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An Investigation of Prehistoric Volcanic Glass Use in the Birch Creek Valley of Eastern Idaho

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Energy dispersive x-ray fluorescence (EDXRF) analysis of geological obsidian samples from three localities in the southern Birch Creek drainage revealed that the vast majority of nodules represent the Walcott Tuff, a widespread toolstone-caliber volcanic glass in eastern Idaho. XRF data generated from analysis of over 500 obsidian artifacts from four archaeological sites in the Birch Creek Valley document the reliance of prehistoric peoples on Walcott Tuff obsidian. Data from newly documented Walcott Tuff exposures lead us to conclude that people who frequented the Birch Creek Valley could have acquired obsidian from proximate Walcott Tuff exposures without having to travel over 100 km. south to the American Falls area. These results underscore the importance of documenting, and geochemically analyzing, locations of artifact-quality ash-flow tuff obsidians prior to advancing archaeological conclusions about obsidian conveyance and population mobility.

THIS PAPER PRESENTS THE RESULTS of provenance analysis of obsidian from four archaeological sites in the Skull Canyon and Kyle Canyon areas of Birch Creek Valley, a 40-mile-long high desert basin in far eastern Idaho. The study area lies just west of the Continental Divide, is flanked by the Beaverhead and Lemhi mountains, and is situated near the Obsidian Cliff, Bear Gulch, and Big Southern Butte obsidian sources, as well as the dispersed Walcott Tuff (aka American Falls) and Packsaddle Creek ash-flow tuffs (Fig. 1). All of these dome-and-flow and rhyolitic ash-flow tuff obsidians were used for millennia by local and regional native peoples, and in many cases obsidian dominates the chipped stone assemblages at archaeological sites in southern and eastern Idaho and in western Wyoming.

PREVIOUS RESEARCH

Since the late 1960s, researchers have used various instrumental methods to document the trace element compositions of site- and source-specific volcanic glasses in eastern Idaho, with notable early work conducted by Wright et al. (1969), Sappington (1981a, 1981b), Nelson (1984), and Bailey (1992). Subsequent studies by

Holmer (1997) and Plager (2001) tracked the geographic distribution of southern and eastern Idaho obsidians, shaping our current understanding of extra-local prehistoric transport and trade across the greater Snake River Plain region. Long distance exchange networks conveyed some of this obsidian onto the High Plains and beyond, with artifacts made of Obsidian Cliff and/or Bear Gulch glass occurring in an Early Woodland period context in southwestern Wisconsin (Stoltman and Hughes 2004), at numerous Middle Woodland period sites in Ohio and Illinois (e.g., Griffin et al. 1969; Hughes 2006), and at Early Woodland through Late Prehistoric period sites and site components in Iowa (e.g., Anderson et al. 1986; Hughes and Nelson 1987; Logan et al. 2001). With the exception of the early investigation by Wright et al. (1969), the documentation of source-specific obsidian use at sites in the Birch Creek drainage is relatively recent, and we hope that the effort reported here prompts others to initiate similar projects in eastern Idaho.

SITE DESCRIPTIONS

The four prehistoric sites of concern here occur at elevations ranging from 6,300 to 7,100 ft. and consist

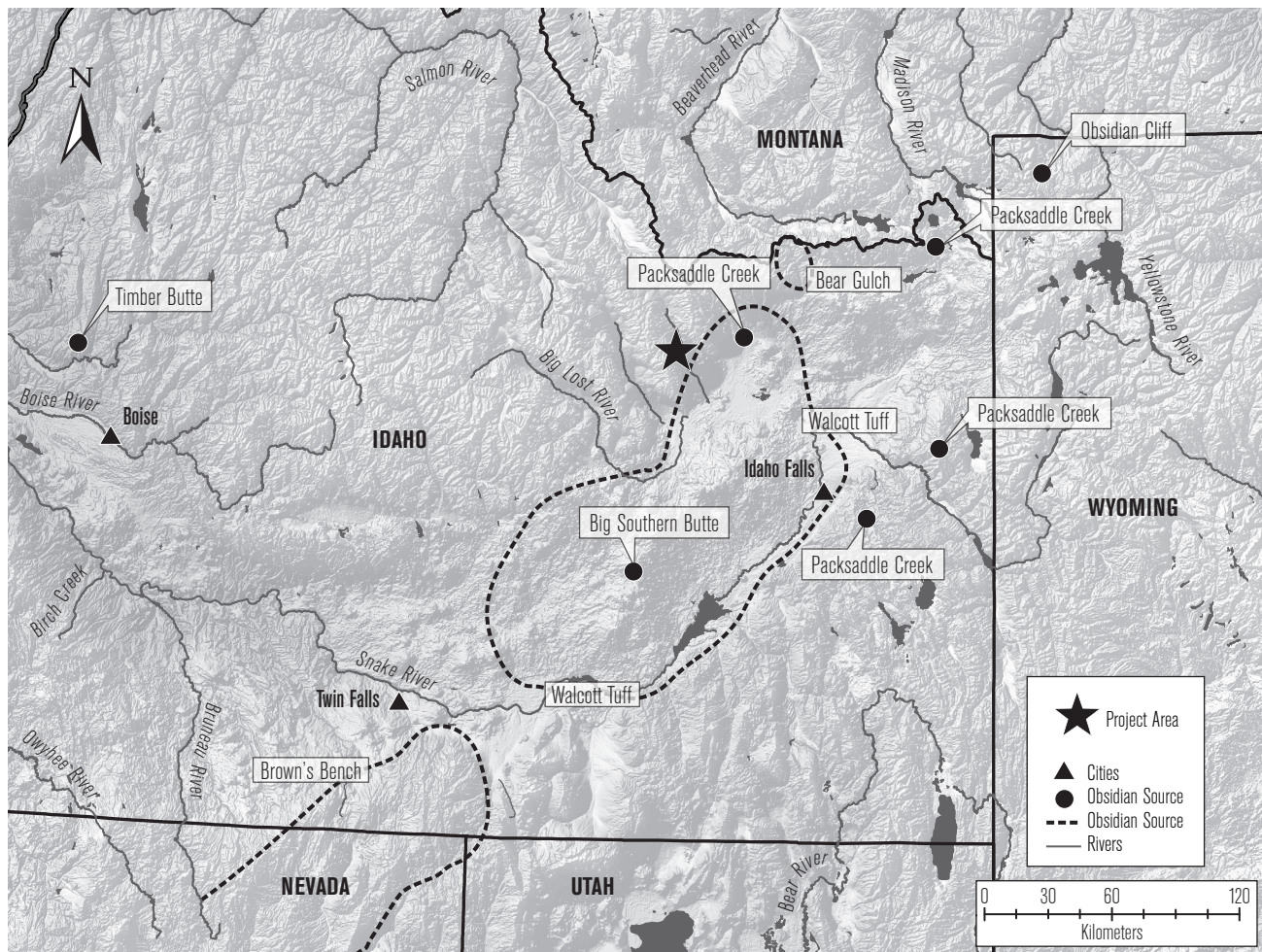


Figure 1. The greater southern Idaho region and locations of obsidian sources mentioned in text.

of Veratic Rockshelter (10-CL-3), a residential hub situated along the eastern margin of Birch Creek Valley; Bobcat Rockshelter (10-CL-11), a bighorn sheep (*Ovis canadensis*) hunting camp in lower Skull Canyon; Cottontail Rockshelter (10-CL-23), a seasonal camp located in upper Skull Canyon; and Kyle Canyon Spring (10-BT-8), another short-term camp in the southern Lemhi Range (Fig. 2). Plant communities within the project area consist of sagebrush-grassland in the valley, juniper woodland in lower canyons, and Douglas fir/limber pine montane forest in upland zones.

Veratic Rockshelter contains a major record of ancient human use dating between about 10,000 and 300 cal B.P. (Keene 2018), and the cultural deposits at adjacent Bison Rockshelter (10-CL-10) may date as early as ca. 11,700 cal B.P. (Swanson 1972:Table 1). Although this latter date may be spurious or derived from naturally-

deposited bone, a recent suite of radiocarbon dates on curated samples from Veratic Rockshelter reported by Keene (2016a:Table 3.1) indicates that the Blue Dome locality was occupied by at least 9,760 cal B.P. Both sites were extensively excavated in 1960 and 1961 by personnel from what was then Idaho State College (ISC), with Earl Swanson, Ruth Gruhn, Alan Bryan, B. Robert Butler, and Don Tuohy among the senior project members (Swanson 1972). Radiocarbon dates and time sensitive artifacts from Veratic and Bison Shelters formed the basis for one of the first cultural chronologies for the upper Snake River drainage, and as recently as 20 years ago, the archaeological record of this area was still interpreted with reference to this early work. Within the last decade or so, site investigations on the Idaho National Laboratory (INL; e.g., Armstrong et al. 2016; Keene 2016b; Long 2007) and the Caribou-Targhee National Forest (e.g.,

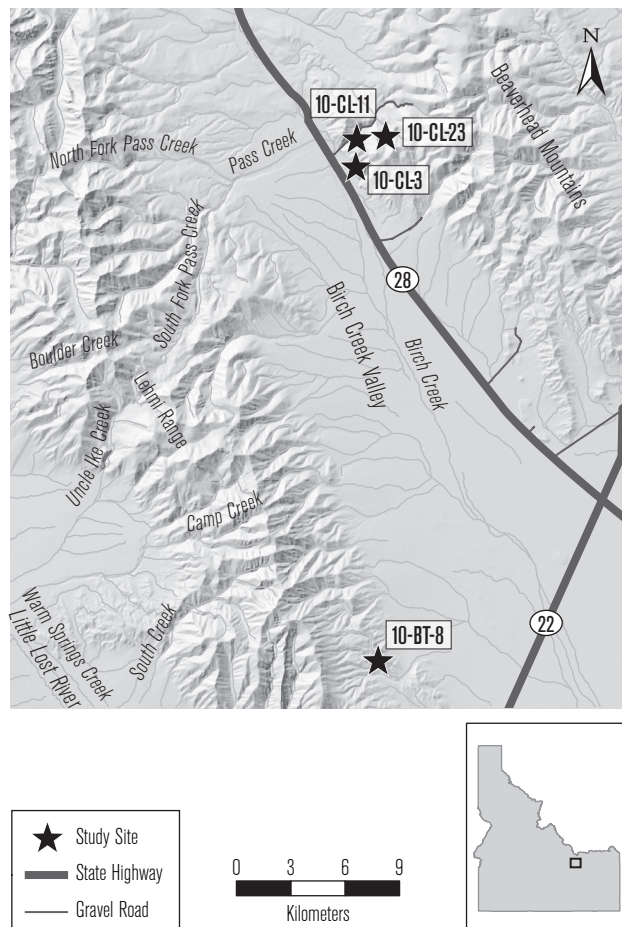


Figure 2. Map of the lower Birch Creek Valley drainage showing locations of the four study sites.

Arkush 2016, 2017; Harris 2011, 2014), and research conducted on curated collections from private property (Henrikson et al. 2017) have significantly expanded our knowledge of aboriginal lifeways in the upper Snake River region, especially concerning Paleoindian settlement systems, and Archaic through Late Prehistoric subsistence regimes.

Kyle Canyon Spring was test excavated by archaeologists from the Targhee National Forest in 1993, revealing an occupational sequence extending to a depth of about 2.2 m. and probably dating back at least 3,500 years (Willingham n.d.). The recovered artifact assemblage is dominated by obsidian tools and debitage; faunal remains consist primarily of fragmentary medium-sized artiodactyl bone, with most diagnostic elements classified as bighorn sheep. While no excavation

report was produced for 10-BT-8, Kathryn Harris (2011) analyzed its chipped stone assemblage. As part of this work, she submitted over 100 obsidian artifacts for geochemical analysis, thus producing an important regional data set for a site whose relevance was never even documented in an internal agency report, let alone in a formal publication (Harris 2014:159).

Both Bobcat and Cottontail shelters were first excavated by ISC in the early 1960s (Swanson et al. 1964). These test excavations revealed the presence of deep, well-stratified deposits at both sites, with those at Bobcat Shelter extending to a depth of about 5.5 m. and consisting of 28 distinct natural and cultural strata. From 2012 to 2016, both sites were investigated by the Weber State University (WSU) Archaeological Field School, which excavated a 16 m.² grid to a maximum depth of 3 m. at Bobcat Shelter in 2012 and 2013, revealing an occupational sequence consisting of 15 strata dating from about 7,800 to 250 cal B.P. (Arkush 2017). Between 2014 and 2016, WSU investigated a 26 m.² area in the northern portion of Cottontail Shelter, documenting 10 strata within the upper 4 m. of deposits, with the deepest cultural materials occurring at 2.9 m. and dating to about 5,600 cal B.P. (Arkush 2016). The 1961 ISC investigation at 10-CL-23 focused on the southern site deposits, and revealed 24 different strata within 5.2 m., with the deepest radiocarbon sample associated with Layer 20 (at a depth of about 3.2 m.) and dated to ca. 5,000 cal B.P. (Swanson et al. 1964).

The chipped stone assemblages from 10-CL-11 and 10-CL-23 are dominated by obsidian and densely welded tuff, with microcrystalline silicates comprising less than about 25% of formed tools and debitage. Bobcat Shelter has yielded approximately 33,000 pieces of large-to-medium-sized mammal bone, with over 79% of these identified as either bighorn sheep, bighorn sheep-sized, or medium artiodactyl. In terms of MNI values, the 10-CL-11 faunal assemblage contains the remains of at least 61 mountain sheep and three bison (Miller 2017). An initial assessment of the Cottontail Shelter fauna has tabulated nearly 28,000 specimens, and 78% of them have been classified as either bighorn sheep, bighorn sheep-sized, or medium artiodactyl (Arkush 2016). Both shelters have yielded perinatal artiodactyl bone, reflecting spring occupations that may have focused on the pursuit of bighorn sheep nursery herds.

WALCOTT TUFF PROCUREMENT LOCATIONS IN THE SOUTHERN LEMHI AND BEAVERHEAD RANGES

Many archaeologists who work in far eastern Idaho are aware that the southern Beaverhead and Lemhi mountains contain artifact-quality volcanic glass, which has been described variously as ignimbrite and/or vitrophyre.¹ The occurrence of this igneous toolstone type in the greater Howe Point area of the southern Lemhi Range was reported to archaeologists by Earl Swanson (1972:145), and Patricia Kimball (1976) later noted the presence of welded tuff exposures and reduction sites in the Deep Creek area in the southern Beaverhead Mountains. However, knowledge of, and research on, this volcanic material has a much longer history in geology, beginning with the work of Mansfield (1927), Anderson (1931), Kirkham (1931), and Mansfield and Ross (1935). Named Walcott Tuff by Stearns and Isotoff (1956), the more recent studies of Morgan (1992), Morgan and Bonnicksen (1989), and Morgan and McIntosh (2005) have provided more detailed information on its genesis, composition, and eruptive history in relation to adjacent tuff units within this part of the Snake River Plain. With the exception of Bailey (1992) and Keene (2016a, 2016b), no archaeologists to our knowledge have collected geological obsidian nodules from the southern periphery of Birch Creek Valley—proximate to exposures of Walcott Tuff—and subjected them to geochemical analysis. In an attempt to address this data gap, we targeted two adjacent drainages east of the valley and one general area south of the valley that contained surface exposures of Walcott Tuff and began searching therein for obsidian nodules and flakes for geochemical analysis.

Our first collection trip occurred in the summer of 2013, when we visited the middle Deep Creek drainage about 28 km. east of Skull Canyon and located a few obsidian nodules eroding out of a two-track road bed (Fig. 3). Closer inspection of the area revealed the presence of a great deal of obsidian “float” and artifact-quality nodules, many of which were fist-sized or larger. The following summer, we collected samples from a lithic procurement site on the west side of Medicine Lodge Canyon, located 7 km. northeast of the Deep Creek site (Fig. 3). This locality was reported by Bailey (1992:314), and contained many surface nodules and flakes of variable quality, from assayed nodules that contained

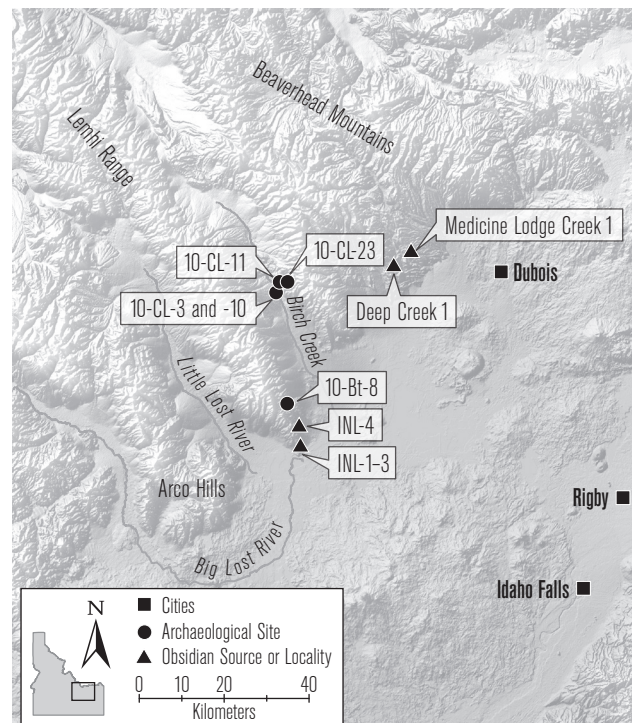


Figure 3. Map of eastern Idaho showing locations of the four study sites and four obsidian sample collection localities.

numerous phenocrysts to ones that had very few. Judging from the amount of reduction debris observed on the surface, this locale had served as a toolstone acquisition area for quite some time.

During the fall of 2014, we collected artifact-quality obsidian nodules and flakes from four locales in the southern Lemhi Range (Fig. 3). All of these sites occur in the northwestern portion of the INL, and we were aided in this effort by personnel from the installation’s Cultural Resources Program. INL collection areas 1–3 are situated on a ridge immediately north of Howe Point and contain thousands of reduction flakes and numerous cobbles (Fig. 4), as well as one concentration of mahogany-colored obsidian. Given its location, this ridge may be the obsidian (“ignimbrite”) source area mentioned by Swanson (1972:145). The fourth INL collection area is located in an ephemeral drainage about 5 km. north of Howe Point.

Figure 5 presents the results of non-destructive EDXRF analysis of a sample of 18 geological obsidian nodules from the Deep Creek ($n=3$), Medicine Lodge Creek (MLC) ($n=3$), and INL ($n=12$) collection locales, and with one exception, all of them match the chemical

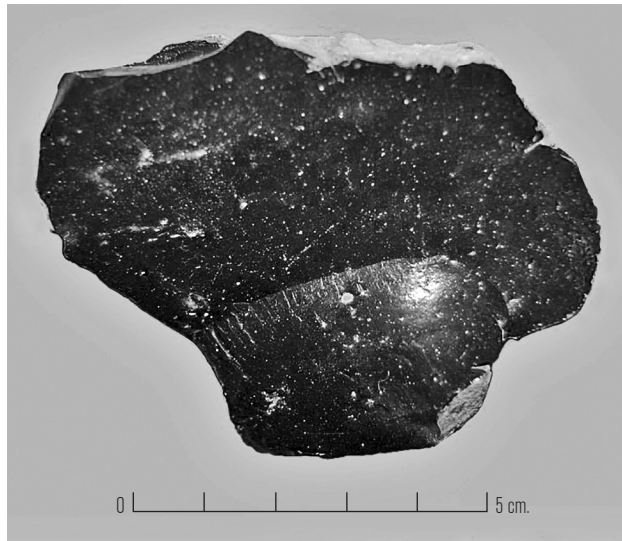


Figure 4. Split geological cobble of tool quality Walcott Tuff obsidian from INL Collection Locality 2.

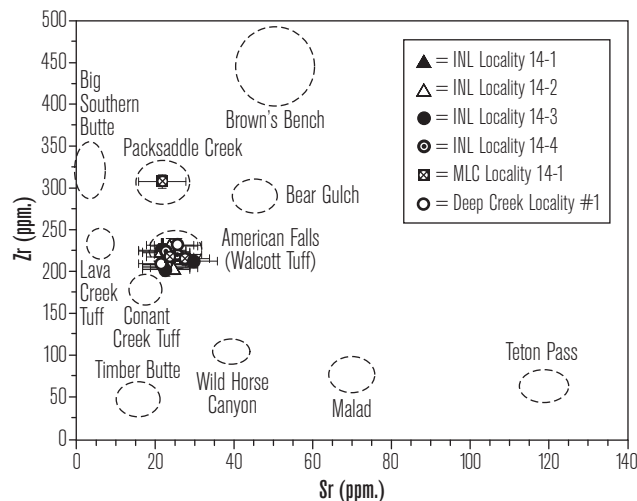


Figure 5. Sr vs. Zr composition of geological obsidian samples from Southern Idaho. Data from Hughes (2014a, 2014b).

profile of Walcott Tuff glass (Table 1). The lone specimen within this sample that does not conform to the Walcott Tuff type comes from the MLC locale and bears the chemical signature of Packsaddle Creek obsidian. A main deposit of the Packsaddle Creek chemical type occurs in the Big Hole Mountains of Teton Basin, some 100 km. southeast of the MLC collection site (Fig. 1), with other occurrences documented at the east end of the Centennial Mountains about 60 km. east of the Bear Gulch source area (Keene 2018: Fig. 1), and in the Ozone/

Table 1

**LOCATIONS AND GEOCHEMICAL TYPES OF
OBSIDIAN NODULES FROM THE SOUTHERN LEMHI
AND SOUTHERN BEAVERHEAD RANGES**

Collection Locality	Catalog Number	Geochemical Type	General Location
Deep Creek 1	DPCK-13-1-1	Walcott Tuff	T. 11N, R. 33E, S.E. 1/4 of Section 20
Deep Creek 1	DPCK-13-1-2	Walcott Tuff	T. 11N, R. 33E, S.E. 1/4 of Section 20
Deep Creek 1	DPCK-13-1-3	Walcott Tuff	T. 11N, R. 33E, S.E. 1/4 of Section 20
Medicine Lodge Creek 1	MLC-14-1-1	Walcott Tuff	T. 11N, R. 34E, N.W. 1/4 of Section 18
Medicine Lodge Creek 1	MLC-14-1-2	Walcott Tuff	T. 11N, R. 34E, N.W. 1/4 of Section 18
Medicine Lodge Creek 1	MLC-14-1-3	Packsaddle Creek	T. 11N, R. 34E, N.W. 1/4 of Section 18
Idaho National Laboratory 1	INL-14-1-1	Walcott Tuff	T. 6N, R. 30E, N.W. 1/4 of Section 35
Idaho National Laboratory 1	INL-14-1-2	Walcott Tuff	T. 6N, R. 30E, N.W. 1/4 of Section 35
Idaho National Laboratory 1	INL-14-1-3	Walcott Tuff	T. 6N, R. 30E, N.W. 1/4 of Section 35
Idaho National Laboratory 2	INL-14-2-1	Walcott Tuff	T. 6N, R. 30E, N.W. 1/4 of Section 35
Idaho National Laboratory 2	INL-14-2-2	Walcott Tuff	T. 6N, R. 30E, N.W. 1/4 of Section 35
Idaho National Laboratory 2	INL-14-2-3	Walcott Tuff	T. 6N, R. 30E, N.W. 1/4 of Section 35
Idaho National Laboratory 3	INL-14-3-1	Walcott Tuff	T. 6N, R. 30E, N.W. 1/4 of Section 35
Idaho National Laboratory 3	INL-14-3-2	Walcott Tuff	T. 6N, R. 30E, N.W. 1/4 of Section 35
Idaho National Laboratory 3	INL-14-3-3	Walcott Tuff	T. 6N, R. 30E, N.W. 1/4 of Section 35
Idaho National Laboratory 4	INL-14-4-1	Walcott Tuff	T. 6N, R. 30E, N.W. 1/4 of Section 11
Idaho National Laboratory 4	INL-14-4-2	Walcott Tuff	T. 6N, R. 30E, N.W. 1/4 of Section 11
Idaho National Laboratory 4	INL-14-4-3	Walcott Tuff	T. 6N, R. 30E, N.W. 1/4 of Section 11

Noon Creek locality 20 km. southeast of Idaho Falls (see Fig. 1). Visual characteristics of the MLC obsidian nodule bearing Packsaddle Creek geochemistry are virtually the same as other nodules at the MLC collection locality—all

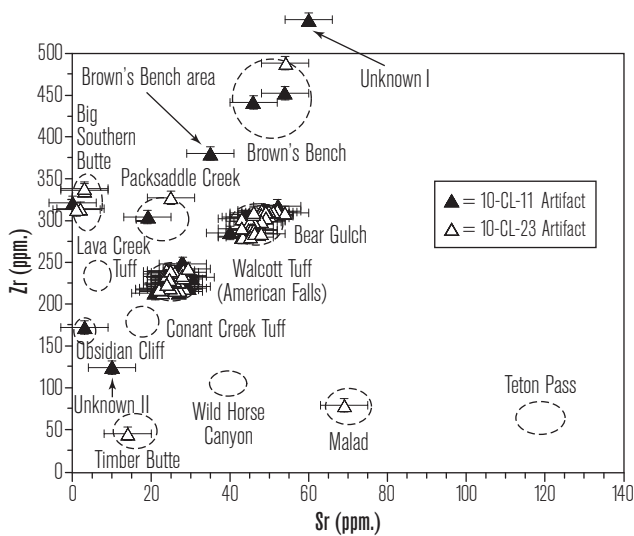


Figure 6. Sr vs. Zr composition of large obsidian artifacts from 10-CL-11 and 10-CL-23, Southern Idaho. Data from Hughes (2014c, 2014d).

cobble interiors consist of opaque, jet black glass, with moderate phenocryst content. Chemically, however, the two Walcott Tuff-derived nodules and the one Packsaddle Creek-derived nodule from MLC are distinct, especially in their zirconium (Zr) and strontium (Sr) composition. Zr values for Packsaddle Creek obsidian range from about 300–340 ppm., whereas Walcott Tuff glass typically contains 200–235 ppm.

GEOCHEMICAL SOURCING RESULTS

To document the obsidian sources used by the native peoples of Birch Creek Valley, we conducted non-destructive EDXRF analysis on stratified samples of flakes, unifaces, bifaces, and projectile points from Bobcat and Cottontail shelters (see Figs. 6 and 7). We then augmented this information with other geochemical data from Veratic Shelter and Kyle Canyon Spring.

Non-destructive laboratory analyses of the artifacts were performed by the junior author on a QuanX-EC™ (Thermo Electron Corporation) EDXRF spectrometer equipped with a silver (Ag) x-ray tube, a 50 kV x-ray generator, digital pulse processor with automated energy calibration, and a Peltier cooled solid state detector with 145 eV resolution (FWHM) at 5.9 keV. The x-ray tube was operated at differing voltage and current settings to optimize excitation of the elements selected for analysis. In this case, analyses were conducted for the elements

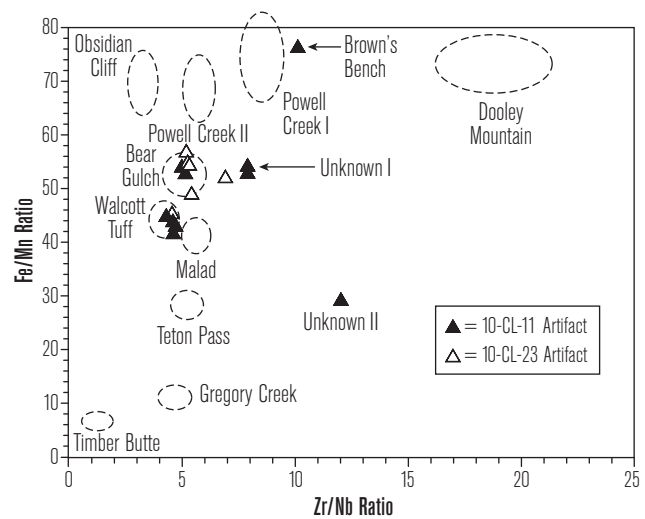


Figure 7. Fe/Mn vs. Zr/Nb composition of small obsidian artifacts from 10-CL-11 and 10-CL-23, Southern Idaho. Data from Hughes (2014c, 2014d).

rubidium (Rb K α), strontium (Sr K α), yttrium (Y K α), zirconium (Zr K α), niobium (Nb K α), and barium (Ba K α). Iron vs. manganese (Fe K α /Mn K α) ratios also were generated for each artifact, and x-ray tube current was scaled automatically to the physical size of each specimen. Further details pertaining to x-ray tube operating conditions, calibration, artifact-to-source (*sensu* Hughes 1998) attribution, and element-specific measurement precision appear in Hughes (1994, 2015). Artifacts too small to generate reliable quantitative composition estimates were analyzed using a protocol described in Hughes (2010).

The Bobcat Shelter sample consists of 60 artifacts from 15 different strata (Hughes 2014c, 2016), whereas the Cottontail Shelter sample consists of 71 artifacts associated with 10 different strata (Hughes 2014d, 2016). One of us had previously analyzed 20 artifacts from 12 strata at Veratic Shelter (Hughes 2007), and more recently, Keene (2016a:Table 4.9) analyzed an additional 249 obsidian artifacts from 10-CL-3, including ISC's Layer 31, which dates between 10,158 and 9,745 cal B.P. Harris (2011:Appendix A) obtained geochemical data on 102 artifacts from 15 arbitrary levels at Kyle Canyon Spring, and this fifth data set completed our sample of 502 geochemically sourced artifacts (Table 2).

Bear Gulch and Walcott Tuff obsidian occurs in each sampled stratum at Bobcat and Cottontail Shelters, whereas the nearby Big Southern Butte source is only

Table 2

**SAMPLE SIZES, STRATA/LEVELS SAMPLED,
AND ASSOCIATED AGES FOR THE STUDY SITES**

Site Name and Number	Number of Sourced Artifacts	Number of Strata or Levels Sampled	Associated Ages
Bobcat Shelter (10-CL-11)	60	15 natural strata	7,800–250 cal B.P.
Cottontail Shelter (10-CL-23)	71	10 natural strata	5,600–250 cal B.P.
Veratic Shelter (10-CL-3)	269	13 natural strata	10,000–300 cal B.P.
Kyle Canyon Spring (10-BT-8)	102	15 arbitrary levels	3,500–200 cal B.P.

minimally present in these two samples (Figs. 8 and 9). It is somewhat surprising that this high-quality obsidian type, located 80 km. south of Birch Creek Valley, would be so scarce at the two Skull Canyon sites. To the extent that our sample reflects the general trend of source-specific obsidian use, this suggests that the principal home ranges of many groups that occupied Cottontail and Bobcat shelters were areas east and north of Birch Creek Valley. Both the Lemhi and Salmon rivers to the north were important summer salmon and steelhead fisheries during prehistoric and ethnographic times (e.g., Murphy and Murphy 1960:330; Steward 1938:42–43, 190–191); perhaps a majority of the bands who pursued bighorn sheep in the Skull Canyon area emphasized spring and fall hunts and often wintered in the low elevation Salmon River Valley (e.g., Steward 1938:188, Fig. 10). If this was the case, people may not have ventured very far south of the Birch Creek drainage on a regular basis.

We were cognizant of the possibility that the casual (i.e., uniface and flakes) and formal (i.e., projectile points and bifaces) obsidian artifacts we analyzed from CL-11 and CL-23 may have been manufactured from different source materials, but we found no significant source-use difference by time period or artifact class in the small sample analyzed from both sites. We note, however, that no dart points in our small Bobcat Shelter sample were made from Bear Gulch obsidian; that all four flakes sourced from stratum 8 derive from the Walcott Tuff; and that all three flakes sourced from stratum 11 came from the Walcott Tuff, whereas five of the six artifacts analyzed from stratum 14 were manufactured from Bear Gulch obsidian.

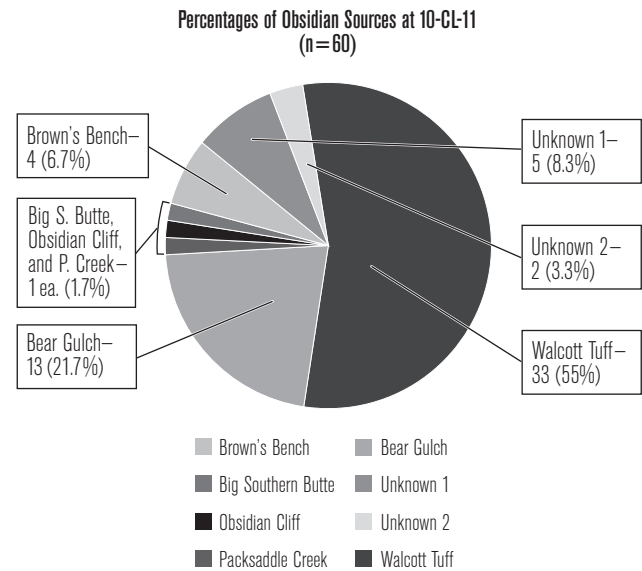


Figure 8. Pie chart showing the source-specific percentages of obsidian in the artifact sample from Bobcat Shelter (10-CL-11).

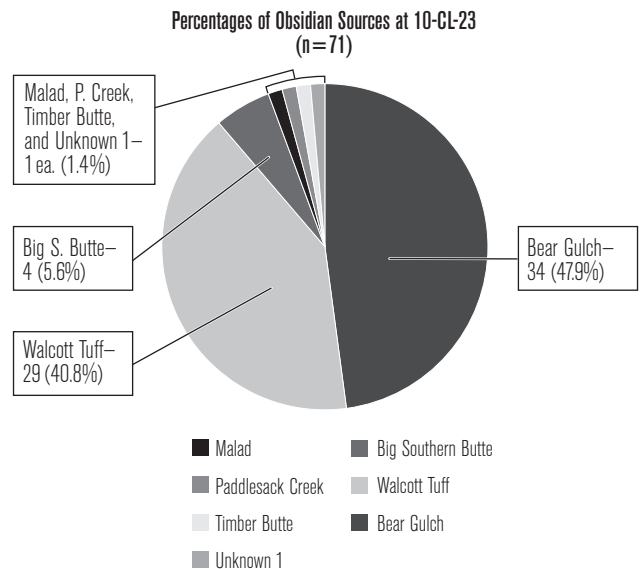


Figure 9. Pie chart showing the source-specific percentages of obsidian in the artifact sample from Cottontail Shelter (10-CL-23).

As depicted in Figure 9, the small sample of geochemically-sourced artifacts from Cottontail Shelter suggests that use of Bear Gulch obsidian may have been somewhat greater than Walcott Tuff obsidian use during three periods. All five artifacts (one arrow point-sized blank and four flakes) from three strata dated approximately 1,450 to 950 cal B.P. were made from

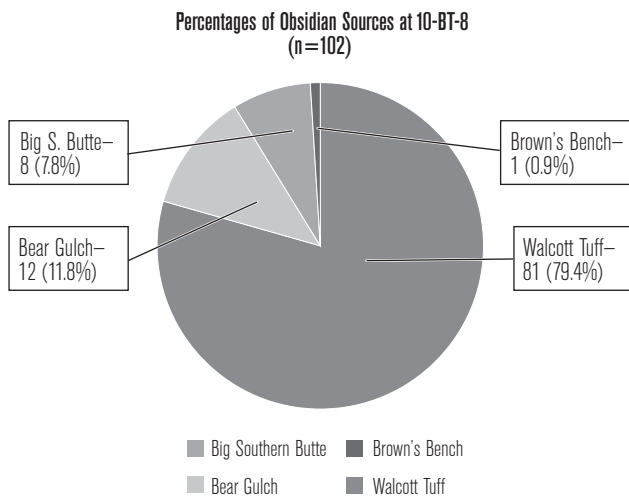


Figure 10. Pie chart showing the source-specific percentages of obsidian in the artifact sample from Kyle Canyon Spring (10-BT-8).

Bear Gulch glass. Similarly, the majority of obsidian artifacts from ISC's Layer 17 (dated to about 3,400 cal B.P.) and Layer 20 (which yielded a radiocarbon date with a midpoint of 4,420 B.P. [~5,000 cal B.P.]; Swanson et al. 1964:116) also consist of Bear Gulch obsidian. Four artifacts from each of these two ISC strata were analyzed, and Bear Gulch obsidian outnumbered Walcott Tuff by a 3:1 ratio. Artifact categories within the Bear Gulch-affiliated sample from layers 17 and 20 consisted of two dart points, as well as a dart-point preform, a biface, a uniface, and one flake, whereas a biface and one flake from these two strata were fashioned from Walcott Tuff glass.

Walcott Tuff dominates the Kyle Canyon Spring sample at nearly 80% (Fig. 10), which most likely is due to the presence of a number of ash-flow tuff obsidian exposures of this chemical type less than 20 km. to the south. INL collection localities 1–4 contain many artifact-quality nodules and thousands of flakes, indicating that these areas have provided people with toolstone for many centuries. The large sample of geochemical data from Veratic Shelter generally mirrors sourcing results for the two Skull Canyon sites, with Walcott Tuff obsidian dominating at about 55%, Bear Gulch glass being quite common at 28%, and Big Southern Butte obsidian comprising about 15% of the assemblage analyzed (Fig. 11). This data set suggests that the settlement systems of many native groups who occupied the Blue Dome locality also emphasized areas north of the Snake River

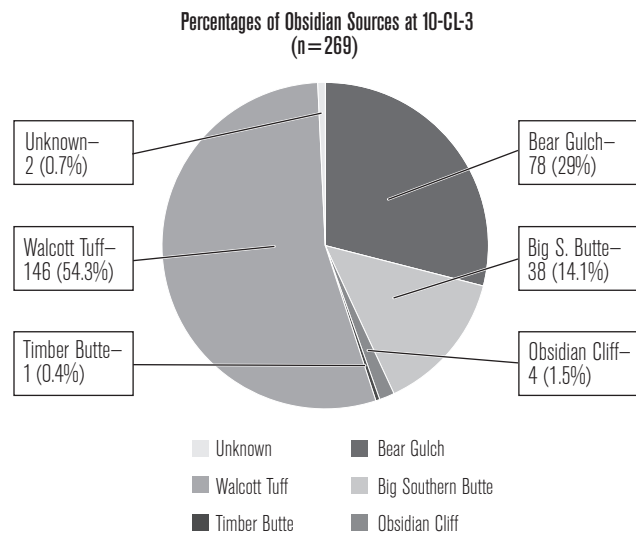


Figure 11. Pie chart showing the source-specific percentages of obsidian in the artifact sample from Veratic Shelter (10-CL-3). Total number of samples combined from data presented in Hughes (2007) and Keene (2016a).

Plain, such as the Pahsimeroi, Little Lost River, Lemhi, Birch Creek, Salmon, and Bitterroot valleys.

In a broader context, it is noteworthy that Walcott Tuff made up only 21% (n=13) of the 64 obsidian samples analyzed from the Challis Bison Jump (Cannon et al. 2010), a late prehistoric site dating from ca. 900 to 850 cal B.P. located 60 km. northwest of Birch Creek Valley. Bear Gulch was the most common obsidian type in the Challis site sample, comprising 56% (n=36) of the specimens. Similarly, no Walcott Tuff artifacts were identified in a cache of nine bifacial blanks found on the north side of American Falls Reservoir, in close proximity to high-quality Walcott Tuff obsidian outcroppings (Hughes and Pavesic 2005). Six artifacts from the Sterling Cache were fashioned from Big Southern Butte glass, two were made of Bear Gulch obsidian, and a single specimen had the same trace element composition as Teton Pass volcanic glass (Hughes and Pavesic 2005:Table 1). This latter case clearly demonstrates that in obsidian-rich landscapes, proximity to a given source is no guarantee that artifact assemblages at local sites will be dominated by that particular source.

CONCLUSIONS

For many years, whenever obsidian of the Walcott Tuff chemical type was identified at archaeological sites in

the upper Snake River region or was listed as a common source in eastern Idaho, it was generally assumed that the material had been obtained primarily from the Lake Walcott and American Falls Reservoir areas west of Pocatello (e.g., Cannon and Cannon 2012; Harris 2011, 2014; Henrikson 2008; Sappington 1981a; Scheiber and Finley 2011). Within the last several years, geological research in the upper Miocene/lower Pliocene-aged (ca. 6.6–4.4 mya) Heise Volcanic Field, which includes the Walcott Tuff (ca. 6.3 mya; see Binderman et al. 2007; Morgan 1992; Morgan and McIntosh 2005), has altered this archaeological view (e.g., Keene 2018). An especially useful map of the general extent and known exposures of Walcott Tuff appears in Morgan and McIntosh (2005:Fig. 2c), showing four different exposures of potential archaeological significance along the northern periphery of the eastern Snake River Plain, from the southern Pioneer Mountains northeast to the southern Beaverhead Mountains.

In summary, this project has added four new Walcott Tuff obsidian acquisition loci to a small data set, and represents an important contribution to regional obsidian provenience studies. Based on these new results, it seems clear that native peoples of the Birch Creek Valley area could easily have obtained artifact-quality ash-flow tuff obsidian from various exposures located south and east of the valley. In light of this proximity, it would not have been necessary to either travel far to the south, or to trade with groups from the American Falls area, to acquire toolstone from the Walcott Tuff formation (cf. Harris 2014:168). Moving forward, it is also clear that our current archaeological interpretations will be influenced by the discovery of additional Walcott Tuff exposures. We have documented those occurring in the Deep Creek and Medicine Lodge Creek drainages and the southern Lemhi Range, but other archaeologically-significant exposures of Walcott Tuff (and other ash-flow tuffs of potential archaeological significance; see Perkins et al. 1995) certainly exist in the area and were undoubtedly exploited by prehistoric and early historic native peoples. Finding these locations, and subjecting them to detailed geochemical analysis, will be an important step in advancing our understanding of prehistoric obsidian acquisition and conveyance patterns in Birch Creek Valley and beyond. More generally, detailed and refined geochemical data will allow meaningful evaluation of the

general patterns of obsidian source utilization in eastern Idaho advanced by Holmer (1997) two decades ago.

NOTE

¹Notwithstanding the use of the terms ignimbrite and vitrophyre in Idaho archaeology (e.g., Bailey 2006; Sappington 1981a, 1981b; Swanson 1972), we follow Smith (1960a, 1960b), Ross and Smith (1961), and Hughes and Smith (1993) in describing these particular glasses as densely welded ash-flow tuffs. Smith (1960a:823–826; 1960b:154–155) and Ross and Smith (1961:24–25) describe the dense welding and compaction of pumice fragments involved in the creation of an “obsidian-like” glass from tuff and illustrate a hand specimen resulting from this process from southeastern Idaho (Ross and Smith 1961:Figure 9; see also Smith 1960b:Figure 21f). Further reasons for adopting a stricter definition here are that most ignimbrites—unless specifically described as being densely welded—are the result of pyroclastic flows with highly variable internal structures and degrees of ash compaction (cf. Branney and Kokelaar 2002; Freundt et al. 2000). Hence, only those exhibiting dense welding of ash and pumice would be of archaeological significance. Vitrophyre typically occurs as basal glass, often extensively hydrated (Lipman 1965), porphyritic, and found in groundmass, so it is of little consequence as a prehistoric artifact manufacturing medium.

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