understanding technological organization and source-specific obsidian use. The Hidden Springs project promises to contribute information to our understanding of ancient human use and occupation of the foothill ecozone within the central Birch Creek Valley, an area that was not emphasized by the earlier ISC work.

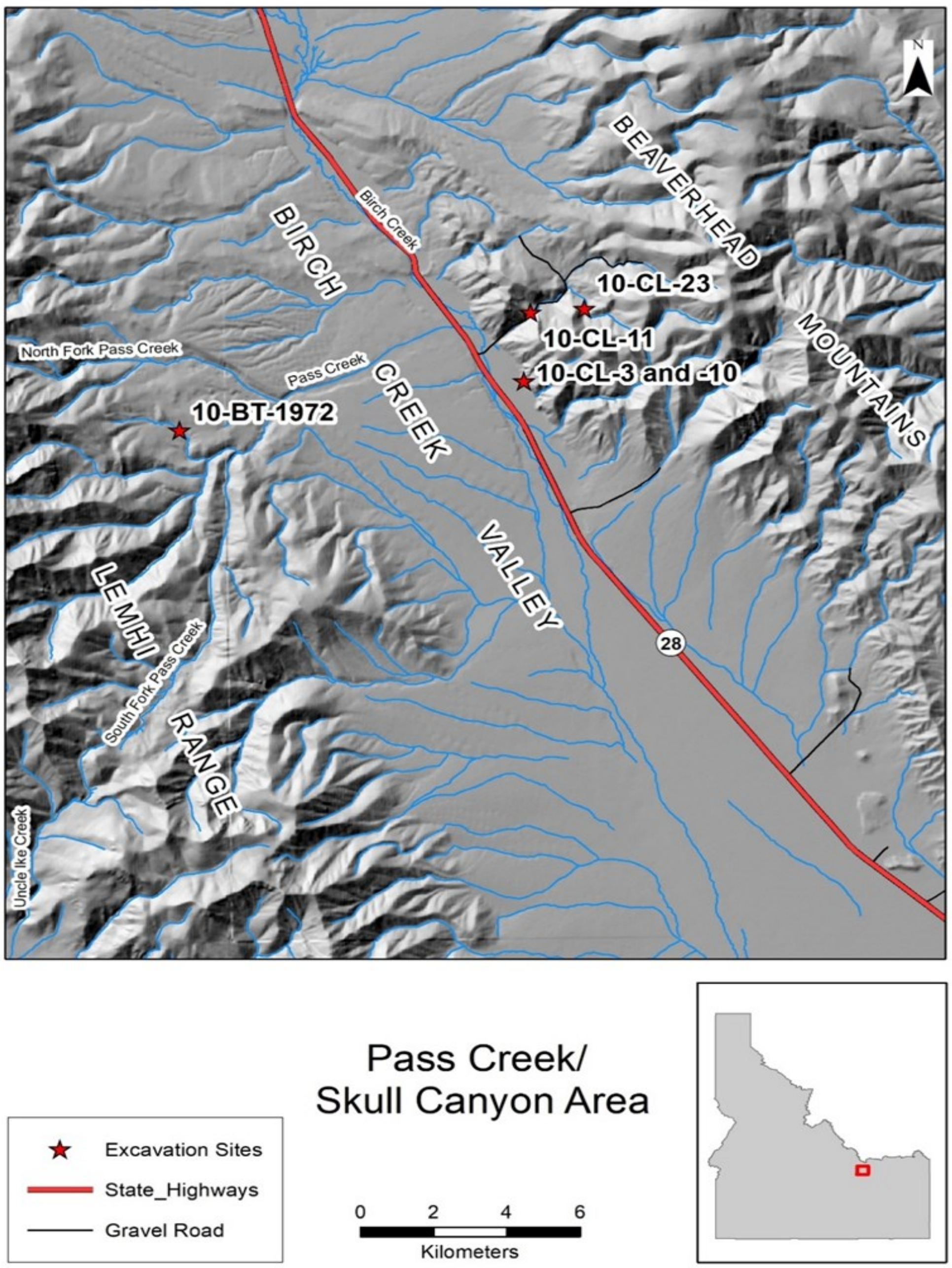

Figure 1. Map of the lower Birch Creek drainage showing the location of 10-BT-1972 in relation to previously excavated sites in the Blue Dome/Skull Canyon area.

This paper provides a general overview of 10-BT-1972, the role that the tool stone quarry seems to have served within the local settlement/subsistence regime, and highlights the most interesting aspects of the site's artifact assemblage - six hammers, three overface biface thinning flakes, two broken Scottsbluff projectile points, and a single microblade core. By doing so, I promote new perspectives on the lithic traditions of the greater Birch Creek area, and propose that ancient residents typically scheduled their seasonal occupation of Hidden Springs in order to exploit ecozone-specific plant and animal foods as well as high quality, non-igneous tool stone.

Birch Creek Project Background and 10-BT-1972 Site Overview

Located within the Dubois Ranger District of the Caribou-Targhee National Forest, 10-BT-1972 lies on the eastern flank of the Lemhi Range at an elevation of 7100 ft., and is the third prehistoric site within the greater Skull Canyon/Blue Dome area to be investigated by the WSU Field School. The other two sites are Bobcat Shelter (10-CL-11) and Cottontail Shelter (10-CL-23), both located in Skull Canyon 10 to 12 km. east/northeast of Hidden Springs in the southern Beaverhead Mountains (see Figure 1). Bobcat Shelter served mostly as a bighorn sheep hunting camp from ca. 5800 B.C. to A.D. 1700, and contained over 3 m. of cultural deposits (Arkush 2017). During two field seasons of work at Bobcat, we documented 25 strata and five hearth features, and recovered approximately 5,100 pieces of butchered bighorn sheep and medium artiodactyl bone that represent a minimum of 54 bighorn sheep (Miller 2017). Nearby Cottontail Shelter functioned mostly as a short-term base camp from about 3700 B.C. until A.D. 1700, and contains cultural deposits at least 4 m. in depth (Arkush 2016). Over the course of three summers at 10-CL-23, we encountered 10 stratigraphic units, five hearths, and one distinct living surface, and recovered a large faunal assemblage (NISP = ~19,300) that also was dominated by bighorn sheep. Both of the Skull Canyon shelters yielded relatively large tool assemblages. When combined, the ISC- and WSU-recovered collections total 331 specimens (10-CL-11: n = 117; 10-CL-23: n = 214), including numerous dart and arrow points, projectile point preforms, bifaces, unifaces, as well as various ornaments, a few bone tools, and a slab metate.

The Hidden Springs project was inspired by Caribou-Targhee National Forest Archaeologist Ali Abusaidi, who told me about a possible Late Paleoindian-aged Cody Complex (ca. 9300 – 6800 B.C.) component occurring there. In 1992, a Forest Service archaeology survey crew collected the base of a chert Scottsbluff spear point from the bottom of a shallow arroyo in the northern portion of the site (Willingham et al. 1992), and the possibility of finding a buried Cody Complex-related occupation at Hidden Springs served as a primary factor in excavating this location. 10-BT-1972 lies within a small montane basin and the area supports a variety of plants including big sagebrush (*Artemisia tridentata*), needle-and-thread grass (*Stipa comata*), crested wheat grass (*Agropyron cristatum*), wild onion (*Allium* sp.), and mountain ball cactus (*Pediocactus simpsonii*) (Figure 6). The entire site complex measures approximately 150 x 420 m. and consists of a northern lithic workshop and camp area (Locus 1), an adjacent stone quarry, and a southern habitation area (Locus 2) (Figure 3). The semi-hidden and protected nature of the locality as well as the occurrence of potable water and a high-quality tool stone source seems to have attracted forager bands from late spring through early fall for millennia. Our investigation at Hidden Springs was intended to address five primary research domains: site chronology, seasonality, subsistence focus, function, and the organization of chipped stone technology. Unfortunately, the absence of hearth features and a paltry faunal assemblage prevented us from recovering unequivocal information regarding the main seasons of site use and primary plant and animal foods. However, six artiodactyl bone-based radiocarbon dates have provided a basic absolute chronology for Hidden Springs; when these dates are combined with temporal data associated with time sensitive projectile points, the upper one meter of site deposits date between approximately 6150 B.C. and A.D. 1800 (Table 1).

Because surface artifacts at Hidden Springs cover such an extensive area and locating high concentrations of buried cultural materials through traditional small-scale testing techniques such as augering or shovel test pits would have been unreasonably time consuming, it was decided to have a geophysical survey conducted at Locus 1 and 2 in order to guide the placement of test units. This work was done by Cannon Heritage Consultants and consisted of a 2 x 35 m. linear transect and a 10 x 40 m. rectangular block at Locus 1 that was surveyed with ground penetrating radar, and a 20 x 20 m. square block at Locus 2 that was inspected with both ground penetrating radar and magnetic gradiometer survey (Peart et al. 2017). The only magnetic anomalies that were detected through remote sensing were thirteen potential cultural features at Locus 2, of which four had a low magnetic strength and were interpreted as possible prehistoric hearths.

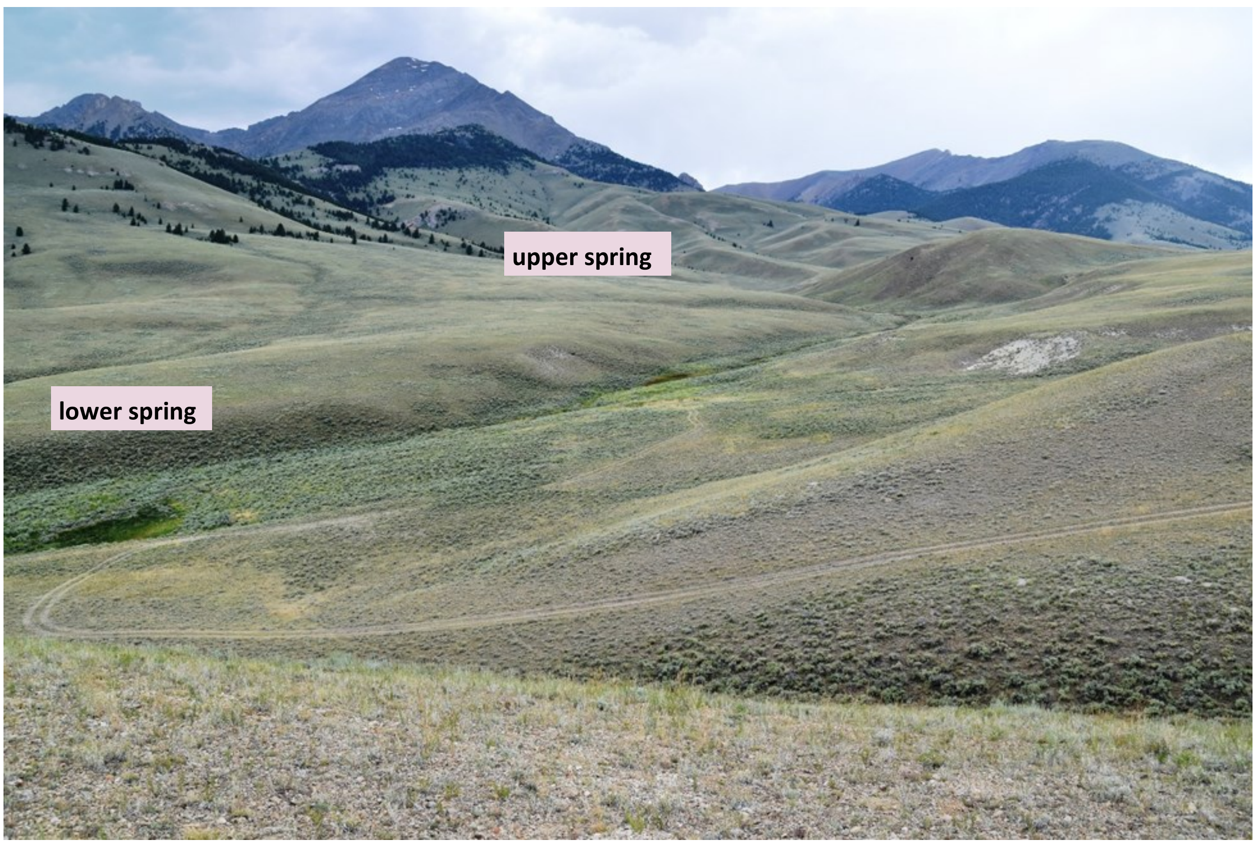

Figure 2. Northwest-facing overview of the Hidden Springs site, with 12,200 foot-tall Diamond Peak on the horizon. Locus 1 and the quarry occur north and east of the upper spring, whereas Locus 2 lies just east of the lower spring.

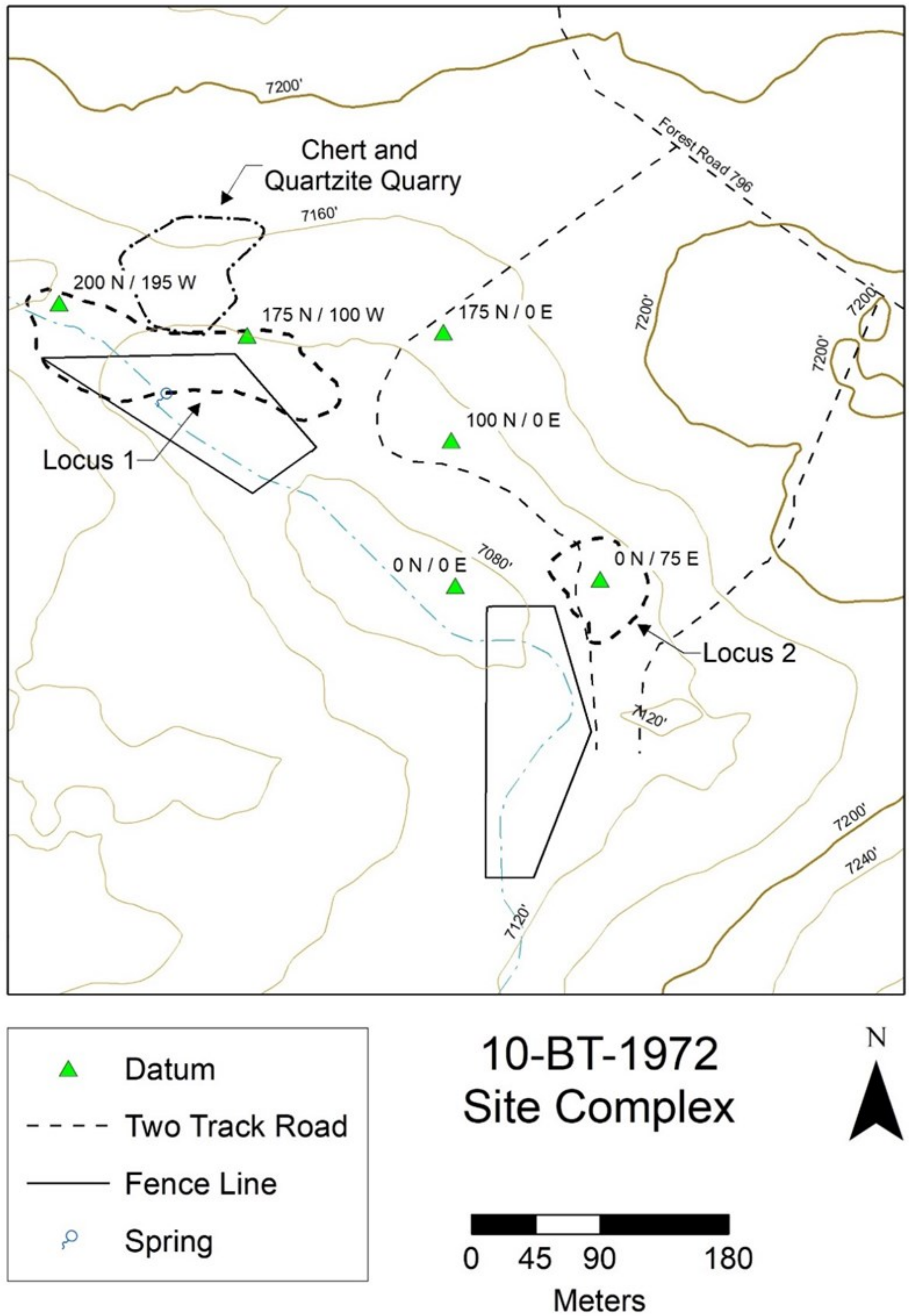

Figure 3. Map of 10-BT-1972 showing locations of Locus 1 and 2, the tool stone quarry on the hillside immediately north of Locus 1, and the site datum network.

Table 1. Radiocarbon Dates for Locus 1, 10-BT-1972.

Laboratory Code	Provenience	Sample Material	Radiocarbon Age (1 δ error)	1 δ Calibrated Age	1 δ Calendric Age
D-AMS 024536	Unit 155N/111W, 29 cm. bgl (below ground level)	artiodactyl bone collagen	5292 ± 42 B.P.[1]	6161 – 6012 B.P.	4211 – 4063 B.C.
D-AMS 024537	Unit 179N/176W, 20-30 cm. bgl	artiodactyl bone collagen	4000 ± 36 B.P.	4515 – 4439 B.P.	2565 – 2489 B.C.
D-AMS 024538	Unit 179N/176W, 59 cm. bgl	artiodactyl bone collagen	4659 ± 36 B.P.	5452 – 5343 B.P.	3502 – 3394 B. C.
D-AMS 024539	Unit 181N/175W, 62 cm. bgl	artiodactyl bone collagen	3265± 36 B.P. [2]	3554 – 3445 B.P.	1604 – 1496 B.C.
D-AMS 033439	Unit 179N/176W, 70-80 cm. bgl	artiodactyl bone collagen	4532 ± 32 B.P.	5286 – 5093 B.P.	3336 – 3144 B.C.
D-AMS 033440	Unit 179N/176W, 80-90 cm. bgl	artiodactyl bone collagen	4686 ± 32 B.P.	5468 – 5349 B.P.	3518 – 3400 B.C.

[1] – A Northern Side-notched dart point base was recovered from the 20-30 cm. level of this excavation unit, which corroborates this date.
[2] – This date seems to be too young for the depth at which the sample was found; it may derive from a secondary context.

The Quarry

A quarry consisting primarily of high-quality chert nodules with smaller amounts of orthoquartzite and chalcedony occurs within a glacial till deposit immediately north of Locus 1 (Figure 4). The main concentration of quarried stone occupies an area of about two acres (~8,000 $m.^2$), and consists of a near continuous scatter of tested/broken cobbles, decortication flakes, and early stage tertiary flakes (Figure 5), as well as various cores (Figure 6). Small concentrations of early stage reduction debris also occur at scattered chert outcrops north and northeast of the site. No obvious pits were documented within the main quarry area at 10-BT-1972, indicating that most aboriginal quarrying activities focused on the collection of surface nodules as well as striking flake blanks from exposed boulders (Figure 7). If this is the case, then many tool stone acquisition episodes at Hidden Springs may have been "embedded" in basic subsistence pursuits (cf. Binford 1979), with local Native groups having utilized this tool stone source since Late Paleoindian times. The existence of a major microcrystalline silicate (MCS) and quartzite tool stone source within an obsidian-rich landscape is notable, and additional MCS and quartzite/orthoquartzite quarries undoubtedly occur in the moraines that flank the eastern slope of the Lemhi Range.

Our general study area contains prehistoric sites where chipped stone artifact assemblages tend to be dominated by obsidian and artifact quality ash-flow tuff (Arkush and Hughes 2018; Harris 2014; Keene 2018). Much of the former volcanic glass derives from the Bear Gulch and Big Southern Butte sources, whereas the latter tool stone type can be acquired from local exposures of the highly dispersed Walcott Tuff and Packsaddle Creek sources (Arkush and Hughes 2018). All four of these geochemically distinct obsidians occur within 100 km. of the Skull Canyon/Blue Dome locality (Figure 8), and seem to have been the preferred tool stone sources for many aboriginal groups that frequented the Birch Creek drainage, especially for producing dart and arrow points (e.g., Arkush 2016; 2017; Swanson 1972). However, many stone tools that were used for scraping, cutting, and pulverizing had to be made from more durable, non-brittle material that was capable of processing tough materials such as dense plant fiber, wood, thick hides, and bone. In these situations, resilient tool stones like quartzite, chert, and chalcedony oftentimes were required, and Native people no doubt were mindful of places on the landscape that contained these materials in abundance. Given the need of having access to durable tool stone, it seems likely that the quarry at Hidden Springs was visited on a regular basis in order for people to replenish their supplies of fine-grained chert, chalcedony, and quartzite.

Figure 4. Northwest-facing overview of the quarry with arrows pointing towards major concentrations of cores and reduction debris.

Figure 5. Overview of the west portion of the 10-BT-1972 quarry showing reduction debris and natural clasts. The white card in mid foreground is approximately 10 cm. long.

Locus 1

Locus 1 consists of an elongated, four-acre area just northwest and east of the main spring in the northern part of the site (see Figure 3). The southern part of the locus contains relatively shallow archaeological deposits less than 50 cm. deep, and seems to have functioned mostly as a lithic workshop where nodules and flake blanks from the adjacent quarry were worked into cores and early stage bifaces (Figure 9), some of which presumably were then fashioned into tools such as scrapers, knives, and projectile points. The northern portion of Locus 1 seems to have functioned mostly as a short-term habitation area, as indicated by the presence of a milling slab and pieces of processed artiodactyl and lagomorph bone. This is the part of the site that yielded a surface Scottsbluff spear point base, and several excavation units were placed there in hopes of recovering additional Cody Complex materials. Cultural deposits in this portion of the locus were relatively deep, extending to about 100 cm., but we failed to find any definitive Late Paleoindian era artifacts from the three units that were placed along the arroyo terrace near the location where the Scottsbluff point base was found when the site was first recorded. However, we did recover an obsidian microblade core and two quartzite overface flakes in the northern Locus 1 excavation area. Both of these artifact types are unusual in the general study area, afford us an opportunity to learn something new about the regional chipped stone toolkit, and will be discussed in more detail below. Besides the mottled white chert Scottsbluff spear point base, the only other diagnostic projectile points that were found at Locus 1 consisted of a gray quartzite Northern Side-notched dart point base and a complete obsidian Desert Side-notched arrow point (Arkush 2018).

Figure 6. In situ multi directional chert core and associated debitage within the quarry.

Figure 7. Two chert boulders from which large flake blanks have been removed. The white card is approximately 10 cm. long.

Locus 2

Locus 2 is a small, ovate-shaped habitation area approximately 0.9 acres in size located on an erosional surface in the southern part of the site complex (see Figure 3). It contains a diverse, but primarily surficial, lithic artifact assemblage consisting of projectile points, bifaces, unifaces, and debitage, as well as a few slab metates and hammers, an overface flake, and a core (Arkush 2019a). Due to the erosional landform on which Locus 2 occurs, the surface and near-surface assemblages consist of a palimpsest from multiple occupational episodes that transpired over many centuries. Soils in this part of the site transitioned from a loosely compacted silt to a highly compacted clayey silt at a depth of about

20 cm., after which artifact yield plummeted and the digging became extremely difficult. In order to determine whether any of the four low strength magnetic anomalies that were identified during the geophysical survey at Locus 2 contained subsurface cultural features, test units were placed directly over these locations and dug to an average depth of 35 cm. No buried hearths, charcoal, or fire-cracked rocks were encountered during excavation work at Locus 2, with these pits yielding only a small artifact assemblage and one piece of artiodactyl tooth enamel. Five small pieces of medium artiodactyl-sized long bone round out the Locus 2 faunal assemblage, and along with the faunal remains that were recovered from Locus 1, provide us with a basic understanding of the hunting-related activities that were carried out within the general 10-BT-1972 catchment area.

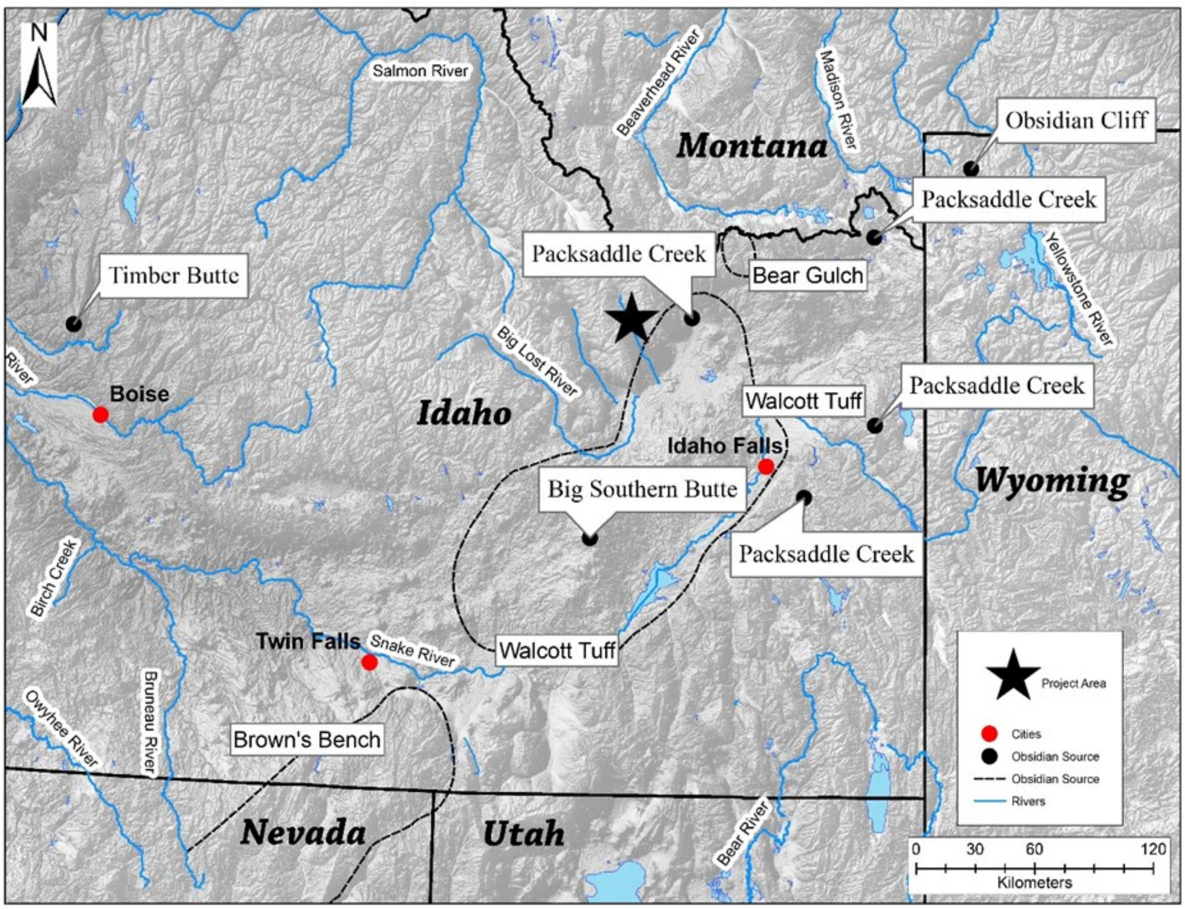

Figure 8. Map of southern Idaho showing locations of major obsidian sources in relation to the Birch Creek Valley, which is marked by the black star.

Figure 9. Bulk sample of chert and orthoquartzite early stage core reduction debris recovered from the Locus 1 lithic workshop.

The proximal portion of a square base, shouldered biface made of a brown chert has provisionally been classified as a Scottsbluff projectile point, and may date initial occupation of the locus sometime between 9300 and 6800 B.C. (cf. Knell and Muniz 2013). However, this artifact may have been scavenged from an older nearby site or on-site context by an Archaic Tradition resident of 10-BT-1972 and subsequently redeposited at Locus 2. Diagnostic projectile points recovered from Locus 2 are represented by an Elko Corner-notched point stem, two complete Humboldt Concave Base projectile points, a Wahmuza Lanceolate biface base, and a Desert Side-notched point base. In the upper Snake River region, these point styles date from Early Archaic through Late Prehistoric periods (e.g., Holmer 1995; Justice 2002; Keene 2018), and indicate that most aboriginal activities at Locus 2 transpired between about 6500 B.C. and A.D. 1800, with initial occupation having occurred as early as ca. 9000 B.C.

Previous Studies of Large Quarry Complexes

The ability to obtain high quality tool stone through either trade or direct access was a critical consideration in the seasonal movements and social relations of many pre industrial societies who did not practice metallurgy. Within the greater Intermountain West region, a number of studies have been devoted to major obsidian sources such as Obsidian Cliff, Wyoming (e.g., Davis et al. 1995), Malad (e.g., Thompson 2004) and Bear Gulch (e.g., Willingham 1995), Idaho, and Glass Buttes, Oregon (e.g., Ambroz et al. 2001). This is largely because the geographic origin of obsidian artifacts can easily be determined via geochemical analysis, and obsidian cores, blanks, and tools were important commodities within far-ranging exchange networks. Within the lithic literature, the preponderance of obsidian quarry and provenance studies stands in marked contrast to those concerning other tool stone types such as chert and quartzite. However, two non-obsidian tool stone quarry complexes in western North America, *Tosawihi* in northern Nevada and Spanish Diggings in eastern Wyoming, are described here in order to provide a comparative context for the Hidden Springs quarry and to illustrate the relative complexity and content of extensive chert and quartzite quarries.

Tosawihi, Nevada

The *Tosawihi* chert quarries cover an area of about 300 mi.^{2} (780 km.^{2}) in the Santa Renia Mountains at the northern end of the Sheep Creek Range in northcentral Nevada, some 40 mi. (65 km.) north/northeast of Battle Mountain (Leach and Botkin 1992). This complex of quarry pits and trenches, lithic workshop/reduction loci, and habitation sites has an extremely long use history, and the quality of the mostly white perlite (volcanic tuff that has been transformed by hydrothermal activity to a high quality chert) made it a desirable tool stone (Elston 2012). As such, it was traded extensively throughout the region and local Shoshone bands were known to other Numic groups as the *Tosawihi* (White Knife) people (Steward 1938:162). Mary Rusco was one of the earliest archaeologists to document the *Tosawihi* quarries in the 1970s, and submitted a National Register District nomination form for the entire complex to the Nevada State Historic Preservation Office in the early 1980s (Rusco 1983). Between 1987 and 1992, Robert Elston and his colleagues at Intermountain Research carried out a relatively comprehensive program of survey, testing, and data recovery in advance of disturbance to parts of the quarry complex caused by gold mining activities (Elston 2006, 2012). Reports generated by this project comprise one of the most intensive studies of an aboriginal North American tool stone quarry. Elston and co-workers conducted surface surveys within three adjacent parcels consisting of about 1,500 acres, and documented nearly 400 prehistoric sites therein. The main quarry precinct was assigned a single site number (26-EK-3932), but it consisted of at least 36 localities reflecting quarrying, cobble reduction/core production, early stage tool production, and short-term habitation. Recovery of a failed chert Clovis point preform from a nearby site (26-EK-3237) suggests that human use of the *Tosawihi* quarries extends back in time some 13,000 years. Based on Intermountain Research's multi-year investigation, the *Tosawihi* quarries comprise the largest aboriginal bedrock tool stone source in the Great Basin, and one of the larger prehistoric quarry complexes in North America. Elston and company's work there represents a pioneering effort at understanding the extent and complexity of a large quarry complex through survey, excavation, and artifact analysis.

Spanish Diggings, Wyoming

Located in the ~1,000 mi.^{2} (2,600 km.^{2}) Hartville Uplift of eastcentral Wyoming, the Spanish Diggings Complex consists of a large number of chert and quartzite quarries as well as lithic workshop and habitation sites (Reher 1991). Occurring within an area of some 400 mi.^{2} (1,040 km.^{2}), the Spanish Diggings quarries and associated sites represent the largest ancient stone quarry in North America, if not the entire New World. The area was named by local residents in the late 1800s who believed that the quarry pits and piles of worked stone had been left behind by early 17th century Spanish gold prospectors. Little by little, word of the quarry complex circulated beyond the eastern Wyoming/ western Nebraska area, and eventually attracted geologists such as Wilbur Knight (1898) and George Dorsey (1900). Charles Reher (1991:254-255) provides us with a general understanding of the number of archaeological features at Spanish Diggings:

> However they are designated or tallied, the exact number or extent of these quarries cannot be specified. Each new inquiry for over almost a hundred years has tended to list previously known quarries and new ones, often adding to the confusion by changing names or nomenclature. Further, the landscape between obvious quarry complexes is riddled with hundreds if not thousands of smaller workshop and quarry pit concentrations, and bedrock exposures which have been subjected to incidental quarrying. Even steep talus slopes are littered with debris from these activities.

Spanish Diggings contains at least 33 major quarries of Jurassic-aged Morrison Formation quartzite, Mississippian-aged Guernsey Formation chert, and Pennsylvanian-aged Hartville Formation chert (Reher 1991:Figure 16.2, 257). The Barbour, Dorsey, and Spanish Creek quarries are adjacent to one another and occupy the northwestern portion of the complex, with the Barbour Quarry being the largest of the three. Quarry pits and extraction piles within the Barbour site cover an area of at least 16,000 m.^{2} (~4 acres), with nearly 200 quarrying features measuring from 3 to 15 m. in diameter and from 1 to 5 m. deep having been recorded there (Reher 1991:266). Workshop areas are characterized by extensive scatters of flaking debris and contain clusters of stone circles measuring between 3 and 5 m. in diameter that may be the foundations of temporary domestic structures or windbreaks that sheltered flintknappers as they engaged in their craft.

One of the most recent professional studies within the Spanish Diggings site complex was a 2015 surface survey conducted by Alpine Archaeological Consultants, Inc., at the request of the Wyoming Bureau of Land Management's Newcastle Field Office (Omvig and Landt 2016). This block inventory covered a total of 1,885 acres, most of which (1,572 acres) occurred on private property, with parcels of public lands managed by the State of Wyoming (262 acres) and the Bureau of Land Management (51 acres) comprising the remainder of the areas that were inspected. Survey blocks were located southwest, south, and southeast of Manville, Wyoming (Omvig and Landt 2016:Figure 1), and focused on the Black Agate, Adele, M. H. Everett, and Brooks Quarries, as well as the Spanish Diggings Main Quarries periphery. The project resulted in relocating and updating the forms for 6 previously recorded sites and documentation of 39 newly discovered sites. Recorded site types consisted of 7 quarries, 19 lithic procurement areas, 8 sites containing multiple stone circles, 4 lithic scatters, 5 isolated rock alignments and cairns, 1 pit, and 1 possible rock alignment game drive feature. Unfortunately, very few formed tools were observed during the Alpine project as well as during previous surveys, thus our understanding of the different periods for Native use of the Spanish Diggings lithic source area is quite poor.

Notable Aspects of the Hidden Springs Lithic Tool Assemblage

As noted above, the focus of this paper concerns a small sub-assemblage of lithic artifacts that were recovered from Hidden Springs and what these objects can tell us about stone reduction and flaked stone tool production techniques, and the presence of several tool traditions that heretofore have either not been reported or only minimally documented within the general project area. The study of percussive implements, specialized cores, unusual biface thinning flakes, and Paleoindian spear points can provide a wealth of information concerning aboriginal technologies and the people who practiced them. This section describes artifacts from 10-BT-1972 that represent these four components of chipped stone technology, how they relate to flint knapping practices, and the possible temporal affiliations of microblade technology and overface flaking in the upper Snake River Basin.

Hammers

Five stone hammers were mapped and collected from the site's surface during the 2017 campaign, and an additional hammer was excavated from the Locus 2 deposits the following year. Four are of conglomerate material, one is made of basalt, and one consists of chert (Figure 10, Table 2). Two of the Locus 1 hammers (catalog numbers 32-1-4 and 32-1-17) exhibit extensive use in the form of step fracturing, and probably functioned mostly for assaying cobbles and early stage core reduction. The surface specimen (32-2-3) from Locus 2 also shows a large amount of use, and about 20 per cent of its original surface has been removed through attrition. Conglomerate rock may have been a preferred stone type for hammers, as it is relatively soft (typically 2 to 3 on the Mohs hardness scale), allowing knappers to remove long, thin flakes from cores. Given the presence of the on-site tool stone quarry, I imagine that the majority of lithic work at 10-BT-1972 consisted of early-to-middle stage percussion flaking of cores and large flake blanks, as well as evaluating the quality of MCS and quartzite nodules.

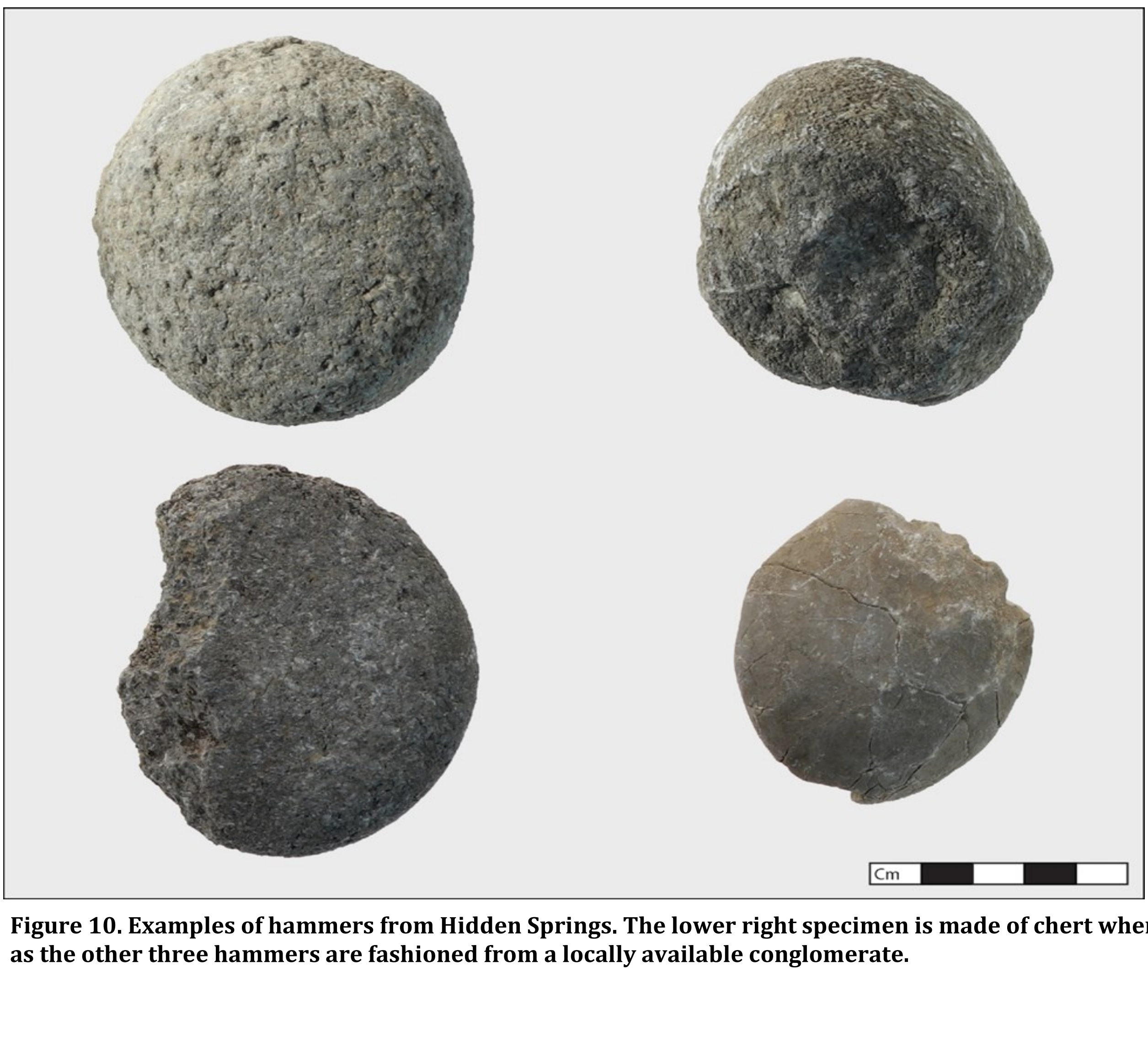

Figure 10. Examples of hammers from Hidden Springs. The lower right specimen is made of chert whereas the other three hammers are fashioned from a locally available conglomerate.

Although not surprising, the occurrence of stone hammers at an ancient tool stone quarry is noteworthy because these implements, especially well-formed, non-expedient ones, are somewhat rare at archaeological sites in the Intermountain West. A review of the artifact assemblages associated with fourteen sites in the hydrographic Great Basin and Snake River Basin (most of which served as residential hubs) attests to this pattern, and this information is presented in Table 3. Among many Native groups within these two regions and beyond, hammer stones may have been viewed as highly personal items, and typically were not left lying about camp and then cast aside when the site was abandoned. For the most part, I believe that well-formed, favored hammers were curated artifacts meant to serve a long use life. The tool kits of ancient knappers, especially those who excelled at this activity, probably contained various stone hammers and antler billets that were preferred for different percussive tasks. If this was the case, then these artifacts would have been handled somewhat carefully because because they were critical for producing the knives, scrapers, projectile points, and other tools

Table 2. Metric Attributes and Proveniences of Hammers from 10-BT-1972.

Catalog Number	Provenience	Material	Dimensions (cm.)	Weight (g.)
32-1-4	Surface, Locus 1	conglomerate	5.4 x 5.9 x 7.8	334.0
32-1-17	Surface, Locus 1	basalt	5.1 x 7.9 x 11.9	603.3
32-1-18	Surface, Locus 1	conglomerate	3.9 x 5.4 x 7.4	205.0
32-1-19	Surface, Locus 1	chert	2.8 x 5.6 x 6.6	110.0
32-2-3	Surface, Locus 2	conglomerate	3.1 x 6.9 x 8.4	224.5
32-50-1	0-10 cm., Unit 4.5N/74E	conglomerate	4.5 x 7.0 x 8.0	338.7

that were so important for successful hunting and efficient processing. Therefore, individualized hammers tended to be made from a particular material and had a preferred weight, size, and feel – they fit the owner's hand just right - and for example, allowed experienced knappers to produce intact, proper -sized flake blanks that could then be fashioned into the archetypal projectile styles that were favored by their group and/or the individual. If ancient people who were heavily invested in lithic technology generally viewed their hammer stones in this manner, then it probably was not generally acceptable for somebody to use another person's hammer, at least not without permission. If aboriginal groups placed a high value on formal stone hammers, then it stands to reason that they were seen as exceptionally personal belongings, and owners could easily recognize their preferred hammers based on visual and tactile qualities if they were temporarily lost or borrowed by a band or tribe member. Some skilled flint knappers may have been buried with their hammers, or more commonly, gave them to relatives or friends upon retiring from this activity.

Microblade Core

Eight (7 chert and 1 obsidian) cores occur in the excavated site collection; most of them display multi-directional flake scars, but one is a single platform microblade core made of obsidian. The microcore is of special interest, as microblade technology in both our study area and the central Rocky

Mountain region is poorly understood. This core consists of an opaque black welded tuff (Figure 11) that derives from the Walcott Tuff source, is about 3/4 intact, and was recovered from a depth of 51 cm. in unit 179N/176W at Locus 1. It is a conical-shaped, single platform core that exhibits four flake

Table 3. Quantities of Hammer Stones Recovered from Selected Intermountain West Sites.

Site Name	Location	Reference(s)	Number of Hammers
Danger Cave	Northwestern Utah	Jennings 1957	0[1]
Hogup Cave	Northwestern Utah	Aikens 1970:72	4
Swallow Shelter	Northwestern Utah	Dalley 1977	0
Camels Back Cave	Northwestern Utah	Elston 2005:116-119	4
Gatecliff Shelter	Central Nevada	Thomas and Bierworth 1983:229-230	77[2]
James Creek Shelter	Northeastern Nevada	Zerga and Elston 1990:216	2
Trapper Cliff Shelter	Southcentral Idaho	Arkush 2013:93-94	4
Wilson Butte Cave	Southcentral Idaho	Bryan 2006:100-101; Cockle 2006:166; Gruhn 1961:87	3 complete; 15 frag-mentary
Bighorn Shelter	Eastern Idaho	Ranere 1971:34	2
Bison Shelter	Eastern Idaho	Swanson 1972:135	3
Veratic Shelter	Eastern Idaho	Swanson 1972	0
Jackknife Cave	Eastern Idaho	Swanson and Sneed 1971	0
Bobcat Shelter	Eastern Idaho	Swanson et al. 1964; Arkush 2017	0
Cottontail Shelter	Eastern Idaho	Swanson et al. 1964; Arkush 2016; n.d.	0

[1] – The Danger Cave monograph does not include hammers or cores, which seems odd considering the large and diverse artifact assemblage that was recovered from this site.
[2] – Thirty-six of these hammers are stream cobbles of unidentified material(s), and forty-one are made of chert. Many of these hammers may have been casual, expedient tools with extremely short use lives.

scars, measures 2.7 x 3.6 x 4.5 cm., and weighs 32.2 g. Several exposures of artifact quality ash flow tuff obsidian of the Walcott Tuff geochemical type occur within 45 km. of 10-BT-1972 (Arkush and Hughes 2018), and this core may derive from one of these nearby obsidian acquisition areas.

A sample of artiodactyl bone that was recovered from 59 cm. below ground level in the same excavation unit yielded a calibrated age of 3502 to 3394 B.C. (Table 1), suggesting that this core was manufactured during the latter part of the Early Archaic period**.** The striking platform is not well-shaped, the specimen doesn't reflect a great deal of investment, and is a good example of an expedient tool that probably was associated with a brief occupational episode of 10-BT-1972. Perhaps the core was meant to fulfill an immediate, activity-specific need and was discarded after it had served its intended purpose.

Figure 11. Obsidian microcore that was recovered from the northwestern portion of Locus 1.

Conical- and wedge-shaped, prepared platform microcores allowed prehistoric knappers to quickly and efficiently produce bladelets, allowing people to both conserve tool stone and have a highly portable nucleus for creating small knives. In this article, I use the terms "microlith" and "microblade" interchangeably, in reference to small, elongated flake blades/bladelets that were removed from microcores, presumably most often by pressure flaking (cf. Flenniken 1987; Morlan 1970). In western North America, microblades and microcores are usually less than 5.0 cm. long (cf. Arnold 1987), and this general maximum length is confirmed by the Hidden Springs microcore as well as a chert microcore that recently was recovered from the nearby Sagebrush Spring site (10-LH-528) and measures 5.0 cm. long (Arkush 2019b). In southcentral Oregon, a chert microcore measuring 2.7 cm. in length was excavated from a shallow late prehistoric context at the Beatty Curve site (35-KL-95) along the Sprague River in the eastern Klamath Basin (Rondeau 2010). Similarly, a sample of microliths from two sites in the general project area are all less than 5.0 cm. long, with a single specimen from Cottontail Shelter measuring 3.7 cm. in length (Arkush n.d.), and five microblades from Mammoth Meadow (24-BE-559) in southwestern Montana ranging between 1.8 and 3.0 cm. long (Lee et al. 2016).

Microcores have a lengthy history in western North America, beginning with the Denali Complex of Alaska as early as ca. 12,500 B.C., as evidenced by the earliest occupation at Swan Point (Bever 2006:Figure 2). Within the Northern Plateau/Fraser River Basin, microlithic industries seem to have reached their zenith between about 5000 and 1500 B.C. (Sanger 1968), but persisted in some areas until at least A.D. 1000 (Whitlam 1976). On the High Plains, microcores and microblades were popular among Late Paleoindian period Cody Complex groups (Wilson et al. 2011), but were also manufactured in this region during Middle to Late Archaic and Late Prehistoric times (Lee et al. 2016:Table 1). Within the hydrographic Great Basin, microcore/microlith technology is virtually unknown, although three bladelet cores and three prismatic blades occur within the large Western Stemmed Tradition lithic assemblage associated with a suite of sites in the Old River Bed Delta, Great Salt Lake Desert, northern Utah (Beck and Jones 2015:201-204). Based on ethnographic and prehistoric examples of hafted microliths such as the well-preserved hafted microblade knife from the Hoko River Wet/Dry site (which dates between about 1000 B.C. and A.D. 300) on the Olympic Peninsula of northwestern Washington (Croes 1995:Figure 4.116), most microliths probably were attached to wood, bone, or antler handles and used for precision cutting tasks.

Overface Thinning Flakes

The overface/full-face percussion flaking technique removes a flake from the entire width of a biface, and is an effective method of quickly thinning the bifacial blank or preform (cf. Bradley et al. 2010). Unlike overshot, or *outre passé* flaking, which removes a flake from the entire face, including part of the opposite margin and is a distinctive aspect of Clovis lithic technology (Bradley 1993; Huckell 2007; Waters et al. 2011), overface flaking was practiced by various Clovis groups (e.g., Waters and Jennings 2015) as well as a small number of non-Clovis Paleoindian and Archaic knappers (e.g, Eren et al. 2018). However, the true temporal and spatial associations of overface reduction are poorly understood at this time. Three non-cortical overface biface thinning flakes were found at Hidden Springs (Figure 12), with two of them occurring at Locus 1 and the other being recovered at Locus 2. The two Locus 1 specimens are made from gray, brown, and red/brown-colored quartzite and were discovered in different contexts in the northwestern portion of this locus, immediately east of the arroyo. One was found on the arroyo bank, whereas the other was recovered from the 20-30 cm. level of adjacent unit 179N/176W. Given the fact that these flakes consist of the same colored fine-grained quartzite, they most likely derive from the same biface. The Locus 2 overface flake consists of a mottled red/brown chert and was recovered from the 10-20 cm. level of unit 5N/65E, about 11 m. west/northwest of a Scottsbluff-like spear point base. Interestingly, the brown-colored portion of that flake is very similar to the brown-colored chert from which the Locus 2 provisional Scottsbluff point base was fashioned. Unfortunately, none of these artifacts can confidently be attributed to the Hidden Springs quarry, as most chert there is blueish-gray in color, whereas the vast majority of quartzite is light gray.

Scottsbluff Projectile Points

Two Scottsbluff type projectile points are known from the site. The first was found along the arroyo in the northwestern portion of 10-BT-1972 during a U.S. Forest Service archaeological survey project in 1992 (Willingham et al. 1992) and consists of a point base made from an off-white chert (Figure 13a). The broken condition of this specimen may reflect use-related breakage and its subsequent on-site discard, after which a new projectile point fashioned from tool stone acquired from the adjacent quarry presumably was manufactured to replace it. During our 2018 site investigation, the proximal portion of a brown chert spear point that can be assigned to the Scottsbluff type was found in the 0-10 cm. level of unit 2N/75E at Locus 2 (Figure 13b). Although it displays the typical square-shaped base of Scottsbluff points, the one intact shoulder of this specimen slopes outward at about 25 degrees as opposed to forming a near-90 degree angle. Furthermore, the base appears to be incompletely shaped and pressure flaked, although one side of the basal margin is edge-ground, which is a common characteristic of Cody Complex projectile points (e.g., Amick 2013:220; Bradley and Stanford 1987:425). In consideration of these traits, the projectile point may have been broken during production at Locus 2. This interpretation makes sense if the brown chert overface flake that was excavated from a nearby unit was produced during the manufacture of the broken projectile.

Scottsbluff projectile points exhibit slight shoulders and square bases and are part of the Plains Cody Complex, which dates from about 9300 to 6800 B.C. (Knell and Muniz 2013). On the Great Plains, most single component Scottsbluff sites date between ca. 9100 and 7550 B.C. (cf. Knell and Muniz 2013:Figure 1.3), and two purified collagen AMS dates on different curated bison humeri from the

Scottsbluff site in western Nebraska that range between 8260 and 7595 B.C. (Hill 2008) corroborate this general chronology. The occurrence of this Late Paleoindian period tool at Hidden Springs is intriguing, and suggests that the site may have first been visited by Native peoples some 11,000 years ago.

Figure 12. Plan and profile views of overface flakes. The upper and middle specimens are quartzite and

derive from the northwestern part of Locus 1, and the lower chert overface flake was excavated from Locus 2.

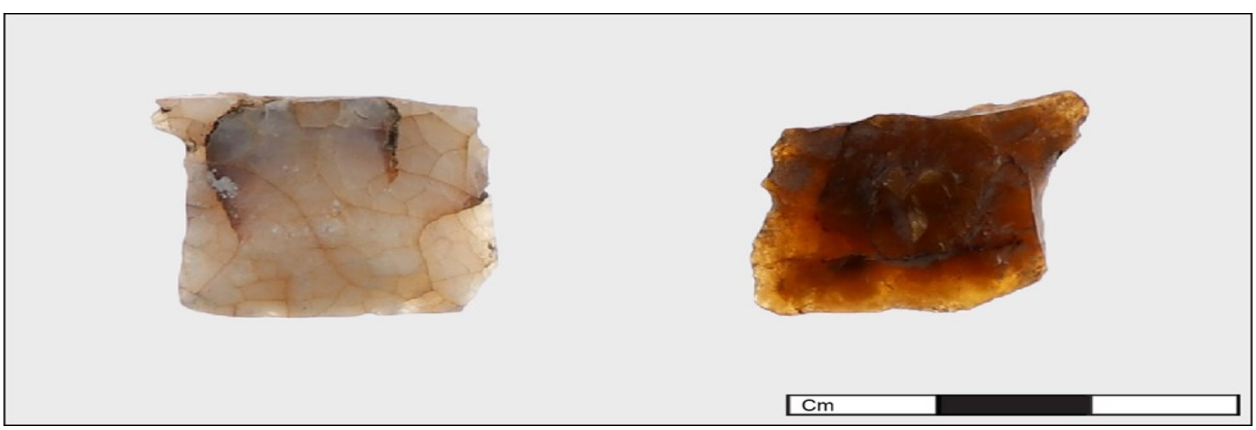

Figure 13. Two chert Scottsbluff projectile point bases. The left specimen (a) was found in the shallow arroyo west of Locus 1 in 1992, and the right specimen (b) was excavated from the Locus 2 deposits in 2018.

Discussion

The following section addresses aspects of Late Paleoindian period lithic traditions within Birch Creek Valley and the apparent temporal associations of local overface flaking and microlith technology. It also considers how the highlighted sub-assemblage from Hidden Springs can provide information concerning embedded tool stone acquisition practices and technological organization at ancient lithic quarries.

A Cody Complex Presence in Birch Creek Valley

Discovery of two Scottsbluff projectile points at Hidden Springs is at least the second reported occurrence of Cody Complex artifacts in Birch Creek Valley. During the 2016 WSU investigation of Cottontail Shelter in upper Skull Canyon (located some 12 km. east/northeast of 10-BT-1972), the base of an obsidian Alberta or Scottsbluff spear point was found in relatively shallow, Late Prehistoric period deposits (Arkush n.d.:53, Figure 21). Stratum 1B dates between about A.D. 1000 and 1450, and the presence of a square base biface with a heavy patina on one side in this level suggests that a more recent occupant of the shelter scavenged what was perhaps a complete Paleoindian projectile point and used it in some capacity before it was broken and subsequently discarded on-site.

A Late Paleoindian presence in Birch Creek Valley is best documented within the early cultural deposits at Bison and Veratic Shelters. In his monograph on the ISC investigations of 10-CL-3 and -10, Swanson (1972:90-93, Figure 48) classified most lanceolate-shaped Paleoindian bifaces from these two sites as Birch Creek A, B, and C types. A comparison of metric attributes and illustrations of these projectile points with those of other regional styles indicates that many can best be classified as Agate Basin, Haskett, and Angostura types, reflecting an early human presence in the valley between about 10,500 and 6500 B.C. The occurrence of a few Scottsbluff projectile points in the eastern Lemhi Range adds another tradition to terminal Pleistocene/early Holocene lithic technologies in far eastern Idaho, and this sparse record suggests that Cody groups made infrequent stops in Birch Creek Valley sometime after about 9000 B.C.

Within the greater project area, the nearest Cody Complex component occurs at Mammoth Meadow in southwestern Montana, located 95 km. north of 10-BT-1972 (Bonnischsen et al. 1992). The Mammoth Meadow site contains a series of occupations ranging from Late Paleoindian to Late Prehistoric times within a relatively shallow deposit of 1.25 m. Cody materials, mostly in the form of Eden and Scottsbluff projectile points, occurred within Levels II and III, which were confined to depths of between 0.8 and 1.25 m. (Bonnischsen et al. 1992:Figure 8.3). A calibrated radiocarbon date on charcoal that was recovered from the bottom of Level III ranges from 8770 to 8560 B.C., placing initial use of the site by Cody Complex peoples within the first half of this tradition.

The Temporal Affiliations of Overface Flaking

A conventional view of western North American lithic technology indicates that the recovery of overface flakes from non-Clovis sites or components is somewhat anomalous, but this distinctive debitage type may also be associated with later Paleoindian groups, such as the Cody Complex people who first occupied the Hidden Springs locality. Edward Knell (personal communication 2018) believes that overshot and overface flaking is not a hallmark of Cody lithic technology, as most of those projectile points were produced from flake blanks as opposed to biface blanks, and therefore did not have to be thinned. According to Knell's perspective, if the 10-BT-1972 overface flakes were indeed made by Cody flintknappers, then it was unintentional. Regardless of which prehistoric group or groups made these flakes, their presence within the Hidden Springs assemblage is notable, and it is even conceivable that the two quartzite specimens were produced by Archaic site occupants during production of bifacial knives. If the quartzite overface flake from the 20-30 cm. level of unit 179N/176W was found in a primary context, then the specimen dates between approximately 2565 and 2490 B.C. and was produced by an Archaic Tradition knapper.

A recent study by Scott Thomas and Michael Rondeau (2016) presents compelling evidence for the Archaic era practice of overshot flaking in the Catlow Valley of southeastern Oregon through obsidian hydration analysis. Thomas and Rondeau (2016:Table 1) reported the presence of 35 overshot thinning flakes made of Beatys Butte glass from two multi component lithic scatters in Guano Slough that ranged from 3.5 to 6.0 microns. The general Archaic age (ca. 6500 B.C. to A.D. 400) of these flakes is indicated by hydration rind values between 3.4 and 5.5 microns that were obtained on 61 surface dart points (representing Gatecliff Split Stem, Elko Eared, Elko Corner-notched, Northern Side-notched, and Pinto Sloping Shoulder forms) that were collected from the same general area and also made of Beatys Butte obsidian (Thomas and Rondeau 2016:Table 2).

Similarly, Goodson Shelter, a Middle Holocene-aged site in northeastern Oklahoma has yielded bifaces and prismatic blades that were produced with Clovis-like techniques, but were recovered from undisturbed deposits dating between ca. 5315 to 5066 cal yr BP (Eren et al. 2018). This assemblage included two stone artifacts exhibiting overface flake scars. Clearly, we have a poor understanding of the time span associated with overface flaking in the Intermountain West and elsewhere, and only additional studies focused on this research topic will reveal the true age range of this practice.

Archaic and Late Prehistoric Microblade Technology

In addition to yielding a Late Paleoindian spear point base, Cottontail Shelter also contained an example of microcore technology in the form of a chert microlith (Arkush n.d.:68, Figure 26). The bladelet measures 0.54 x 1.36 x 3.73 cm., and exhibits one dorsal arris along its entire length as well as edge wear along one margin. It was recovered from the 110-120 cm. level of unit 5N/4W in a stratum (2a) that was radiocarbon dated at A.D. 631 to 655. Stratum 2a also contained a chert dart point preform, a chert proximal biface fragment, and 155 chert flakes. Based on these associated artifacts made of the same material, the microlith seems to have been found in a primary context, thus placing its manufacture during the early part of the Late Prehistoric period. Several other sites in the Birch Creek area have yielded small numbers of microblades and/or tabular microblade cores, namely Bison Shelter (2 microblades) (Swanson 1972:136), Veratic Shelter (1 microblade) (Briana Budge, personal communication 2018), Bighorn Shelter (2 microblade cores) (Ranere 1971:33), and Jackknife Cave (1 probable microblade core) (Briana Budge, personal communication 2018). The levels/components from which most of these specimens derive date between about 1500 B.C. and A.D. 1700, placing their manufacture from Middle Archaic to Late Prehistoric times.

Although microblade technology appears to be a minor part of Archaic and Late Prehistoric lithic tool kits in the upper Snake River region, it is a relatively common part of the post-1000 B.C. archaeological record in the Northwestern Plains and eastern Rocky Mountains (cf. Lee et al. 2016:Table 1). As with Scottsbluff projectile points, the Mammoth Meadow site is the nearest location to our project area that has yielded numerous microliths. A total of 325 "specialized flakes" occur in the site collection, with 120 of them being found in post-A.D. 100 contexts (Bonnichsen et al. 1992:Table 8.2). Unfortunately, the 24-BE-559 report does not specify how many of these flakes are microblades. Mammoth

Meadow does contain one or more Late Paleoindian components, but Lee et al. (2016:151-152, Figure 10) believe that many of the microblades at the site were produced by Archaic and/or Late Prehistoric peoples. Younger deposits at Mammoth Meadow yielded Elko, Northern Side-notched, Pelican Lake, Avonlea, and Desert Side-notched projectile points, and the upper 1 m. of site deposits (which contained the bulk of dart and arrow points) post-date ca. 3000 B.C. (Bonnichsen et al. 1992:Figure 8.3, 304).

Multi-Tasking is Nothing New

Ethnographic data concerning hunter-gatherers who lived in arid and semi-arid ecosystems characterized by dispersed, or "patchy" resources indicate that these people typically organized themselves as small, highly mobile bands (cf., Gould 1969; Lee 1968; Lowie 1909; Steward 1938). By doing so, task groups and even entire camp populations could easily move over relatively long distances in order to maximize harvests of seasonally-specific plant and animal foods. This type of settlement strategy probably was a dominant one among pedestrian foragers who frequented the Birch Creek Valley area, and is reflected in the assemblages of archaeological sites that WSU has excavated there thus far. Given the foothill location of 10-BT-1972, it seems likely that many occupational episodes of this site occurred from mid spring through early fall and were geared toward collecting plant foods, hunting large and small game such as bighorn sheep and marmots, and acquiring tool stone from the adjacent quarry. In this sense, the procurement of a critical raw material was embedded in seasonal subsistence-settlement regimes, much in the same way that Binford (1979:259) described for the Nunamiut of northern Alaska:

> Raw materials used in the manufacture of implements are normally obtained incidentally to the execution of basic subsistence tasks. Put another way, procurement of raw materials is embedded in basic subsistence schedules. *Very rarely, and then only when things have gone wrong, does one go out into the environment for the express and exclusive purpose of obtaining raw materials for tools.*

If the typical Birch Creek Valley forager population was organized in this fashion, then they probably moved into the eastern foothills of the southern Lemhi Range when upland food resources were at or near their peak. By positioning themselves at a mid-elevation potable water source that contained a source of high quality tool stone, 10-BT-1972 residents could forage for foods across a fairly wide elevational transect as well as acquire and reduce microcrystalline silicate, quartzite, and orthoquartzite nodules from the adjacent quarry over a week-long stay. The immediate (as opposed to the extended) foraging radius associated with Hidden Springs may have ranged from the mountain base/valley margin at about 6600 feet to the forested sub-alpine zone above the site up to around 9400 feet, which translates to a roundtrip distance of no more than 6 km. in either direction. Healthy juveniles and adults probably could have foraged effectively in either the lower or upper elevations surrounding 10-BT-1972 over the course of one or two days, including travel time (cf. Kelly 1995).

Ancient foragers who lived in challenging environments were adept at acquiring critical resources and knew exactly which areas afforded them the best provisioning opportunities at different times of the year. The seasonal availability of major foods resulted in settlement practices that emphasized landscape positioning and which ideally allowed them to access several different ecozones from a temporary encampment (cf. Arkush 2004; Elston 1992; Kelly 2001). If some of these short-term camps were situated near important non-food resources such as quarries for making chipped and ground stone implements, containers, and ornaments, then so much the better. In our fast-paced world, many contemporary people pride themselves in the ability to "multi-task." While this practice among young- and middle-aged adults (especially those in densely populated urban areas) is common, it almost certainly is an ancient phenomenon with roots in prehistoric foraging societies. As popularized by Lewis Binford (1979), the likelihood that the acquisition of many non-food resources was often embedded in the basic subsistence practices of hunter-gatherer groups allows us to perceive them in part as the original multi-taskers. The efficient acquisition of key food and non-food resources was a critical element of surviving in challenging environments, and through embedded strategies, many upper Snake River region foragers probably obtained the things that they needed in bulk fashion, especially before the onset of winter conditions and the lean season that followed.

The Technological Organization of Quarrying

Many publications and reports concerning North American aboriginal quarrying practices contain sections on technological organization and assemblage expectations (e.g., Burke 2007; Elston 1992; Trubitt 2007). Some of the more common activities that transpired at quarries and associated workshops probably consisted of exposing buried clasts and boulders, assessing material quality, removing large flakes from boulders with both percussion and heat, reducing cores, and producing flake blanks and bifaces for off-site transport. If this is generally correct, then most of the artifacts within quarries and non-residential lithic workshops should consist of digging implements, hammers, assayed nodules, cores, core fragments, early stage bifaces, decortication flakes, and early stage thinning flakes.

At Hidden Springs, the eastern part of Locus 1 has been used repeatedly as a workshop where chert and orthoquartzite nodules were fashioned into cores from which tools and high-quality tool nuclei were produced. Because the basic function of this area seems to have changed little through time, it serves as an excellent example of how technology was organized in response to the main tasks at hand – acquiring artifact quality tool stone, reducing it into workable masses, producing new tools to replace broken ones, and fashioning lightweight cores and early stage bifaces to be used elsewhere. Situated just south of the quarry and northeast of the spring head, this semi linear area occupies about 2100 m.[2] and contains a surface assemblage dominated by cores (n = 30) and early stage bifaces (n = 10), as well as core shatter and large thinning flakes (Figure 14). Three stone hammers were also part of this surface assemblage; one was expedient and minimally used, whereas the other two were well-formed and exhibited various step fractures and facets.

In order to better determine the general age, level of occupational intensity, and character of the cultural deposits here, we excavated three 1 x 2 m. units in a relatively level part of the workshop (Figure 15). Although the anthropogenic soils did not extend much deeper than 40 cm., our excavations recovered a relatively large assemblage of lithic debris and a modest number of formed artifacts. A focus on nodule reduction and initial tool production at the three sampled areas is reflected by 6 cores, 2,013 core fragments, 767 early stage biface thinning flakes, and 4 early stage bifaces. The contents of this lithic workshop is probably a good example of the assemblage characteristics for many non-bedrock quarry sites in the central Rockies where nodules and exposed boulders provided the bulk of workable stone masses. A small array of hammers and abraders may have been the primary implements that were used for core reduction and initial biface manufacture at many quarry-associated workshops within the greater study area, with the primary goal being the production of unfinished bifaces and projectile point- and scraper-sized flake blanks. If this was the case, then the lithic workshop tool nuclei, tools, and debris from Hidden Springs can be used to form expectations for the range of artifacts that occur at other quarry sites in the region. The small lithic quarry is probably a common site type within the foothills and mountains of the upper Snake River Basin, and perhaps not

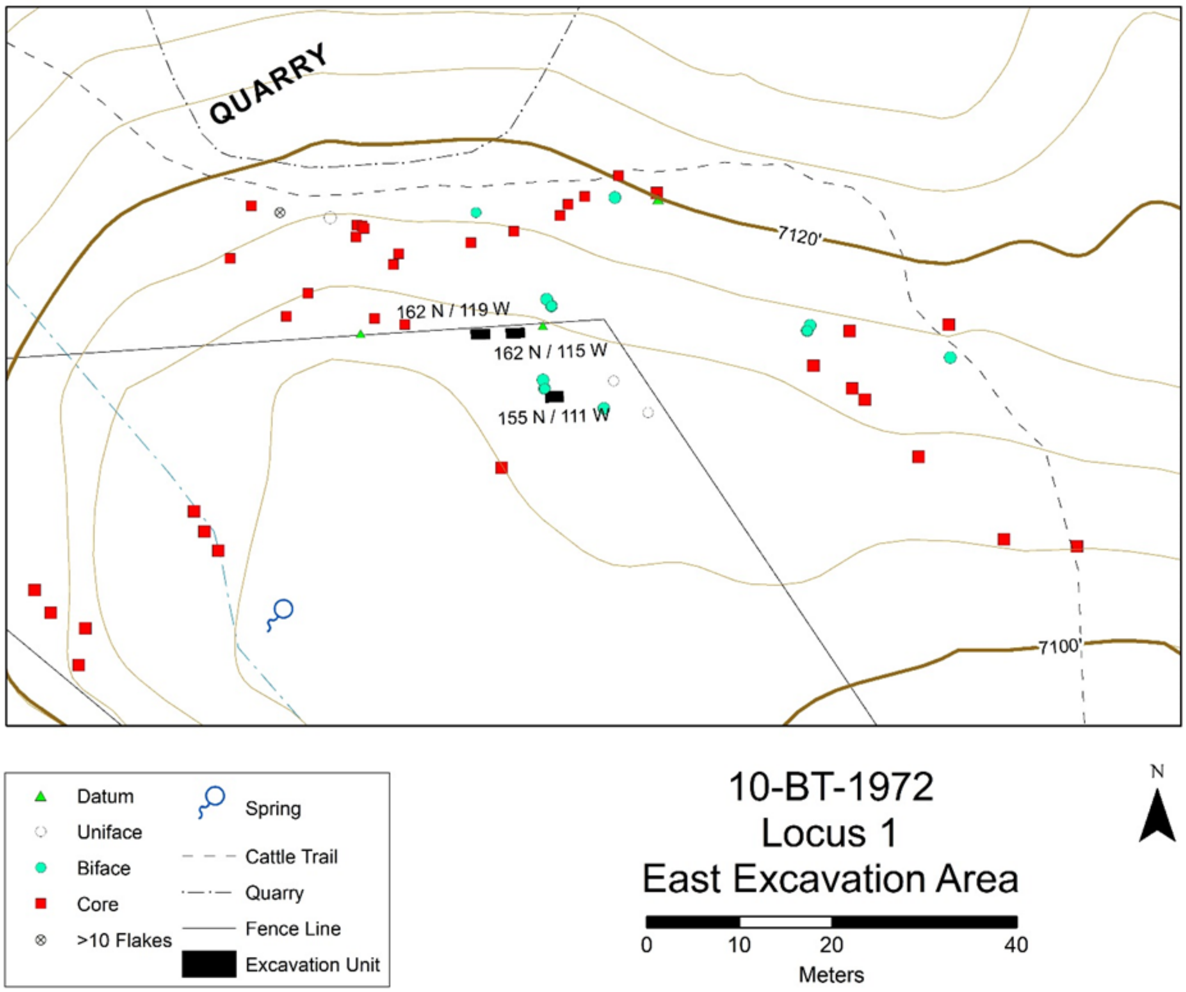

Figure 14. Plan map of the main lithic workshop area within Locus 1, showing locations of surface artifacts, datums, and excavation units.

many have been recorded because of their small size and subtle artifact content. A comprehensive, well-designed survey aimed at locating non-obsidian tool stone quarries in upland zones of eastern Idaho is much-needed and could provide a wealth of information concerning how common these lithic source areas are, the general structure of Native tool kits that were used there, and the predominant assemblage signature at these locations.

Conclusion

The preceding sections have shown that Hidden Springs contains an important record of tool stone acquisition, artifact production, and seasonal habitation. It is clearly a significant archaeological resource and a prime example of what we can learn from prehistoric open-air sites that are situated in foothill settings and associated with a few key resources – in this case, potable water and high quality tool stone. The recent WSU study of site 10-BT-1972 has improved our understanding of culture history and lithic technology in far eastern Idaho, especially in regard to a Late Paleoindian Cody Complex presence, post-Clovis period overface flaking, and Archaic and Late Prehistoric era microcore and – blade technology in the Birch Creek drainage.

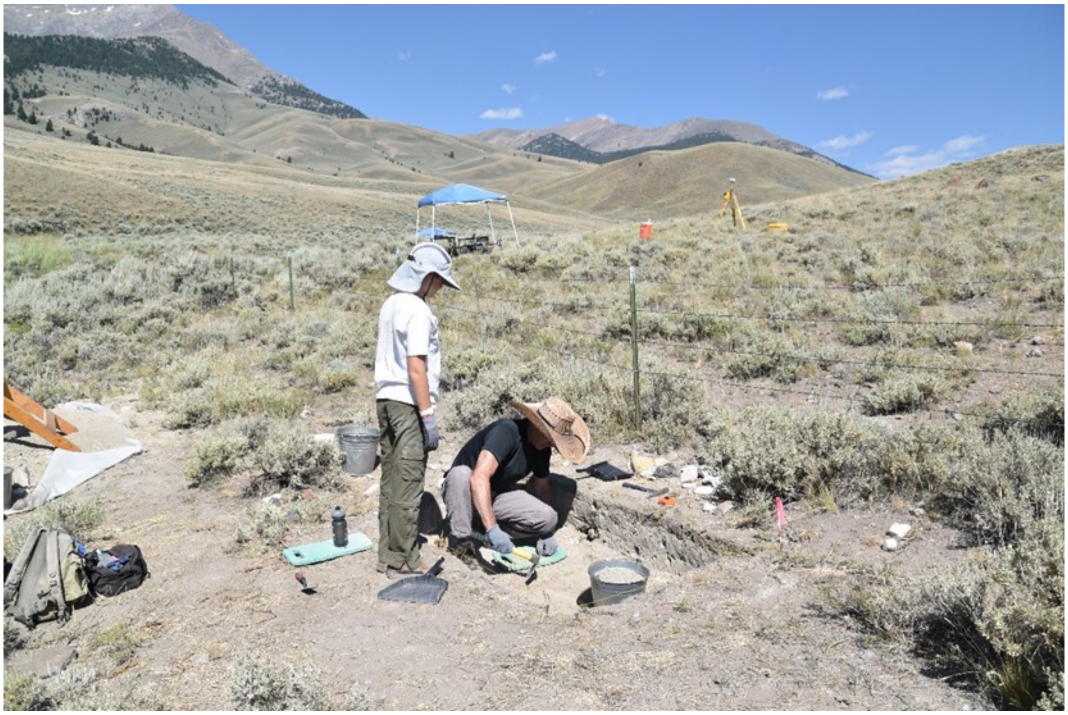

Figure 15. Upper image - Marco and Lorenzo Calavetta excavating at the Locus 1 lithic workshop in the summer of 2017. Lower image – North-facing overview of Locus 1 units 162N/119W and 162N/115W at depths of 30 cm., with pin flags marking various surface artifacts in the background.

The archaeological record at Hidden Springs is a good example of the untapped potential of seemingly unremarkable lithic scatters associated with small tool stone sources in western North America. Because of the subtle signature and modest size of the site's quarry, it was not included on the site maps produced by the first two survey parties that inspected the area. Now that the main features of 10-BT-1972 have been recorded and a sample of materials recovered via small-scale excavation, I certainly have gained a new appreciation for lithic quarry/workshop sites and the information that they contain. In obsidian-rich regions such as the upper Snake River Basin, the study of non-obsidian tool stone quarries allows us to gain a more complete picture of ancient lithic technological systems and the strategies that people implemented to provision themselves with different tool stone types in order to accomplish various tasks. A number of other sites similar to Hidden Springs undoubtedly exist along the lower mountain flanks that frame the Birch Creek, Lemhi, Little Lost River, and Pahsimeroi Valleys. The time has come for the Idaho archaeological community to focus some of its attention on recording and studying this important component of prehistoric settlement and technological systems. Hopefully, this paper will provide an impetus for other researchers to locate and investigate non-obsidian lithic sources in the general Birch Creek Valley, an area that has received relatively little attention from archaeologists since the mid-1960s, when Idaho State College concluded its Birch Creek Valley prehistory project.

Acknowledgments

Various individuals and institutions made significant contributions to the Hidden Springs project. The Caribou-Targhee National Forest provided analytical funding through the Challenge Cost Share Program. Ali Abusaidi, Trinity Bugger, Rich Childs, Bill Davis, Mark Federman, Sarah Russell, and Steve Stroud of the U.S. Forest Service provided administrative and field support. Katharine French Fuller and James Taylor of Weber State University's Office of Sponsored Projects also provided administrative assistance. Ali Abusaidi, Denise Arkush, Briana Budge, Marco Calavetta, Lorenzo Calavetta, Nikki England, Dana Flatter, Chris Jensen, Mackenzie Jensen, Susanne Miller, Jody Porath, Nettie Radley, Ken Reid, Alissa Van Tassell, Jason Whittier, and Courtney Winsness served as crew members. Alisha Jimenez was instrumental in producing GIS maps for this publication as well as for the entire 10-BT-1972 project, and David Yoder produced the high resolution artifact images. Mark Sutton and two anonymous reviewers provided comments that improved the quality and clarity of the manuscript.

References

Aikens, C. Melvin
1970 Hogup Cave. *University of Utah Anthropological Papers* 93. Salt Lake City.

Ambroz, Jessica A., Michael D. Glascock, and Craig E. Skinner
2001 Chemical Differentiation of Obsidian Within the Glass Buttes Complex, Oregon. *Journal of Archaeological Science* 28:741-746.

Amick, Daniel S.
2013 Way Out West: Cody Complex Occupations from the Northwestern Great Basin. In: *Paleoindian Lifeways of the Cody Complex*, Edward J. Knell and Mark P. Muniz, eds., pp. 215-248. Salt Lake City: University of Utah Press.

Arkush, Brooke S.
2004 Prehistoric Settlement Systems in Southeastern Idaho: A View From the Curlew Valley. *Idaho Archaeologist* 27(1):3-16.

2013 The Archaeology of Trapper Cliff Shelter: A Late Holocene Residential Site in Cassia County, South Central Idaho. *USDA Forest Service, Intermountain Region Heritage Reports* 5-05. Ogden, Utah.

2016 Progress Report for the 2014 - 2016 Excavations at Cottontail Rockshelter on the Caribou-Targhee National Forest in Eastern Idaho. Report on file, Caribou-Targhee National Forest Supervisor's Office, Idaho Falls, Idaho.

2017 Excavations at Bobcat Shelter, A Prehistoric Bighorn Sheep Hunting Camp in the Birch Creek Drainage of Far Eastern Idaho. Report on file, Caribou-Targhee National Forest Supervisor's Office, Idaho Falls, Idaho.

2018 Progress Report for Archaeological Investigations at Hidden Springs, Site 10-BT-1972, on the Caribou-Targhee National Forest in Eastern Idaho. Submitted to the Caribou-Targhee National Forest Supervisor's Office, Idaho Falls, Idaho.

2019a Progress Report for Archaeological Investigations at Locus 2 of the Hidden Springs Site (10-BT-1972), on the Caribou-Targhee National Forest in Eastern Idaho. Submitted to the Caribou-Targhee National Forest Supervisor's Office, Idaho Falls, Idaho.

2019b Recent Investigations at Sagebrush Spring: A Prehistoric Foothill Hunting Camp in Far Eastern Idaho. Read at the 14th Biennial Rocky Mountain Anthropological Conference, Logan, Utah.

n. d. Final Report for Excavations at Cottontail Rockshelter on the Caribou-Targhee National Forest in Eastern Idaho. Report in preparation.

Arkush, Brooke S., and Richard E. Hughes
2018 An Investigation of Prehistoric Volcanic Glass Use in the Birch Creek Valley of Eastern Idaho. *Journal of California and Great Basin Anthropology* 38(1):75-86.

Arnold, Jeanne E.
1987 *Craft Specialization in the Prehistoric Channel Islands, California*. Berkeley: University of California Press.

Beck, Charlotte, and George T. Jones
2015 Lithic Analysis. In The Paleoarchaic Occupation of the Old River Bed Delta, pp. 97-208, David B. Madsen, Dave N. Schmitt, and David Page, eds. *University of Utah Anthropological Papers* 128. Salt Lake City.

Bever, Michael R.
2006 Too Little, Too Late? The Radiocarbon Chronology of Alaska and the Peopling of the New World. *American Antiquity* 71(4):595-620.

Binford, Lewis R.
1979 Organization and Formation Processes: Looking at Curated Technologies. *Journal of Anthropological Research* 35(3):255-273.

Bonnichsen, Robson, Marvin Beaty, Mort D. Turner, Joanne C. Turner, and Diane Douglas
1992 Paleoindian Lithic Procurement at the South Fork of Everson Creek, Southwestern Montana: A Preliminary Statement. In: *Ice Age Hunters of the Rockies*, Dennis J. Stanford and Jane S. Day, eds., pp. 285-321. Boulder: University Press of Colorado.

Bradley, Bruce A.
1993 Paleoindian Flaked Stone Technology in the North American High Plains. In *From Kostenki to Clovis: Upper Paleolithic-Paleoindian Adaptations*, pp. 251-262, O. Soffer and N. Praslov, eds., Inter-disciplinary Contributions to Archaeology. New York: Plenum Press.

Bradley, Bruce A., Michael B. Collins, and A. Hemmings
2010 Clovis Technology. *International Monographs in Prehistory, Archaeological Series* 17. Ann Arbor.

Bradley, Bruce A., and Dennis J. Stanford
1987 The Claypool Study. In: *The Horner Site: The Type Site of the Cody Cultural Complex*, George C. Frison ad Lawrence C. Todd, eds., pp. 405-434. Orlando: Academic Press.

Bryan, Alan
2006 Description of Other Artifacts from the Disturbed Deposits. In New Excavations at Wilson Butte Cave, South-Central Idaho, pp. 93-114, Ruth Gruhn, ed., *Occasional Papers of the Idaho Museum of Natural History* 38. Pocatello.

Burke, Adrian L.
2007 Quarry Source Areas and the Organization of Stone Tool Technology: A View from Quebec. *Archaeology of Eastern North America* 35:63-80.

Cockle, Diane
2006 The Late Prehistoric Phase at Wilson Butte Cave: Evidence for a Fremont Occupation. In New Excavations at Wilson Butte Cave, South-Central Idaho, pp. 139-237, Ruth Gruhn, ed., *Occasional Papers of the Idaho Museum of Natural History* 38. Pocatello.

Croes, Dale R.
1995 *The Hoko River Archaeological Site Complex: The Wet/Dry Site (45CA213), 3,000 - 1,700 BP*. Pullman: Washington State University Press.

Dalley, Gardiner F.
1976 Swallow Shelter and Associated Sites. *University of Utah Anthropological Papers* 96. Salt Lake City.

Davis, Leslie B., Steven A. Aaberg, James G. Schmitt, and Ann M. Johnson
1995 The Obsidian Cliff Plateau Prehistoric Lithic Source, Yellowstone National Park, Wyoming. *Selections from the Division of Cultural Resources* 6, Rocky Mountain Region, National Park Service. Denver, Colorado.

Elston, Robert G.
1992 Archaeological Investigations at Tosawihi, A Great Basin Quarry. Intermountain Research, Silver City, Nevada.

2005 Flaked- and Battered-Stone Artifacts. In Camels Back Cave, pp. 92-119, Dave N. Schmitt and David B. Madsen, eds. *University of Utah Anthropological Papers* 125. Salt Lake City.

2006 An Intensive Reconnaissance of the Tosawihi Quarries Archaeological District (Site 26EK3032). *Nevada Bureau of Land Management Cultural Resource Series* 16. Carson City.

2012 Archaeological Research at Tosawihi Quarries, Nevada. *The Quarry* 7:3-12.

Eren, Metin I., David J. Meltzer, and Brian N. Andrews
2018 Is Clovis Technology Unique to Clovis? *Paleoamerica* 4(3):202-218.

Flenniken, J. Jeffrey
1987 The Paleolithic Dyuktai Pressure Blade Technique of Siberia. *Arctic Anthropology* 24(2):117-132.

Gould, Richard
1969 *Yiwara: Foragers of the Australian Desert*. New York: Scribners.

Gruhn, Ruth
1961 The Archaeology of Wilson Butte Cave, South-Central Idaho. *Occasional Papers of the Idaho State College Museum* 6. Pocatello.

Harris, Kathryn Ann
2011 Human Landscape Use at Site 10-BT-8, Butte County, Idaho. Master's Thesis, Washington State University, Pullman.

Hill, Matthew E., Jr.
2008 New Investigations of the Cody-Age Finley and Scottsbluff Bison Bone Beds. *Current Research in the Pleistocene* 25:90-93.

Holmer, Richard N.
1995 *Guide to the Identification of Projectile Points from the Upper Snake River Basin, Eastern Idaho*. Pocatello: Department of Anthropology, Idaho State University.

Huckell Bruce B.
2007 Clovis Lithic Technology: A View from the Upper San Pedro Valley. In Murray Springs: A Clovis Site with Multiple Activity Areas in the San Pedro Valley, Arizona, pp. 170-210, C. Vance Haynes and Bruce B. Huckell, eds. *University of Arizona Anthropological Papers* 71. Tucson.

Jennings, Jesse D.
1957 Danger Cave. *University of Utah Anthropological Papers* 27. Salt Lake City.

Justice, Noel D.
2002 *Stone Age Spear and Arrow Points of California and the Great Basin*. Bloomington: Indiana University Press.

Keene, Joshua L.
2018 A diachronic perspective on Great Basin projectile point morphology from Veratic Rockshelter, Idaho. *Quaternary International* 466:299-317.

Kelly, Robert L.
1995 *The Foraging Spectrum: Diversity in Hunter-Gatherer Lifeways*. Washington D.C.: Smithsonian Institution Press.

2001 Prehistory of the Carson Desert and Stillwater Mountains. *University of Utah Anthropological Papers* 123. Salt Lake City.

Knell, Edward J., and Mark P. Muniz
2013 Introducing the Cody Complex. In: *Paleoindian Lifeways of the Cody Complex*, Edward J. Knell and Mark P. Muniz, eds., pp. 3-30. Salt Lake City: University of Utah Press.

Knight, Wilbur C.
1898 Prehistoric Quartzite Quarries in Central Eastern Wyoming. *Science* 7:308-311.

Leach, Melinda, and Steven G. Botkin
1992 Archaeological Investigations at Tosawihi, A Great Basin Quarry, Part 2: A Regional Survey. Report on file, Nevada Bureau of Land Management Elko Resource Area Office. Elko.

Lee, Craig M., Michael Neeley, Mark D. Mitchell, Marcel Kornfeld, and Crae O'Connor
2016 Microcores and microliths in Northwestern Plains and Rocky Mountain front lithic assemblages. *Plains Anthropologist* 61(238):136-158.

Lee, Richard B.
1968 What Hunters do for a Living, Or, How to Make Out on Scarce Resources. In *Man the Hunter*, pp. 30-48, Richard B. Lee and Irvin DeVore, eds. Chicago: Aldine.

Lowie, Robert H.
1909 *The Northern Shoshone*. Anthropological Papers of the American Museum of Natural History 2(2):165-306. New York.

Miller, Susanne J.
2017 Bobcat Rockshelter (10-CL-11) Faunal Analysis. Appendix A in Excavations at Bobcat Shelter, A Prehistoric Bighorn Sheep Hunting Camp in the Birch Creek Drainage of Far Eastern Idaho, by Brooke S. Arkush, pp. 97-151. Report on file, Caribou-Targhee National Forest Supervisor's Office, Idaho Falls, Idaho.

Morlan, Richard E.
1970 Wedge-Shaped Core Technology in Northern North America. *Arctic Anthropology* 7(2):17-37.

Omvig, Jeremy, and Matthew J. Landt
2016 A Class II Cultural Resource Inventory of the Spanish Diggings Quarries Cultural Landscape, Niobrara County, Wyoming. Report on file, Wyoming Bureau of Land Management Newcastle Field Office, Newcastle, Wyoming.

Peart, Jonathan M., Molly Boeka Cannon, and Kenneth P. Cannon
2017 2017 Archaeological Prospection Investigations at Site 10BT1972, Butte County, Idaho. Cannon Heritage Consultants Technical Report Number ID-17-030. Logan, Utah.

Ranere, Anthony J.
1971 Birch Creek Papers No. 4: Stratigraphy and Stone Tools from Meadow canyon, Eastern Idaho. *Occasional Papers of the Idaho State University Museum* 27. Pocatello.

Reher, Charles A.
1991 Large Scale Lithic Quarries and Regional Transport systems on the High Plains of Eastern Wyoming. In: Raw Material Economies Among Prehistoric Hunter-Gatherers, A. Monet-White and S. Holen, eds., pp. 251-284. *University of Kansas Publications in Anthropology* 19. Lawrence.

Rondeau, Michael F.
2010 An Analysis of a Blade Core from the Beatty Curve Site, 35KL95, Klamath County, Oregon. Rondeau Archaeological Lithic Analysis Report 75, Sacramento, California.

Sanger, David
1968 The High River Microblade Industry, Alberta. *Plains Anthropologist* 13:190-208.

Steward, Julian H.
1938 *Basin-Plateau Aboriginal Sociopolitical Groups*. Bureau of American Ethnology Bulletin 120. Washington: Government Printing Office. (Reprinted: University of Utah Press, Salt Lake City, 1970 and 1997.)

Swanson, Earl H., Jr.
1972 *Birch Creek: Human Ecology in the Cool Desert of the Northern Rocky Mountains, 9,000 B.C. - A.D. 1850.* Pocatello: The Idaho State University Press.

Swanson, Earl H., Jr., B. Robert Butler, and Robson Bonnichsen
1964 *Birch Creek Papers No. 2: Natural and Cultural Stratigraphy in the Birch Creek Valley of Eastern Idaho*. Occasional Papers of the Idaho State College Museum 14. Pocatello.

Swanson, Earl H., Jr., and Paul G. Sneed
1971 Jackknife Cave. *Tebiwa* 14(1):33-69.

Thomas, David H., and Susan L. Bierworth
1983 Material Culture of Gatecliff Shelter: Additional Stone Tools. In The Archaeology of Monitor Valley2. Gatecliff Shelter, pp. 212-245, David H. Thomas, ed. *Anthropological Papers of the American Museum of Natural History* 59(1). New York.

Thomas, Scott P., and Michael F. Rondeau
2016 Are Clovis Diagnostics Always Diagnostic? Paper presented at the 35th Biennial Great Basin Anthropological Conference, Reno, Nevada.

Thompson, Randy A.
2004 Trade or Transport: Occurrence of Obsidian From the Malad, Idaho, Source in the Great Plains. Unpublished Master's thesis, Idaho State University. Pocatello.

Trubitt, Mary Beth D.
2007 The Organization of Novaculite Tool Production: Quarry-Workshop Debitage Comparisons. *Index of Texas Archaeology: Open Access Gray Literature from the Lone Star State*: Article 13. Austin.

Waters, Michael R., and Thomas A. Jennings
2015 The Hogeye Clovis Cache. College Station: Texas A&M University Press.

Waters, Michael R., Charlotte D. Pevny, and David L. Carlson
2011 *Clovis Lithic Technology: Investigation of a Stratified Workshop at the Gault Site, Texas*. College Station: Texas A&M University Press.

Wilson, Michael C., John Visser, and Martin P. R. Magne
2011 Microblade Cores from the Northwestern Plains at High River, Alberta. *Plains Anthropologist* 56(217):23-36.

Whitlam, Robert G.
1976 Archaeology in the Williams Lake Area, British Columbia. *Occasional Papers of the Archaeological Sites Advisory Board of British Columbia* 1. Victoria.

Willingham, Charles G.
1995 Big Table Mountain: An Obsidian Source in the Centennial Mountains of Eastern Idaho. *Idaho Archaeologist* 18(1):3-7.

Willingham, Charles G., Jack Erb, and Scott Johnson
1992 Intermountain Antiquities Computer System Site Form for 10-Bt-1972. Document on file, Caribou-Targhee National Forest Supervisor's Office, Idaho Falls, Idaho.

Zerga, Donald L., and Robert G. Elston
1990 Flaked Stone Technology. In The Archaeology of James Creek Shelter, pp. 191-226, Robert G. Elston and Elizabeth E. Budy, eds. *University of Utah Anthropological Papers* 115. Salt Lake City.

IDAHO ARCHAEOLOGIST, Vol. 43, No. 1 Spring 2020, 37-58

ARTICLE

The Influence of River Configuration on Late Archaic Forager Camp Locations in Southwest, Idaho

JOSEPH D. WARDLE

University of Michigan

Abstract

Previous work has established a relationship between physiographic features of the Middle Snake River channel in southern Idaho and the presence of fishing sites. To improve on future studies of this type, it is important to question two assumptions: 1) the category of "fishing site" is useful and defensible; and 2) the configuration of the Middle Snake River was static during the period when archaeological evidence suggests increased use of fish. This study assesses the argument that prehistoric camp locations, regardless of evidence for fishing, were influenced by physiographic features of pre-dam channels and changes in those features over time. The results suggest that islands and funneled channels likely conditioned where hunter-gatherers placed camps, although this relationship varied over time. Both aquatic and terrestrial resources would have been utilized at these locations.

KEYWORDS; Snake River, Fishing, Geospatial, Hunter-Gatherer

Introduction

In the western Snake River Plain of southern Idaho, archaeological site location has been shown to correlate with two physiographic features of the Snake River's configuration: islands and localized narrows where the river channel funnels (Pitkin 2010). Archaeological investigations of settlement in fluvial landscapes must account for the complexity of these dynamic systems (Chatters and Hoover 1986). River configuration is influenced by a range of variables such as seasonal variation in stream flows (Doulatyari et al. 2014), historic cycles of floods and droughts (Lytle and Poff 2004), the fluvial geomorphology of river channels (Charlton 2008), geologic intrusions such as lava flows or landslides (Davis 2007), and human intervention in the form of dams, canals, irrigation, and pollution (Surian et al. 2009). If river configuration is assumed to have influenced decisions of where to forage and varied over time, those decisions would have changed over time in response to interannual and seasonal variability. The goal of this study is to reassess the relationship between site location and physiographic features of the Middle Snake River within the context of what can be inferred from archaeological evidence about the extent of fishing and from historical river flow data about the variability in river conditions expected over time.

The study area, defined as the Middle Snake River, includes a section from a western boundary at 43.680887° N, -117.026529° W – where the Snake River first crosses into Oregon – to an eastern boundary at Shoshone Falls (Figure 1). This is distinct from the Upper Snake in eastern Idaho and its headwaters in western Wyoming; as well as the Hells Canyon and Lower Snake portions downstream of the study area. The western limit is chosen to create a distinct Middle Snake section within Idaho, and the eastern limit is based on reports that salmon did not venture farther upstream than Shoshone Falls (Murphy and Murphy 1960).

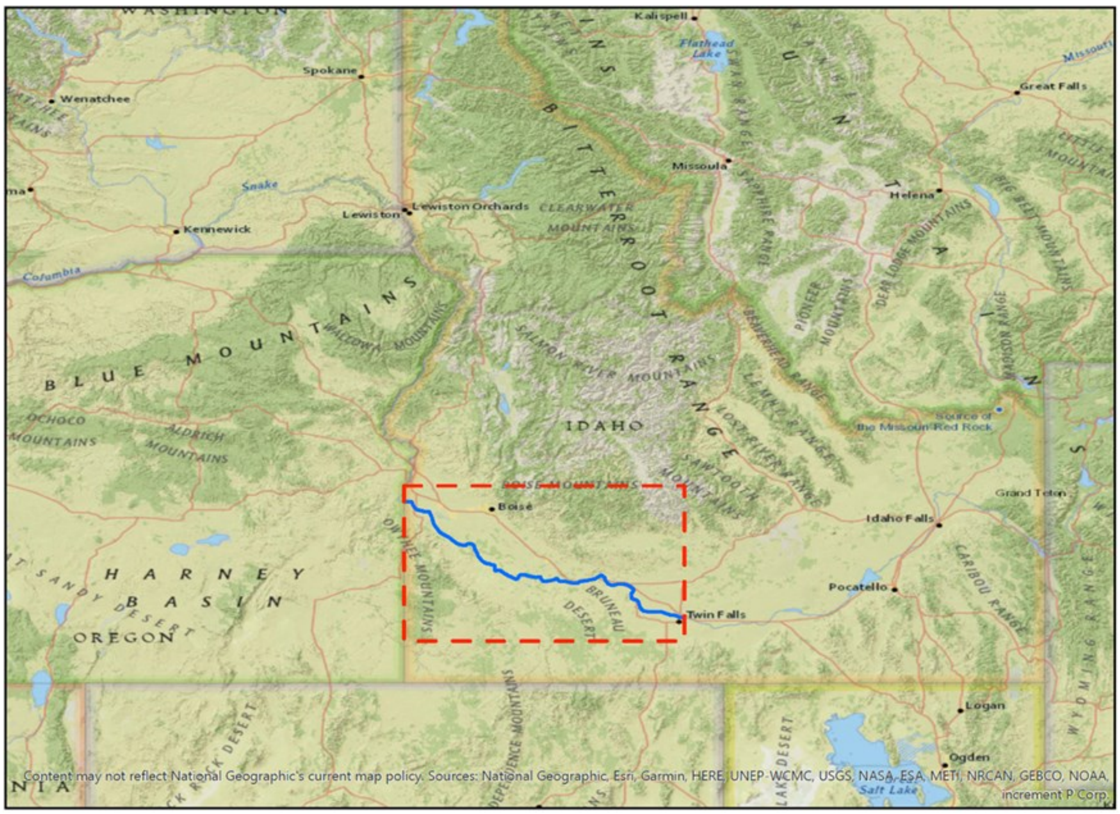

Figure 1. Map of Middle Snake River within western Snake River Plain.

This study focuses on the Late Archaic time period when fishing was a part of the subsistence spectrum of groups on the western Snake River Plain, as suggested by archaeological evidence (Table 1). As of 2015, 31% of known Late Archaic sites on the Middle Snake River contain salmonid or non-salmonid fish remains (Plew and Guinn 2015: 49). A sample of 25 sites was chosen based on their proximity to the Snake River, not the presence of evidence for fishing (see below). This allowed for the possibility that islands and narrowed channels attracted groups for other reasons, such as game crossing and access to patches on both sides of the river.

Table 1. Chronology of Snake River Plain Archaeology (Plew 2016).

Period	Dates
Paleoindian Tradition	12,000-8,000 B.P.
Early Archaic	8,000-5,000 B.P.
Middle Archaic	5,000-2,000 B.P.
Late Archaic	2,000-250 B.P.
Proto-Historic	250 B.P.- Historic period

Archaeological Background

Across the western Snake River Plain, and along the Middle Snake River, archaeological sites have produced little evidence (Plew 2016) to support the view that aggregated winter villages were supported by caches of salmon (sensu Meatte 1990) or even the view that sites were "fishing sites" in any way. It is likely that fishing was a portion of the subsistence spectrum during earlier periods, although remains are fewer suggesting it played a smaller role than in later times. Three individual fish remains from the Early and Middle Archaic have been documented on the Middle Snake River, and fishing activity may have occurred 11,000 years ago at the Hetrick site near Weiser, Idaho (Plew and Guinn 2015; Plew 2016). However, there is little evidence of significant fishing on the Snake River Plain during the Early or Middle Archaic.

Faunal remains of fish species are the most common type of evidence for fishing in the sample of Late Archaic sites. However, a survey of the assemblages reveals few specimens in most sites, and even at Three Island Crossing (10-EL-294), where more than 19,000 specimens were documented during the 1986-1987 excavations by the Boise State University Archaeology Field School, the minimum number of individuals (MNI) is approximately 300. Subsequent excavations failed to expand that number in any significant way (2008 and 2018 excavations found no identifiable fish remains) (Eastman 2011; Wardle 2018).

The lack of fish remains at sites within the study area could be due to other factors: fish remains often do not preserve well in montane or arid river contexts (Lubinski 1996) and an absence of evidence could be explained by river terraces still forming (Bentley 1981). Even when faunal evidence is present, fishing and some amount of processing could have been done at a location different from the location of deposition (Lubinski and Partlow 2012). The presence of fish remains could also be attributed to natural deaths (Butler 1993) and often exhibit limited evidence of butchering (Willis et al. 2008). Experimental butchering, though, suggests that fish bones should exhibit more evidence of cutting (Willis et al. 2008). This discrepancy could occur because samples of bones present in the archaeological record are of the type that prehistoric people avoided cutting or that estimates of the number of naturally-deposited fish bones in archaeological contexts are low (Willis et al. 2008).

Few pieces of fishing technology have been recovered in southwest Idaho, which includes some net sinkers (e.g., Higby Cave) (Plew 1998), rock weirs, two short-term storage pits at Three Island Crossing (Gould and Plew 2001), and a cache of fishing gear (Figure 2) that includes harpoon points, net sinkers, a hook, matting, and line (Schellbach 1967). The latter two instances of storage and fishing gear are the only two examples of their kind found in southwest Idaho (Plew 2016). This is not surprising, considering that archaeological sites in the region are characterized by expedient toolkits that are similar in form, regardless of site function (Gould and Plew 1996). Yu and Cook (2015) have also discussed the difficulty of assigning diagnostic characteristics of lithic technology to fishing activity due to the multifunctional nature of lithic butchering tools. Another consideration is that an absence of fishing toolkits could reflect a preservation bias since most gear components are organic (Yu and Cook 2015).

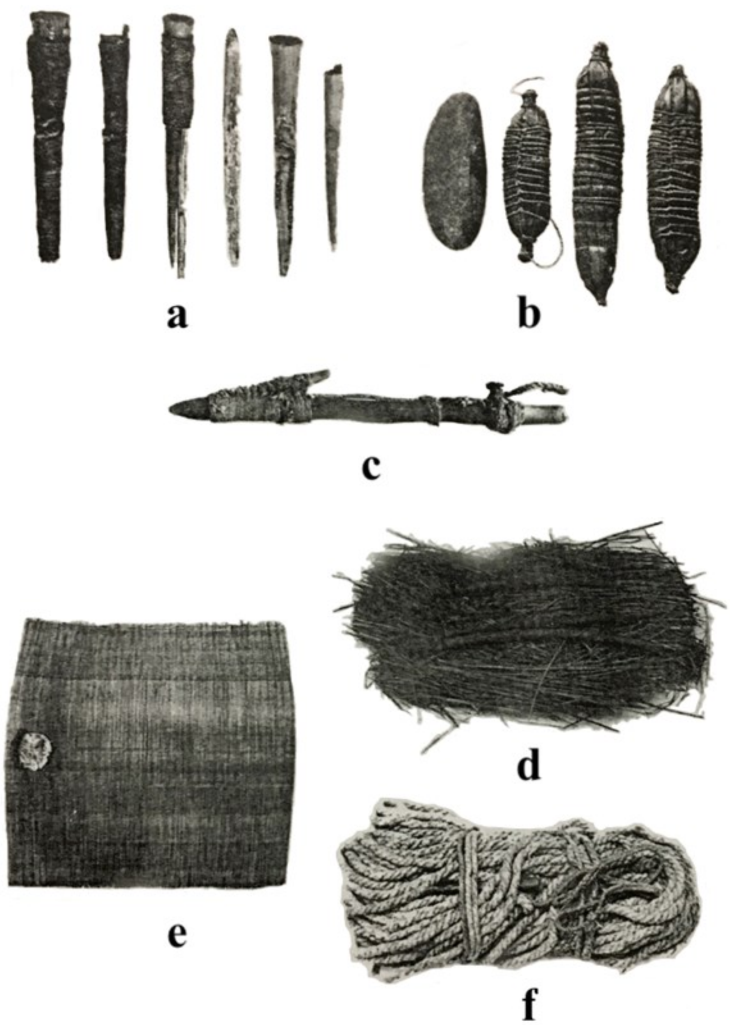

Figure 2. Sample of fishing gear found at Schellbach Cave: a, Harpoon points; b, Net sinkers; c, Fishhook; d, Bundle with wooden spear; e, Matting; f, Fishing line (from Schellbach 1967).

Had fishing been a focus at these locations, residential mobility would have decreased to some extent, but there is no evidence for this in the archaeological record. Most sites are ephemeral and typical of a foraging residential pattern (Plew and Guinn 2015) described in the Binford mobility continuum (Binford 1980). Archaeological sites reflecting a foraging mobility pattern will exhibit "low visibility" with little accumulation of debris, little reuse of locations, and few smaller logistical camps because such foraging occurs close to the central base camp (Binford 1980: 7). The one exception would be groups in an arid environment that are "tethered" (sensu Taylor 1964) to isolated and discretely placed water sources (not the case on the Snake River Plain). Also, high residential mobility is suggested in most sites along the Middle Snake River when applying Kelly's (2001) index of residential mobility, which infers mobility based on 14 dimensions of lithic assemblages. Additional indicators, such as ceramics, also suggest high levels of residential mobility (Roberts 2015).

The evidence from archaeological sites along the Middle Snake River offers little to support the claim that fishing was the primary function at these locations, even when factoring in preservation bias. An extended version of this study (Wardle 2019) includes a survey of the archaeological evidence for fishing from the sample's 25 sites. The most parsimonious explanation for why no other caches of fishing gear have been found, like those recovered at Schellbach Cave (Schellbach 1967), is that simple fishing strategies would have been more productive. In addition to considerations of fishing technology, it is likely that other factors influenced foraging decisions. One important example is terrestrial prey behavior: mule deer seek out lower elevations, south facing slopes, and canopy cover to conserve energy during winter (Smith et al. 2015). These are characteristics found along the Snake River. Both islands and funneled channels often allow for crossings when the river depth is low, such as at Three Island Crossing. Beyond taking advantage of game crossings, humans can cross the river to access patches on either side. Although the proportion of fishing in the subsistence strategy of Late Archaic foragers in the study area was likely low, physiographic features of the river may still have influenced decisions of where to forage for a variety of resources. The extent to which these features changed can be inferred somewhat from the historic data on flow levels available from the period prior to dam construction.

Historic Variability in the Pre-Dam Middle Snake River Configuration

The variability inherent in river systems would have influenced site placement over time. Exploring the possibility that physiographic features were part of the calculations of where to forage requires an understanding of how much variation is expected to have occurred in the river system during the Late Archaic period. Fluvial systems are open ones with both internal variables (e.g., soil type, slope angle, channel depth, or vegetation) and external variables (e.g., climate, tectonics, or human activity), characterized by a constant state of feedback between those variables (Charlton 2008). Changes in the river's configuration could have been gradual, over millennia, or rapid, such as paleoseismic events that are within the timescale of archaeology (see Plew and Guinn 2015). Rapid changes such as landslides would have had considerable effects on human foragers, halting the ability of salmon to reach the middle and upper stretches of the Snake River, altering river channels and flows, and potentially changing areas in which fish were traditionally expected even after runs resumed. Archaeological reconstructions of past lifeways must consider these changes. While many variables influence this fluvial system, two significant factors are explored here: flow levels and island morphology.

Flow Levels

Seasonal and annual variation in stream flow levels are of particular importance in understanding the change over time of the location, size and morphology of islands and localized narrows. Formation, maintenance, and alteration of these physiographic features are sensitive to changes in flow levels. Flow levels instantaneously influence river depth, alter channel morphology through deposition of sediment (Mueller and Pitlick 2013), create suitable spawning areas for anadromous and resident fish species (Knapp et al. 1998; Simpson and Wallace 1982), and affect dissolved oxygen levels (Webb et al. 2008) and water temperature (Blakey 1966; Smith and Lavis 1975). The extent to which flows influence sediment buildup and change channel morphology is difficult to measure, and build-up of sediment is rarely measured in conjunction with precipitation (Mueller and Pitlick 2013). Also, accumulation of sediment will depend on local variables such as basin lithology, relief ratio, hillslope angle, drainage density, and mean annual precipitation (Mueller and Pitlick 2013), all of which vary east to west along the Middle Snake River. Over time, though, buildup of sediment will change channel morphology. Depth, riverine vegetation and the force of flows in depositing sediment are the three main contributors to configuring a channel morphology.

Flows also directly affect water temperature, an important condition for the life history, behavior, and nutritional value of aquatic species. Temperature is perhaps the most obvious, and in many ways the most important parameter in determining water quality (Blakey 1966). Lower flows reduce thermal capacity and speed, thus increasing water temperatures, which can affect dissolved oxygen levels (Webb et al*.* 2008) and spawning timing (Simpson and Wallace 1982). Low flows can also allow ground seepage to reduce temperatures in some cases (Smith and Lavis 1975). Higher temperatures during migratory runs can increase energetic expenditures (Plumb 2018), but species also have optimal temperature ranges for spawning. Optimal temperatures for an adult chinook salmon are around 16.5°C; and fish that migrate too early or too late will likely die due to exhausting all energy reserves (Plumb 2018). The Middle Snake River currently has monthly temperatures that are ideal for chinooks during a five to seven-month period, which covers the three migratory runs. For example, water temperatures in the Snake River near King Hill, Idaho average approximately 15°C from April to September, with a spike in July (Figure 3).

Chinook salmon have an energy expenditure between 3 and 4.5 kilojoules/gram at the time of death, compared to 5.2 to 12.1 kilojoules/gram energy expenditure at the beginning of a migration (Plumb 2018). In addition to migration run and spawning, egg hatching is directly influenced by water temperatures. Steelhead eggs usually hatch when water temperatures are approximately 10°C after an incubation of about 50 days (Grabowski 2015). There is no variable more consequential to the success of a migratory spawning run than water temperature.

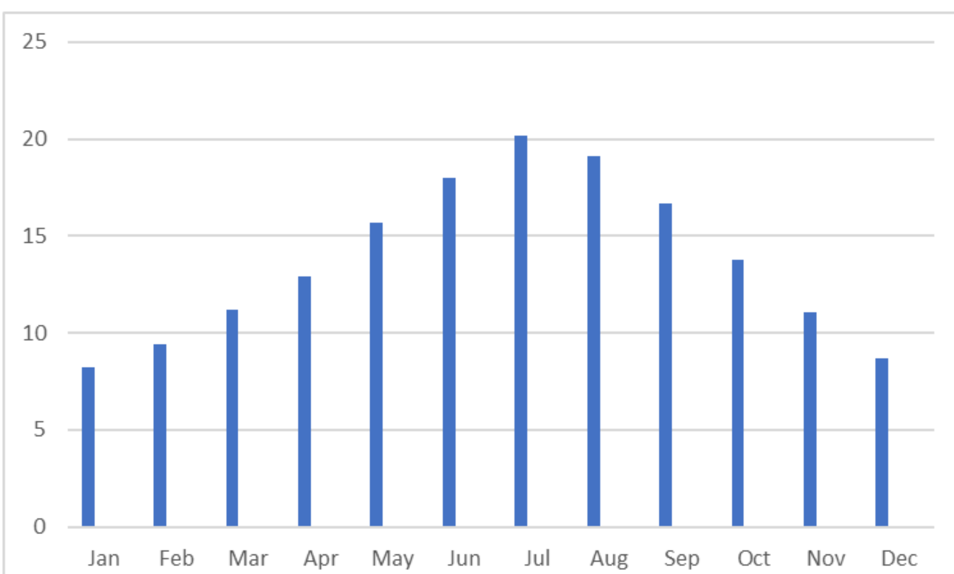

Figure 3. Mean of monthly temperatures (1996-2018) of Snake River near King Hill, Idaho (USGS National Water Information System 2018).

Inferring the amount of variability in flow levels that occurred in prehistory is difficult. Climate cycles that would have influenced the Middle Snake River fluvial system have been inferred from tree ring chronologies taken from the region of the river's headwaters in western Wyoming. A 415-year reconstruction of the stream flow of the Upper Snake River revealed that drastic changes to the flow occurred in the past, most notably in the presence of a 30-year low flow period in the mid-1600's (Wise 2010). Wise's (2010) study also revealed many other periods of low flow which ranged from 2-7 years long, including six periods of six years or longer. However, flow levels in the Middle Snake relative to the Upper Snake would have had the additional influence of tributaries and groundwater seepage, both products of snowfall levels (Geological Survey (U.S.) and Kjelstrom 1986).

Historic pre-dam flow data, although limited, offers the ability to infer the potential level of variability in prehistory. Flow levels at the Snake River near King Hill in the nearly 40 recorded years before the construction of nearby dams reflect high variability. Looking at just three months (May, July, and September), there is high variation in flow levels. May and July have wide ranges of means. For May, the mean cfs was 12,327 with a standard deviation of 5,949.66. For July, the mean cfs was 8,951 with a standard deviation of 3,677.93. The high standard deviation reflects more variation in temperatures, whereas the lower standard deviation of September (mean=8,417, SD=1,684.99) represents more clustering toward the mean and less variation, as is visible in Figure 4.

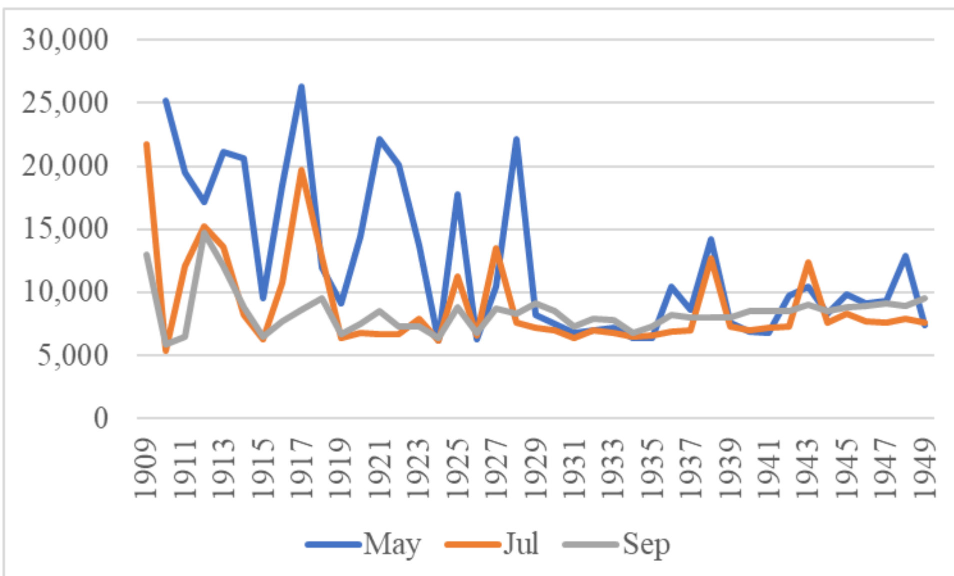

Figure 4. Monthly mean discharge (cfs) of Snake River at King Hill for May, July and September (1909-1949) (USGS National Water Information System 2018).

Islands

The form of islands is particularly dependent on flow regimes. Fluvial islands, like those on the Middle Snake River, are the result of high energy processes like floods, glaciation, or avulsion, and are unstable and highly variable over geologic time scales (Osterkamp 1998). Unlike other islands, fluvial islands surrounded by a river channel are less permanent, and their form can vary seasonally, annually, and daily due to events like landslides or floods. However, it has been noted that dynamic fluvial zones around islands are beneficial to terrestrial plants and animals by providing a wide range of riparian habitats and high species diversity (Osterkamp 1998; Stanford et al. 1996). They also offer island organisms protection from predation, which leads to high bioproductivity (Osterkamp 1998).

Islands can form in numerous ways, with the most rapid channel alteration occurring in the event of avulsion, recession of floods, or the deposition of new mass in the form of debris from a landslide (Osterkamp 1998). The life of an island is a balance between continual erosion and deposition. Flow levels, though, will significantly alter the form of an island. On the Middle Snake River, this is evident in maps of Dolman Island before the construction of dams (Figure 5) and after (Figure 6), as shown in a 1903 Government Land Office map and a 2017 USGS 7.5 Quad map.

Most of the islands on the Snake River may have formed about 15,000 years ago and many of the islands are more than one kilometer long (Osterkamp 1998). The most common formation process for present-day islands was rapid evacuation of sediment associated with relict islands that are elongate and may not have been flooded over since formation at the time of the Bonneville Flood (Osterkamp 1998). There is variation in form, though. Many islands, typically the smaller ones, are not relict islands, but regime islands which are more subject to erosion by floods and channel migration (Osterkamp 1998).

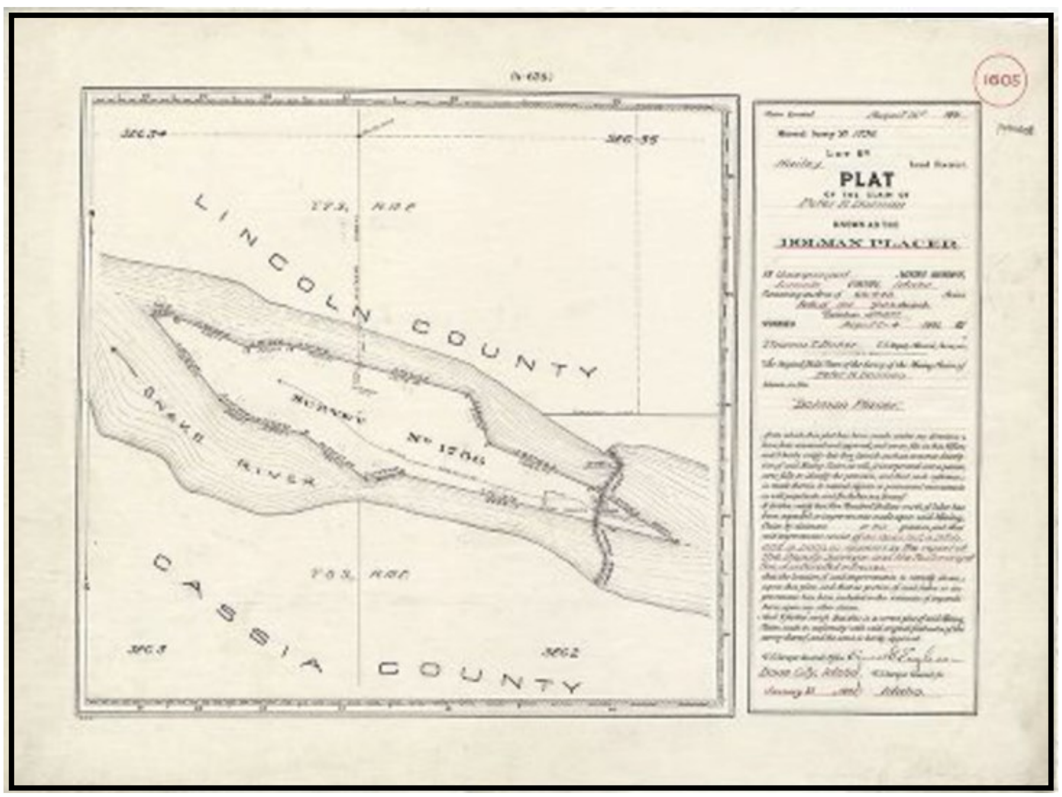

Figure 5. Map of Dolman Island in 1903.

At the time scale of this study most alterations to the form of islands and to the dependent elements they influence within the configuration of the river are related to flows, geological intrusions, and changes in vegetation. The variation in landscape features can have significant influence on the selection pressure of salmonids (Micheletti et al. 2018). Paleoseismic events can shape the configuration of islands and localized narrows by dramatically altering the landscape through geologic obstructions, changes in flow levels, and increases in sediment discharges (Plew and Guinn 2015). Earthquakes can increase groundwater discharge and river flows (such as Borah Peak in 1983) and fire erosion can lead to sediment discharges because of smooth soil surfaces.

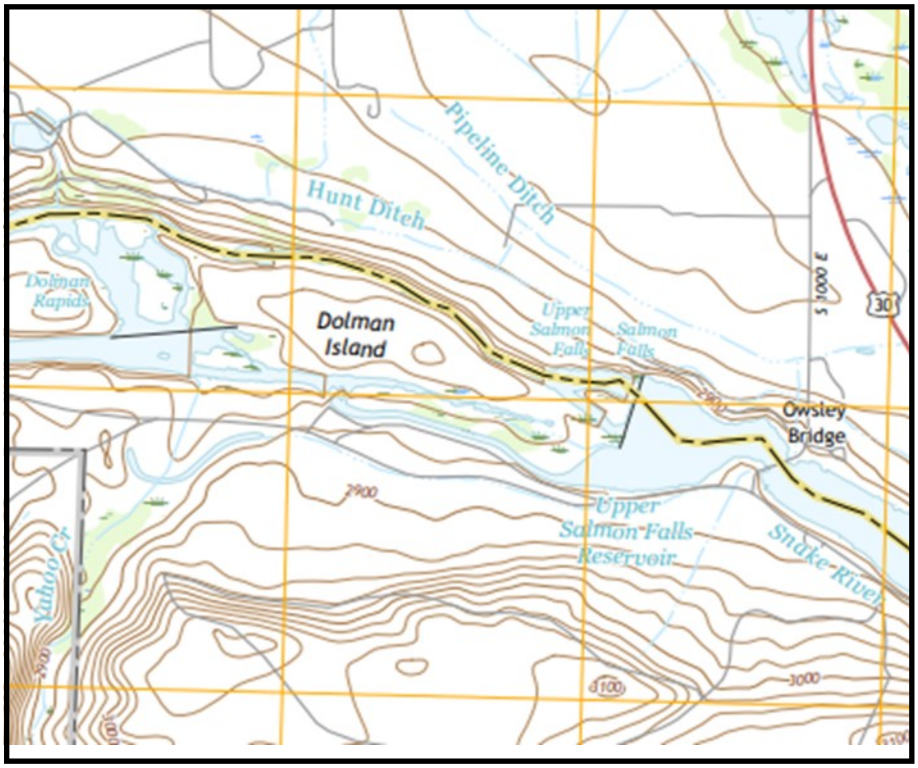

Figure 6. Map of Dolman Island in 2017.

Finally, dams have significant impacts on river configuration; understanding those impacts and how they shape rivers today is essential to making inferences about past river configuration and past human behavioral responses. The most consequential impact is the erosion of downstream channels (Csiki and Rhoads 2010) and the accumulation of sediments upstream within an impoundment (artificial lakes) (Csiki and Rhoads 2010). Slow-moving waters will affect temperature and temperature gradients (Smith and Lavis 1975; Webb et al. 2008), and original channels are drowned in sediment (Pizzuto 2002). The dams that cover the study area would have had profound effects on the flow and temperature of the Snake River (Table 2). Even by 1906, when Robert Lowie (1909) came to Idaho to conduct ethnographic research with the Shoshone, the river would have been completely altered by the dam constructed at Swan Falls in 1901.

Table 2. Dams Within the Study Area (U.S. Army Corps of Engineers 2003).

Dam	Height	Year Completed
Lower Salmon	16 m	1949
Bliss	43 m	1950
C.J. Strike	35 m	1952
Swan Falls	25 m	1901

The King Hill section of the Snake River is downstream of Lower Salmon Falls Dam (1949) and of Bliss Dam (1950) and would have begun experiencing the effect of the dams on streamflow immediately (Figure 7). Two trends are visible: a far greater discharge before the construction of dams was completed and less monthly variation afterward.

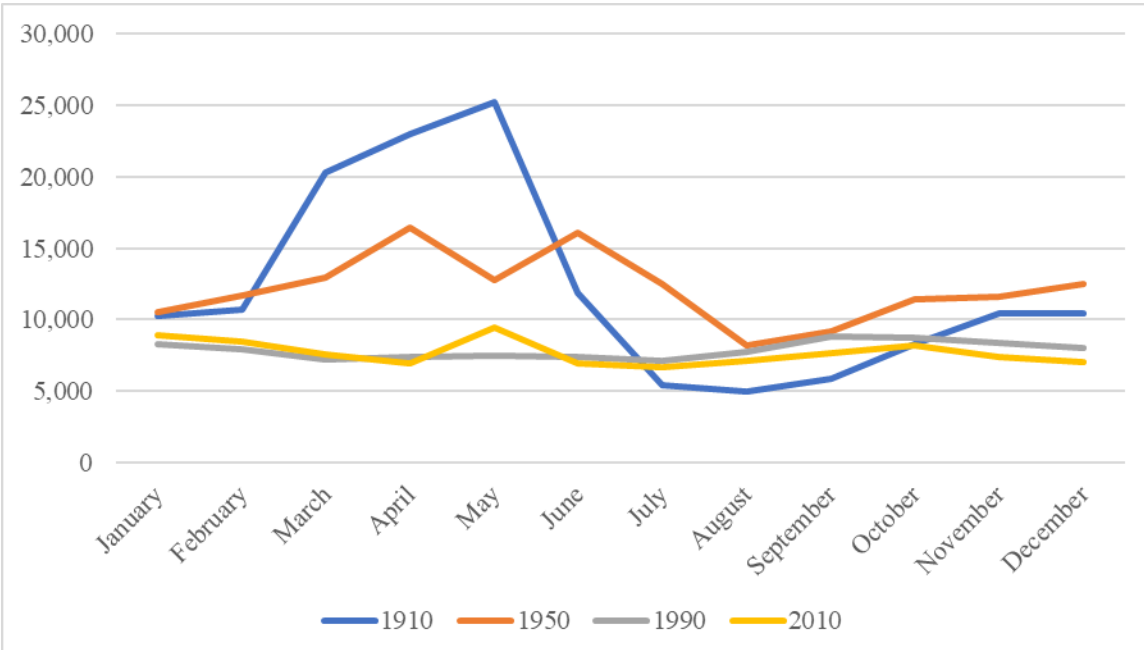

Figure 7. Monthly mean cfs (cubic feet/sec) discharge of Snake River near King Hill, Idaho (USGS National Water Information System 2018).

To summarize, previous archaeological investigations suggest a foraging pattern moving people to resources on a seasonal basis. This included fish but fishing was not the subsistence focus. From what can be inferred from the morphology of islands and the variation in flow data from the pre-dam historic period, it is likely that river condition changed significantly over time. If groups had chosen locales based on physiographic features of the river, they would have had to respond adaptively to changes over time in the structure and location of those features. A series of research questions follow. Are archaeological sites correlated with islands and funneled channels? Are either of these physiographic features ubiquitous and thus meaninglessly correlated with archaeological sites (i.e., sites adjacent to the river correlate with water)? Were these locations repeatedly used by Late Archaic foragers?

Research Design and Methods

The following hypotheses are based on an approach that predicts site location if related to physiographic features of the Middle Snake River and duration of occupations at specific locations if the river configuration is static over time.

Hypothesis One: The Middle Snake River configuration influenced the positioning of camp locations.

This hypothesis proposes that groups considered physiographic features that facilitated either potentially productive fisheries or game crossings when choosing camp locations adjacent to the Middle

Snake River. If the hypothesis is supported, it does not suggest that fishing was the primary subsistence strategy (an assertion for which there is minimal archaeological evidence), but that the variation in the configuration of the river influenced decisions of location and timing. A general foraging pattern would include fish but not necessarily in the numbers that would support village life and winter caching of salmon (Pavesic 1978). Other aspects of the riparian zone may have conditioned mobility as well (e.g., shellfish, aquatic plants, waterfowl, terrestrial game crossings, riparian vegetation used as fuel, etc.).

The expectation is that archaeological site locations will correlate with islands and funneled channel locations on the pre-dam Middle Snake River. The measurement variables were proportion of land area and proportion of archaeological sites within 2-km radius zones around physiographic features. These were both relative to the total number of land and sites within the study area, a 4-km wide and 669.9 km long section of land with the river course at its center (Figure 8).

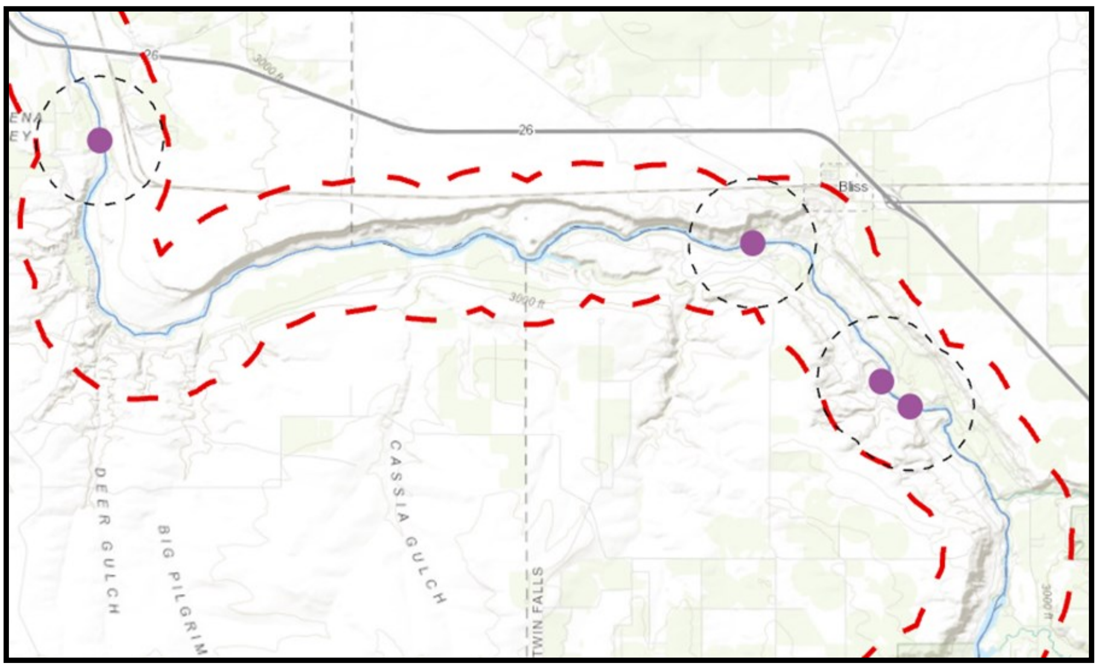

Figure 8. Example of zones around islands (purple dots) and 4 km wide study area (red dashes).

The analysis created a predictive map of sites based on the independent variables of fish behavior and river conditions (e.g., spawning aggregation, flow levels, etc.). Using ArcGIS Pro, a series of data layers were superimposed onto two base maps of the study area. United States Geological Survey (USGS) 7.5-minute quad maps were used as the first base map. The USGS quad maps show a pre-dam river channel, but another layer of Government Land Office (GLO) historical maps was placed over the reservoirs to identify a more detailed pre-dam configuration. GLO maps are much more accurate for identifying pre-dam configurations (U.S. Bureau of Land Management 2018).

A data layer of the river course with a 2-km buffer on either side was superimposed onto the base maps. Two kilometers was estimated as the distance foragers would travel for transporting food. While this may in fact be an underestimate, since a foraging radius typically extends 6-10 km from a residential base (Kelly 2013), it is a number that encompasses Pitkin's (2010) categories of adjacent (within 2 km) and immediate (within 1 km). It also is not far from Steward's (1938) estimate that Owens Valley Paiute foraging trips rarely exceeded 3.6 km one-way, which seems a reasonable substitute for the Snake River Plain, for which Steward provides no estimate. If caches of salmon were being transported, the distance would likely have been similar to what is seen among the Western Mono in the southern Sierra Nevada – an average of 3.4 km one-way trip from settlements to caches (Morgan 2008).

Zones with a 2-km radius were established around each occurrence of an island longer than 100 meters and of the minimum channel width for every 20-km section of the river beginning at the western boundary of the study area (Table 3). The latter of these is based on the fact that Pitkin (2010) designates minimum channel width as the average of the minimum width of every 1 km extending 10 km upstream and downstream from each archaeological site. These physiographic features (i.e., islands and points at which the channel funnels) within the river configuration potentially increase the productivity of fisheries (either by reducing search time or allowing the utilization of nets, spears, weirs with their optimal river conditions). This created two categories: land within zones around the physiographic features and land within the study area but not within those zones.

Table 3. River Features and Requirements for Inclusion in Analysis.

River Feature	Requirements for Inclusion
Islands	>100 m long
Funneled Channel	Minimum channel width (MCW) within 20 km long sections

A sample of 25 archaeological sites near the Snake River from Shoshone Falls to the border of Oregon was selected and compiled based on site location (Figure 9). Sites were selected based on their being situated within 2 km of either side of the Middle Snake River and having evidence of Late Archaic occupations based primarily on projectile types, presence of pottery, and radiocarbon dating.

Using IBM SPSS Statistics, a binomial test was conducted to assess whether the proportion of land area within 2 km zones around the physiographic features was similar to the proportion of sites within those same zones (relative to total land area within the study area or total number of sites within the study area) For example, if land within zones is .05 proportion of total land within the study area, then H_0: $p=.05$, H_a: $p>.05$ (where p=proportion of archaeological sites within zones around river features).

Statistical analysis of the first hypothesis (Binomial Test of Proportions) hinges on the assumption that it is more reasonable to compare the relationship between site location and physiographic feature within the context of the entire stretch of river rather than note which physiographic features happen to be near sites.

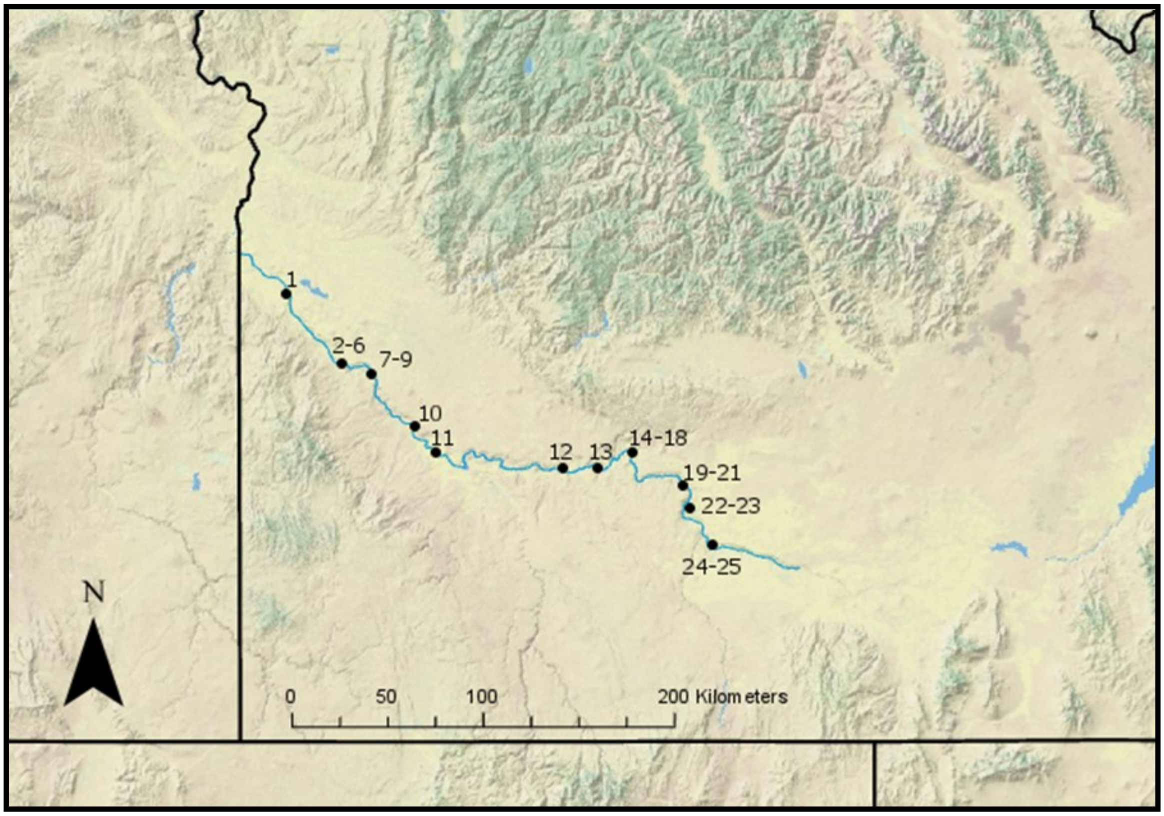

Figure 9. Map showing location of Late Archaic archaeological sites used in study sample (1=10-OE-2792, 2=10-CN-1, 3=10-CN-5, 4=10-CN-6, 5=10-OE-240, 6=10-AA-306, 7=10-OE-277, 8=10-AA-188, 9=10-AA-17, 10=10-OE-269, 11=10-EL-392, 12=10-EL-1367, 13=10-EL-294, 14=10-EL-110, 15=10-EL-1417, 16=10-EL-22, 17=10-EL-215, 18=10-EL-216, 19=10-GG-1, 20=10-TF-352, 21=10-GG-332, 22=10-GG-191, 23=10-GG-176, 24=10-GG-312, 25=10-GG-278).

Hypothesis Two: The Middle Snake River configuration influenced the duration of re-occupation of camp locations.

The premise that archaeological site location and river configuration are related leads to the hypothesis that certain locations would have been repeatedly used, as is suggested in Harris (1940), Steward (1938) and Murphy and Murphy (1960), where groups were aware of better fisheries, had preferred locales, cached equipment, and built semi-permanent structures like weirs. The expectation is that sites near areas of potentially productive fisheries (and game crossings) will have longer ranges of occupation than sites farther from those areas. These ranges of occupations are represented by radiocarbon date ranges which are not perfect representations of actual durations. If those productive areas, as seen today, were somewhat consistent over the last 2,000 years, then there should be longer ranges of occupation near those areas than seen in archaeological sites not near those physiographic features. However, if those physiographic features change over time, then it would be expected that ranges of occupations would be similar between sites near and sites not near these physiographic features. In other words, as river configuration changed, preferred camp locations changed in response over time. This presumes good preservation of Late Archaic sites and a good representation of sites that are not underwater.

A smaller sample of archaeological sites (N=8) on the western Snake River Plain with radiocarbon-dated specimens was split into two categories: sites within the zones and those outside the zones. The range of dates (number between earliest and latest) was established for each archaeological site. A non-parametric Mann-Whitney test compared the means of the two samples to test whether, on average, sites near the features had similar occupation ranges to sites not near the features.

Results: Archaeological Site Location and Physiographic Features

Islands

Islands are a ubiquitous physiographic feature of the Middle Snake River's configuration. Just over half of the study's land area (56.7%) was within 2 km of an island. There are 178 islands that are at least 100 m long within a river course that spanned 669.6 km. The distribution of the islands is not homogeneous across the river. Within the 20 km sections that were used to select minimum channel width, the mean number of islands is 5.24, or one island every 3.82 km (Figure 10). This is a pattern that existed at least in the 1890's and remains today.

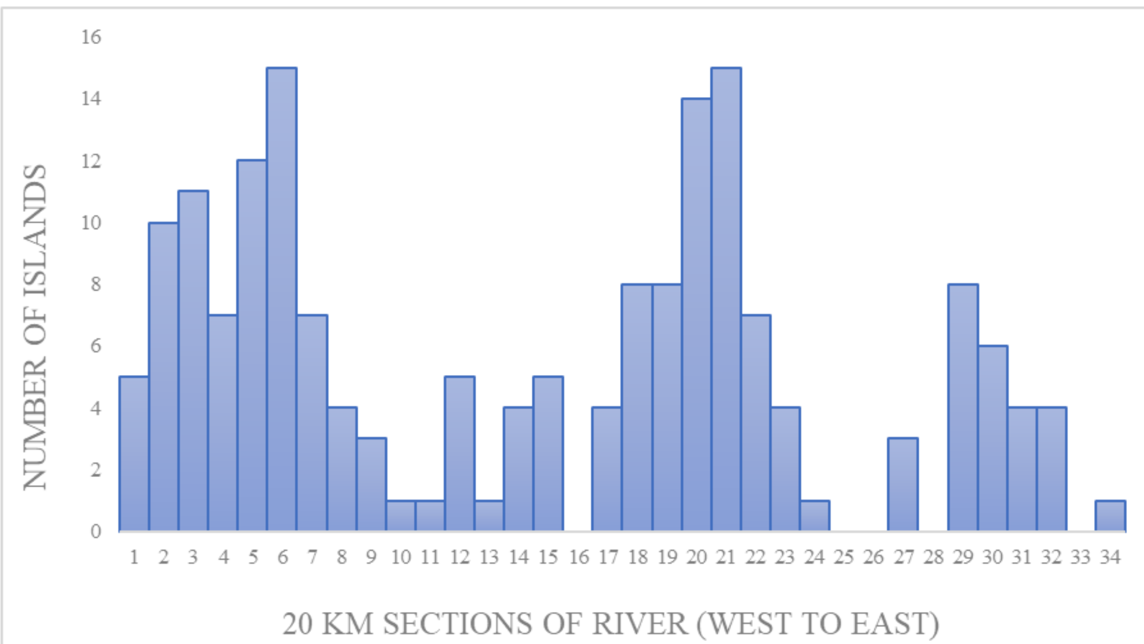

Figure 10. Bar graph of island distribution in Middle Snake River configuration (7=Celebration Park, 22=Three Island, 27=Bliss, 34=Shoshone Falls).

There are more islands in the western half of the study area than in the eastern half. If every section upstream of Three Island Crossing were omitted from the study area, the mean number of islands per 20 km section would increase to 6.68, or one island every 2.99 km.

The following hypothesis was proposed: that the proportion of sites within zones would be greater than the proportion of land area within zones. The null hypothesis (H_0: Proportion of Sites = .567) would suggest that the placement of archaeological sites was likely to have been random. The alternate hypothesis (H_a: Proportion of Sites > .567) would suggest that the placement of archaeological sites occurred near islands to a greater extent than would be expected if the placement were random. The results from the geospatial analysis are outlined in Table 4 and maps of the analysis can be found in Wardle (2019).

Table 4. Results of Geospatial Analysis of Islands.

Length of river in study area	669.6 km
Total study area (with 4 km wide buffer)	1814.15 km^2
Number of Archaeological Sites in Sample	25
Number of Islands >100 m long	178
Area of Total Land Within Island Zones	1,029.22 km^2
Number of Archaeological Sites Within Island Zones	16

A binomial test of proportions suggests that the null hypothesis can be rejected. The proportion of sites within zones around islands was 0.64, greater than the expected proportion if site placement were random (0.567). However, the proportion of sites within zones around islands is only slightly greater (+7.3%) than expected if site placement were random.

Locations of Minimum Channel Width (MCW)

There were 34 sections of the river, each 20 km long, except for the final section near Shoshone Falls, which was 9 km long. The total area of land across the study area that was within 2 km of a section's MCW was 412.61 km^2, or 22.7%. The number of sites within zones surrounding locations of MCW was 11.

The following hypothesis was proposed: that the proportion of sites within zones would be greater than the proportion of land area within zones. The null hypothesis (H_0: Proportion of Sites = .227) would suggest that the placement of archaeological sites was likely to have been random. The alternate hypothesis (H_a: Proportion of Sites > .227) would suggest that the placement of archaeological sites were near locations of MCW to a greater extent than would be expected if the placement were random. The results from the geospatial analysis are outlined in Table 5.

Table 5. Results of Geospatial Analysis of MCW.

Length of river in study area	669.6 km
Total study area (with 4 km wide buffer)	1814.15 km^2
Number of Archaeological Sites in Sample	25
Area of Total Land Within MCW Channel Zones	412.61 km^2
Number of Archaeological Sites Within MCW Zones	11

A binomial test of proportions suggests that the null hypothesis can be rejected. The proportion of sites within zones around locations of MCW was 0.44, greater than the expected proportion if site placement were random (0.227). This is a much stronger relationship than that between camp locations and islands. The proportion of sites within zones around locations of MCW is nearly double the proportion expected if site placement were random.

Results: Variation in Physiographic Features and the Duration of Site Use

Mean Radiocarbon Ranges in Relation to Islands

The mean radiocarbon ranges between sites within 2 km of an island and sites not within 2 km of an island are not significantly different when analyzed using a non-parametric Mann-Whitney Test (U=8, p=.874). Sites near islands were not occupied for a significantly longer time than sites not near islands. The ranges of occupation for single component sites were listed as 100-year ranges to capture the possible timeframe of occupation.

Mean Radiocarbon Ranges in Relation to MCW

The mean radiocarbon ranges between sites within 2 km of a location of MCW and sites not within 2 km of a location of MCW are not significantly different when analyzed using a non-parametric Mann-Whitney Test (U=11, p=.266). Sites near locations of MCW were not occupied for a significantly longer period of time than the sites not near locations of MCW. The same sample of eight sites from the previous analysis was used.

In both cases, the null hypothesis, that sites near the physiographic features would have average duration of re-occupation similar to that of sites not near the physiographic features, cannot be rejected. Sites near both islands and locations of funneled channels (the minimum channel width) are related to archaeological site placement, but this was a relationship characterized by variability. Thus, site placement is conditioned by physiographic features, but site use appears to be more complicated and varies over time.

Discussion

The results of this study support the proposal that the variability inherent in river configuration would have made any relationship between archaeological site placement and physiographic features of the river one that varied significantly during the last 1,500-2,000 years. Both islands and localized narrows correlate with camp site placement, but islands are situated throughout most of the study area. Islands would be ubiquitous if the distance a forager would likely travel is raised from the 2-km range to Steward's (1938) 3.6 km range or Kelly's (2013) 6-10 km global average range. Furthermore, the binomial test of proportions barely exceeds the .567 proportion expected if site placement were random. Factors such as the range of the buffer around islands, the size and composition of the archaeological sample, and the length and width of the study area could alter a result this close.

These results are more ambiguous than those of the study conducted ten years ago (Pitkin 2010). That study noted types of physiographic features near sites with fishing evidence. By surveying the entire Middle Snake River for islands, the present study identified features where archaeological sites are expected and tested for a correlation within the context of the entire landscape. This ensures that sections of the river where sites are not located are included in the analysis.

The much stronger correlation occurred between archaeological site location and minimum channel width. These locations are mentioned in ethnographic sources as being linked to productive fishing, and many of the minimum channel width locations corresponded with falls and rapids. These are also locations where spearfishing would have been productive (a likely behavior when considering the multifunctional nature of the toolkit found throughout the western Snake River Plain). This correlation also potentially speaks to areas where facilities could have been placed (e.g., traps, weirs, etc.).

If one predicts that a general foraging pattern that moves people to resources occurred during the Late Archaic, as other archaeological analyses suggest, then it is reasonable to expect that groups that utilized the Middle Snake River on a seasonal basis considered river configuration not solely relative to fish but to a spectrum of potential prey. It is also worth considering the relationship between islands and MCW that is not explicit in the design of this study. Many of the narrow points on the river course are on the peripheries of islands. It is possible that islands are simply more MCW locations that are drawing human actors because of the potential for game crossings and access to patches on either side of the river. Furthermore, islands themselves are very productive environments with higher rates of species diversity relative to riparian environments. Locations of MCW not associated with islands will be more stable over time but funneling on the peripheries of islands offers all of the benefits of any MCW location with the added benefits of productive vegetation.

Perhaps more importantly, the results suggest that people did not use the sites that correlate with physiographic features of the river ca. 1890 any longer than the sites positioned elsewhere. This means that either sites do not actually correlate with physiographic features (Type I error) or that there is variation over time in the spatial distribution of the physiographic features. Flows and depths in one century, or decade, or year, will vary because of a variety of causes – altering the size of islands and the points on the river where the channel width is at its minimum relative to nearby points.

A number of factors could influence the results of this study. First, it is possible that other features are worth examining. Rapids and falls were certainly productive fisheries, but these overlapped with many of the MCW locations as defined by this study. Confluences, where many anadromous and resident fish species spawn, are another possibly significant physiographic feature. Although Pitkin found no correlation between confluences on the Middle Snake River and archaeological site locations, it may be worth testing under the new design that compares proportions.

Second, the size of the sample of sites with radiocarbon data could be increased. Most of the 25 sites used in this sample have no radiocarbon-dated specimens. Future expansions of the archaeological dataset might allow for improvements. A broader sample might aid in avoiding a non-parametric comparison of means, if distributional assumptions are met, and instead allow use of an independent t-test that would give a clearer comparison of the mean occupation ranges of the sites within zones and those outside. There would be considerable value in expanding the study to include all known archaeological sites that have been recorded as part of cultural resource management surveys. This could include sites that are up to 10 km away from the river. Finally, it must be noted that many of the archaeological sites adjacent to the river may have been destroyed by natural river activity or dam operations over time. This can create a bias in the sample.

Conclusion

There is a significant relationship between archaeological site location and physiographic features of the Middle Snake River, though the width of the river channel seems to have had a stronger influence over groups' decisions of where to camp during the Late Archaic period than does the presence of islands. The proportion of archaeological sites within zones near locations of minimum channel width is .44, much higher than the .227 expected if site placement were random. The proportion of the same archaeological sites within zones near islands is .64, only slightly above the .567 expected if site placement were random. Furthermore, islands are ubiquitous across the section of the Snake River that flows through southwest Idaho. These results are expected and support the findings of Pitkin (2010), but the presence of islands may not be a viable predictor of foraging locations. The correlation between islands and archaeological sites, less strong in this new study, is possibly a side effect of sites mapping onto funneled channels (which are sometimes created by islands).

It has also been shown that river configuration is highly variable, influenced by climate cycles, geological events, variability in flows, and human intervention. Within the categories of land area within zones near physiographic features and land area within the study area but beyond these zones, the archaeological sites with radiocarbon-dated specimens suggest no difference between the ranges of reoccupation. This could mean that the correlations found in this study and those of its predecessor are non-existent or lacking some other variable that is influencing site placement. Or if site placement and physiographic features are correlated, then the variability in river configuration can be said to have altered that relationship over time. The locations that ethnographies suggest were claimed by specific groups would not necessarily have been consistent over two millennia.

Understanding variability in river configuration is a useful starting point for framing new research questions about prehistoric foraging decisions on the western Snake River Plain. This study suggests that any camp placement adjacent to the Middle Snake River, whether related to fishing or not, would have been forced to contend with seasonal and annual variation in flows, channel morphology, and a number of other interrelated fluvial variables. The methods and results presented here hopefully offer a modest example of how spatial and temporal variability can be accounted for when attempting to infer past dynamic behavior from static archaeological remains situated in riverine settings.

References

Bentley, Elton B.
1981 Geomorphic History and Soils Analysis of Archaeological Sites 10-GG-1 and 10-TF-352. In *Archaeological Test Excavations at Four Prehistoric Sites in the Western Snake River Canyon Near Bliss, Idaho*. Mark G. Plew, pp. 198-233. Project Reports no. 5. Boise: Idaho Archaeological Consultants.

Binford, Lewis R.
1980 Willow Smoke and Dogs' Tails: Hunter-Gatherer Settlement Systems and Archaeological Site Formation. *American Antiquity* 45(1): 4-20.

Blakey, J. F.
1966 Temperature of Surface Waters in the Conterminous United States. *U.S. Geological Survey Hydrologic Investigations Atlas* HA-235. Washington, D.C.

Butler, V. L.
1993 Natural Versus Cultural Salmonid Remains: Origins of the Dalles Roadcut Bones, Columbia River, Oregon, U.S.A. *Journal of Archaeological Science* 20: 1-24.

Charlton, Ro
2008 *Fundamentals of Fluvial Geomorphology*. New York: Routledge.

Chatters, James C., D.A. Neitzel, M.J. Scott, and S. Shankle
1991 Potenital Effects of Global Climate Change on Pacific Northwest Spring Chinook Salmon (*Oncorhynchus tshawytscha*): An Exploratory Case Study. *Northwest Environmental Journal* 7: 71-92.

Csiki, Shane, and Bruce L. Rhoads
2010 Hydraulic and Geomorphological Effects of Run-of-River Dams. *Progress in Physical Geography* 34(6): 755-780.

Davis, Loren G.
2007 Paleoseismicity, Ecological Change, and Prehistoric Exploitation of Anadromous Fishes in the Salmon River Basin, Western Idaho, USA. *North American Archaeologist* 28(3): 233-263.

Doulatyari, Behnam, Stefano Basso, Mario Schirmer, and Gianluca Botter
2014 River Flow Regimes and Vegetation Dynamics Along a River Transect. *Advances in Water Resources* 73: 30-43.

Eastman, Meghan Kim
2011 Recent Archaeological Investigations at Three Island Crossing: Insights Regarding Late Archaic Diet Breadth and Mobility. Master's Thesis, Boise State University.

Gould, Russell T., and Mark G. Plew
1996 Prehistoric Salmon Fishing in the Northern Great Basin: Ecological Dynamics, Trade-Offs, and Foraging Strategies. In *Prehistoric Hunter-Gatherer Fishing Strategies*, edited by Mark G. Plew, pp. 64-83. Boise State University, Boise.

2001 *Archaeological Excavations at Three Island Crossing*. Boise State University.

Grabowski, Stephen J.
2015 Structure of a Resource: Biology and Ecology of Pacific Salmon in the Columbia River Basin. In *Rivers, Fish, and the People: Tradition, Science, and Historical Ecology of Fisheries in the American West*, edited by Pei-Lin Yu, pp. 12-41. Salt Lake City: The University of Utah Press.

Harris, Jack Sargent
1940 *The White Knife Shoshoni of Nevada*. New York: D. Appleton-Century Co.

Harrison, John
2015 After 87 Years, Salmon Return to the Shoshone-Paiute Reservation. https://www.nwcouncil.org /news/after-87-years-salmon-return-shoshone-paiute-reservation, accessed September 10, 2018.

Kelly, Robert L
2001 Prehistory of the Carson Desert and Stillwater Mountains: Environment, Mobility, and Subsistence in a Great Basin Wetland. *University of Utah Anthropological Papers* No.123. University of Utah Press, Salt Lake City.

Kelly, Robert L
2013 *The Lifeways of Hunter-Gatherers: The Foraging Spectrum*. Cambridge University Press, New York.

Knapp, Roland A., Vance T. Vredenburg, and Kathleen R. Matthews
1998 Effects of Stream Channel Morphology on Golden Trout Spawning Habitat and Recruitment. *Ecological Applications* 8(4).

Kjelstrom, L.C.
1986 Flow Characteristics of the Snake River and Water Budget for the Snake River Plain, Idaho and eastern Oregon. *U.S. Geological Survey Publication* Series 680.

Lowie, Robert H.
1909 *The Northern Shoshone*. Anthropological Papers 2(2), American Museum of Natural History, New York.

Lubinski, Patrick M.
1996 Fish Heads, Fish Heads: An Experiment on Differential Bone Preservation in a Salmonid Fish. *Journal of Archaeological Science* 23: 175-181.

Lubinski, Patrick M., and Megan A. Partlow
2012 Evidence for Local Fish Catch in Zooarchaeology. *Journal of Ethnobiology* 32(2): 228-245.

Lytle, David A., and N. LeRoy Poff
2004 Adaptation to Natural Flow Regimes. *Trends in Ecology & Evolution* 19(2): 94-100.

Meatte, Daniel S.
1990 *Prehistory of the Western Snake River Basin*. Occasional Paper of the Idaho Museum of Natural History No. 35. Pocatello, Idaho.

Micheletti, Steven J., Amanda R. Matala, Andrew P. Matala, and Shawn R. Narum
2018 Landscape Features Along Migratory Routes Influence Adaptive Genomic Variation in Anadromous Steelhead (*Oncorhynchus mykiss*). *Molecular Ecology* 27(1): 128-145.

Morgan, Christopher
2008 Reconstructing Prehistoric Hunter-Gatherer Foraging Radii: A Case Study from California's Southern Sierra Nevada. *Journal of Archaeological Science* 35: 247-258.

Mueller, Erich R., and John Pitlick
2013 Sediment Supply and Channel Morphology in Mountain River Systems: 1. Relative Importance of Lithology, Topography, and Climate. *Journal of Geophysical Research: Earth Surface* 118(4): 2325-2342.

Murphy, Robert F., and Yolanda Murphy
1960 Shoshone-Bannock Subsistence and Society. *Anthropological Records* 16:293-338. University of California Press, Berkeley.

Osterkamp, W. R.
1998 Processes of Fluvial Island Formation, with Examples from Plum Creek, Colorado and Snake River, Idaho. *Wetlands* 18(4): 530-545.

Pavesic, Max G.
1978 Ethnohistory and Cultural Ecology: A Study of Shoshonean Salmon Fishing. Paper Presented at the 31st Annual Northwest Anthropological Association Meetings. Pullman, Washington.

Pitkin, Travis Jay
2010 Islands in the Stream: Searching for Structure in the Aboriginal Fishery Along the Snake River. Master's Thesis, Boise State University.

Pizzuto, Jim
2002 Effects of Dam Removal on River Form and Process. *BioScience* 52(8): 683-691.

Plew, Mark G.
1998 Net Sinker from Higby Cave, Southwest Idaho. *Idaho Archaeologist* 21(2): 27-28.

2016 *The Archaeology of the Snake River Plain*. Department of Anthropology, Boise State University, Boise.

Plew, Mark G., and Stacey Guinn
2015 Assessing the Potential Impacts of Natural Events on the Holocene Productivity of Anadromous Fish Populations in Western Idaho. In *Rivers, Fish, and the People: Tradition, Science, and Historical Ecology of Fisheries in the American West*, edited by Pei-Lin Yu, pp. 42-69. Salt Lake City: The University of Utah Press.

Plumb, John M.
2018 A Bioenergetics Evaluation of Temperature-Dependent Selection for the Spawning Phenology by Snake River Fall Chinook Salmon. *Ecology and Evolution* 8(19): 9633-9645.

Roberts, Shawn Elizabeth
2015 Reassessing the Use of Kelly's Mobility Index in Examining Late Archaic Assemblage Variability in Southern Idaho. Master's Thesis, Boise State University.

Shellbach, Louis
1967 The Excavation of Cave No. 1, Southwestern Idaho. *Tebiwa* 10(2): 63-72.

Simpson, James C., and Richard L. Wallace
1982 *Fishes of Idaho*. University Press of Idaho, Moscow.

Smith, K., and M.E. Lavis
1975 Environmental Influences on the Temperature of a Small Upland Stream. *Oikos* 26:228-236.

Smith, Sonja M, Paul R Krausman, and Greg Painter
2015 Winter Habitat use by Mule Deer in Idaho and Montana. *Northwestern Naturalist* 96(1): 50-70.

Stanford, J. A., J. V. Ward, W. J. Liss, C. A. Frissell, R. N. Williams, J. A. Lichatowich, C. C. Coutant
1996 A General Protocol for Restoration of Regulated Rivers. *Regulated Rivers Research and Management*. 12: 391-413.

Steward, Julian
1938 *Basin-Plateau Aboriginal Sociopolitical Groups*. Smithsonian Institution Bureau of American Ethnology, Washington.

Surian, Nicola, Luca Ziliani, Francesco Comiti, Mario A. Lenzi, and Luca Mao
2009 Channel Adjustments and Alteration of Sediment Fluxes in Gravel-Bed Rivers of North-Eastern Italy: Potentials and Limitations for Channel Recovery. *River Research and Applications* 25(5): 551-567.

Taylor, Walter W.
1964 Tethered Nomadism and Water Territoriality: an Hypothesis. *Acts of the 35th International Congress of the Americanists*. 197-203. Mexico City.

U.S. Army Corps of Engineers
2003 Columbia and Snake River Dams. *Reservoir Data: Project Data.*

U.S. Bureau of Land Management
2018 General Land Office Records. http://glorecords.blm.gov, accessed September 20, 2018.

U.S. Geological Survey National Water Information System
2018 USGS 13154500 Snake River at King Hill, Idaho. https://nwis.waterdata.usgs.gov, accessed September 20, 2018.

Wardle, Joseph D.
2018 Field Notes of Excavation of Three Island Crossing (10-EL-294).

2019 Variation in the Configuration of the Middle Snake River and its Relationship to Prehistoric Fishing Site Locations. Master's Thesis, Boise State University.

Webb, B.W., D.M. Hannah, R.D. Moore, L.E. Brown, and F. Nobilis
2008 Recent Advances in Stream and River Temperature Research. *Hydrological Processes* 22:902-918.

Willis, Lauren M., Metin I. Eren, and Torben C. Rick
2008 Does Butchering Fish Leave Cut Marks? *Journal of Archaeological Science* 35(5): 1438-1444.

Wise, Erika K.
2010 Tree Ring Record of Streamflow and Drought in the Upper Snake River. *Water Resources Research* 46(11).

Yu, Pei-Lin, and Jackie M. Cook
2015 Scale and Organization in Traditional Salmon Fishing: Insights from Ancient Technology of the Upper Columbia River. In *Rivers, Fish, and the People: Tradition, Science, and Historical Ecology of Fisheries in the American West*, edited by Pei-Lin Yu, pp. 70-95. Salt Lake City: The University of Utah Press.