

## OBSIDIAN SOURCE USE IN THE GREATER YELLOWSTONE AREA, WYOMING BASIN, AND CENTRAL ROCKY MOUNTAINS

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*Using x-ray fluorescence (XRF) analysis from nearly 2,300 sourced obsidian artifacts in western Wyoming, southwestern Montana, and eastern Idaho, we demonstrate regional diachronic changes in access to and preference for particular obsidian sources throughout the West. We focus on both (1) long-term patterns of obsidian use that may inform us about the timing of precontact migrations of Numic (Shoshone) speakers into the Rocky Mountains and (2) the extent to which later contact among Native inhabitants and European immigrants was a mechanism for reducing elements of precontact mobility and exchange in the postcontact era. We view indigenous responses to contact in the study area as an active, strategic process with measurable material consequences. Despite a well-documented increase in mobility among local Native groups as a result of the introduction of the horse, our study demonstrates a restriction and reduction in Historic period source use in western Wyoming. We propose that changes in obsidian source use are a reflection of ethnogenesis and development of ethnographic bands as a response to culture contact among indigenous inhabitants and with Europeans.*

*A través de un análisis de la radiografía (XRF) de casi 2.300 artefactos de obsidiana recuperados al oeste de Wyoming, el suroeste de Montana y el este de Idaho, demostramos cambios diacrónicos regionales en el acceso y la preferencia de ciertas fuentes de obsidiana para el oeste de los Estados Unidos. Nos enfocamos en dos temas: 1) las pautas a largo plazo del uso de la obsidiana que nos puede informar acerca de cuando los hablantes de Numic (Shoshone) emigraron a las Montañas Rocosas y 2) cómo el primer contacto entre los indígenas y los inmigrantes europeos sirvió para reducir la movilidad y el intercambio entre los indígenas en la época después del contacto. Vemos las respuestas de los indígenas al contacto en el área de estudio como un proceso estratégico y activo con consecuencias materiales que sí se pueden medir. A pesar del aumento de la movilidad entre los grupos locales de la gente indígena como un resultado de la introducción del caballo, nuestro estudio demuestra una restricción y reducción de la utilización de la obsidiana en la época histórica en el oeste del estado de Wyoming. Proponemos que los cambios del uso de las fuentes de la obsidiana reflejen la etnogénesis y el desarrollo de pequeños grupos étnicos como una respuesta al contacto cultural entre los indígenas y los europeos.*

In this paper, we use obsidian source data as a method for identifying prehistoric and historic mobility and exchange networks in the Greater Yellowstone area, the Central Rocky Mountains, and the Wyoming Basin. Obsidian in northwestern Wyoming and eastern Idaho is arguably the best-known source of volcanic glass in the United States as well as the largest source of obsidian outside the western Great Basin and northern California. The Snake River and Greater Yellowstone volcanic region produces high-quality obsidian sources in the Yellowstone Plateau, Jackson Hole, and eastern Idaho (Cannon and Hughes 1997; Holmer 1997; Iddings 1888; Kunselman 1998; Schoen 1997).

Artifacts made of Yellowstone obsidian have been found up to 2,400 km east of the Rocky Mountains in mid-continental Hopewell sites (Griffin et al. 1969; Hatch et al. 1990). The social context of this exchange remains enigmatic but likely occurred via interactions between hunter-gatherers in the Central Rocky Mountains and northern High Plains and neighboring Plains farmers to the east. People also participated in extensive prehistoric exchange networks west of the Continental Divide, trading obsidian and olivella shell across the Sierra Nevada between coastal California and the western Great Basin (Hughes and Bennyhoff 1986). While some of these materials were traded into the

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Yellowstone area, relatively little is understood of aboriginal exchange networks in the North American Rocky Mountains or of diachronic obsidian use within the Central Rockies. To complicate the issue, patterns of exchange and mobility are often indistinguishable in the archaeological record of nomadic foragers, or at least we lack a method for separating them (Hughes 1998). We thus do not view the material consequences of these two processes as mutually exclusive.

In many archaeological contexts, obsidian is not available locally and obsidian artifacts are viewed as exotic items representing distant raw material sources (Barker et al. 2002; DeBoer 2004; Glascock 2002). However, in the Greater Yellowstone area, where obsidian is relatively abundant and not necessarily exotic, source analysis studies reveal more than the introduction of foreign raw materials into local contexts. Beginning with pattern recognition studies to identify changes through time in obsidian source use, archaeologists can make important inferences about past social processes. Specifically we are interested in both (1) long-term patterns of obsidian use that may inform us about the timing of precontact migrations of Numic (Shoshone) speakers into the Rocky Mountains, and (2) the extent to which later contact among Native inhabitants and European immigrants was a mechanism for reducing elements of precontact mobility and exchange in the postcontact era. We view culture contact as a two-part process involving contact between local and migrant indigenous groups (both precontact and postcontact) and between indigenous groups and Euro-American colonists.

Ethnogenesis—the process of forming new identities—is one consequence of culture contact leading to the development of distinct ethnic groups such as the Plains and Mountain Shoshone (Hoebel 1938; Murphy and Murphy 1986; Shimkin 1986). As documented ethnographically, Shoshone groups were highly flexible in membership and organization through the nineteenth century (Steward 1938). Groups recognized today did not formally solidify into the Wind River, Lemhi, and Fort Hall Shoshone until forced reservation settlement (Heaton 2005; Mann 2004; Stamm 1999). Identity formation was ongoing prior to the beginning of the nineteenth century, and we ask whether we can trace these processes in the archaeological record.

We address this question within the context of obsidian source use in western Wyoming, eastern Idaho, and southwestern Montana, and ask whether precontact mobility patterns and exchange networks were well-established and for how long prior to the late 1800s. The broader context of this research is on long-term landscape use in the remote high country surrounding Yellowstone National Park at which archaeological teams have recently recovered mixed stone and steel technologies in clear postcontact archaeological associations (Eakin 2005; Scheiber and Finley 2010). This region was the scene of complex nineteenth-century social networks among indigenous Indians and migrant Euro-Americans, well-documented for instance during the American fur trade between 1825 and 1840 (Utley 2004; Wishart 1979).

We are also interested in the material and social effects of culture contact on Shoshone peoples throughout the Greater Yellowstone area beginning about A.D. 1600 as new groups of Plains Indians such as the Crow expanded into the area and continuing into the late 1800s with Euro-American incursions.

We hypothesize that access to food and other resources decreased during the transition from precontact to postcontact periods with the breakdown of traditional exchange networks as a result of territory reduction, impediments or restrictions to certain travel corridors, epidemic diseases, and increasing economic involvement in the fur trade. We expect this disruption to be evident in the archaeological record by reduced diversity of utilized obsidian sources and greater reliance on local Yellowstone and eastern Idaho obsidian sources in postcontact sites, as these sources are closest in distance to our study area. These disruptions in resource acquisition did not completely affect resource use despite the availability of new materials and technologies in the form of metal and firearms. Both obsidian and metal are often present at postcontact sites, and we do not suggest a simple replacement of stone tools with steel ones<sup>1</sup> (Scheiber and Finley 2010). In fact, while visiting Idaho in 1906 Robert Lowie (1909:173) noted that the Lemhi Shoshone continued to prefer obsidian stone tools to metal ones because obsidian was considered to be more powerful (*na'róyunt*). Obsidian choice and access adds an important dimension to the more familiar discussions of technological

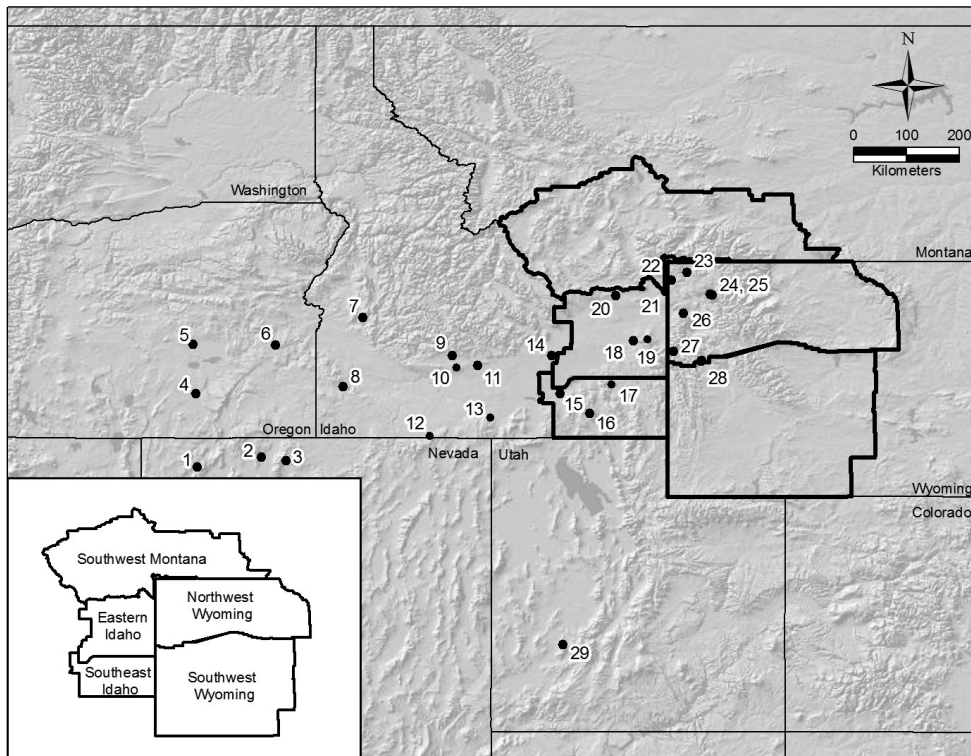


Figure 1. Locations of five subregions (in bold outline) and of select regional obsidian sources discussed in the text. 1. Summit Lake, 2. Double H Mountain, 3. Paradise Valley, 4. Beatys Butte, 5. Burns, 6. Coyote Wells, 7. Timber Butte, 8. Owyhee, 9. Cannonball Mountain, 10. Camas Prairie, 11. Wedge Butte, 12. Coal Bank Springs, 13. Picabo Hills, 14. Big Southern Butte, 15. American Falls, 16. Malad, 17. Chesterfield, 18. Kelly Canyon, 19. Pack Saddle Pass, 20. Bear Gulch, 21. Reas Pass, 22. Warm Creek, 23. Obsidian Cliff, 24. Park Point, 25. Gibbon River Flow, 26. Grassy Lake, 27. Teton Pass, 28. Gros Ventre Butte, 29. Wild Horse Canyon.

transitions that occurred between the sixteenth and twentieth centuries (Ehrhardt 2005; Rodríguez-Alegría 2008).

To establish a precontact baseline of obsidian acquisition, we conducted a regional study to address diachronic variability in source use. We also compared the results to known historic assemblages to demonstrate that postcontact assemblages in our dataset do in fact show significantly reduced diversity compared with other regions and times.

### Mountain and Plains Shoshone

The study area encompasses the Central Rocky Mountains, Wyoming Basin, and eastern Snake River Plain, a vast region of rugged mountain ranges separated by numerous intermountain valleys located in western Wyoming, southwestern Montana, and eastern Idaho (Figure 1). Spanning the Continental Divide, elevations range from 1,000 m

asl on valley floors to 4,000 m asl at mountain peaks. The Greater Yellowstone area is located at the north-west edge of the Central Rocky Mountains physiographic province, which includes all of the Wyoming ranges, as well as mountains in parts of southwestern Montana and northeastern Idaho. Adjoining the Greater Yellowstone area on its eastern and southern boundaries is the Wyoming Basin, a series of intermountain basins that covers much of the southern and central parts of Wyoming. This region is often referred to as the Greater Yellowstone Ecosystem, based originally on grizzly bear range but now researched from combined demographic, economic, and ecological perspectives (Hansen et al. 2002). Much of our study area, which includes two national parks, seven national forests, and part of the Wind River Reservation in the Greater Yellowstone area, is included within the boundaries of the ecosystem as defined by the U.S. Geological Survey (<http://rockyweb.cr.usgs.gov/html/gye>).

Archaeologically and culturally, the area is intermediary or transitional between the Great Plains, Great Basin, and Columbia Plateau. This setting on the edge of several well-defined culture areas and state boundaries bias individual researcher perspectives and interpretations of the archaeological and ethnographic record. For example, Wyoming and Montana archaeologists tend to make connections to the people, chronologies, and artifacts of the Northwestern Plains. Idaho archaeologists tend to envision connections to the Columbia Plateau. Great Basin archaeologists in Utah tend to emphasize connections to the Numic-speaking seed-gatherers of Nevada and California (i.e., Wissler 1917). In each of these scenarios, mountain archaeology is often seen as peripheral to a greater core cultural area, which constrains interpretations (Husted 2002; Kornfeld 1999).

Numerous nomadic foragers occupied the region throughout prehistory, but Numic-speaking Shoshone groups are the prominent indigenous people (Larson and Kornfeld 1994; Madsen and Rhode 1994). Defining the temporal limits of Numic expansion into the Central Rocky Mountains is an issue that archaeologists continue to debate (Bettinger and Baumhoff 1982). Some question a single, late Numic expansion and argue for a sustained regional occupation spanning millennia (Francis and Loendorf 2002; Holmer 1994; Husted and Edgar 2002; Loendorf and Stone 2006; Swanson 1972). Others argue that the distinct material features recognizable as Shoshone date only to the last 500 years (Butler 1981; Madsen 1975; Malouf 1968; Wright 1978).

By the 1700s, Shoshones were living throughout the entire region while Crow, Blackfeet, Nez Perce, and possibly Salish entradas were a function of relatively recent emigration, warfare, or seasonal hunting forays (Greiser 1994; Nabokov and Loendorf 2004). The Crow in particular claim Yellowstone within the four figurative tipi poles that define their homeland (Old Horn and McCleary 1995). This region was contested, but Shoshone occupations have continued since the eighteenth century.

Building models of precontact Shoshone settlement patterns and exchange networks based on ethnographic data is problematic because of relatively recent changes in sociopolitical organization among Shoshone groups that span from California

to Wyoming (see numerous chapters in Sturtevant and D'Azevedo 1986). Shoshones are well-known for their political fluidity, with little well-defined social organization beyond the family level. Traditionally, social organization at the local level corresponded closely with key food resources, and use-names were commonly derived from those food items (Murphy and Murphy 1986; Shimkin 1986; Steward 1938). Shoshone bands said to occupy the study area include the Buffalo Eaters (*Kukundika*), Sheep Eaters (*Tukudika*), Salmon Eaters (*Agaidika*), Rabbit Eaters (*Kanurika*), and Elk Eaters (*Parahiadika*) (Hoebel 1938; Hultkrantz 1961; Steward 1938).

We use the concept of local groups as a basic unit of social organization akin to bands, which allows consideration of resource use, mobility, and exchange at spatial scales congruent with probable band territorial ranges (Murphy and Murphy 1986). Local groups consisted of dispersed extended families with typically permeable boundaries that may have periodically hunted bison, fished salmon, collected seeds, dug roots, or trapped bighorn sheep. Thus, membership in food-named social groups was fluid across space and through time. After European contact, greater political cohesion was required of some Shoshone bands east and west of the Continental Divide who made regular hunting expeditions to the Plains and faced constant warfare with other nomadic hunters (Shimkin 1986).

In some parts of the study area, identifying the presence of any particular group during postcontact times is complicated by factors such as the remoteness of the area and conservation policy. For instance, the creation of Yellowstone National Park was founded on the concept of pristine environments that were unaltered by past humans. The existence of a local group of so-called Sheep Eaters in the mountains inside and near the park has obtained a mythical status difficult to separate from ethnographic reality. In fact, Hughes (2000) believes that the Sheep Eaters were a construction of the European imagination, part of a mythical wild man story. Most ethnographers and archaeologists do, however, recognize a unique Mountain Shoshone presence in the region, with a subsistence economy that revolved around bighorn sheep (Dominick 1964; Loendorf and Stone 2006; Nabokov and Loendorf 2004), and this study lends credibility to this claim. Complicating matters are

reservation amalgamations that brought small groups of Yellowstone Sheep Eaters to Wind River and Idaho Sheep Eaters to Lemhi and later Fort Hall, thus rendering both nearly invisible in twentieth-century narratives that focus on more powerful residents dominating reservation politics.

While it is difficult to project specific local groups onto the landscape beyond the Late Prehistoric period ca. 1,000–750 years ago, we believe the ethnographic pattern of regionally distinct local groups living in the Central Rocky Mountains, specifically within the Greater Yellowstone area and Wyoming Basin, has some archaeological merit. These local groups developed and maintained access to obsidian and other resources, as well as mobility and exchange networks particularly during the terminal Late Prehistoric and Historic periods (A.D. 1600–1900).

#### Archaeology of Identity and Ethnogenesis

Negotiations among Native groups and between indigenous inhabitants and European settlers contributed to economic, political, and social changes through time; and issues of ethnogenesis are critical to our study. These processes may have affected migration, settlement strategies, territory maintenance, and trade relations, along with obsidian procurement. Cultural identity is performed and reinforced through a combination of practices and actions (Barth 1969; Graves-Brown et al. 1996; Meskell 2001; Royce 1982), but the material manifestation of identity is often difficult to identify in the archaeological record. For instance, the quest for food is a primary way that groups identify themselves, but is not terribly diagnostic and is difficult to tease apart from animal bones and nondiagnostic lithic artifacts (Scheiber 2001). Archaeologists often rely on types of foods, their spatial distribution, butchering and processing strategies, refuse disposal, preparation techniques, raw material extraction, and tool production in addition to the presence of diagnostic artifacts, as measures of cultural identity (Hodder 1982; Jones 1997; Lightfoot et al. 1998; Wobst 1999).

Ethnogenesis is the process by which people come to define themselves as a separate group with a unique cultural identity (Hill 1996; Klein 1997; Moore 2001). Concepts of ethnogenesis are sometimes difficult to operationalize in hunter-gatherer

studies (Wobst 1978) and are better studied in sedentary agricultural societies. For instance, Clark and colleagues (2008) use the concepts of cultural diasporas and meta-identities to describe social changes that arose in periods of rapid social change among migrant Late Prehistoric farming communities in southern Arizona. Identity formation and negotiation are not just processes that affected farmers, and we think that careful consideration of multiple lines of evidence (even obsidian sources) can reveal ethnogenesis in hunter-gatherer past societies as well.

Ethnic identities may be formed or reformed during migrations to new areas and during times of intense social change (Clark 2001; Lyons et al. 2008; Wood and Downer 1977). Smaller groups may leave parent communities, sometimes resulting in, and sometimes because of, factional competition (Brumfiel 1994). The kinds of changes that occur include new forms of settlement strategies, economic decisions, meal preparation and food practices, and land use, as well as intermarriage, the use of new technologies and new goods, emulating the practices of others, production of new commodities, attaching new meanings to objects, and incorporating intercultural practices into daily lives. The material consequences of identity change may be manifested in foodways (food choice and preparation), import and export of nonlocal materials, spatial distributions, and architecture (housing and construction techniques) (Lightfoot 2005; Lightfoot et al. 1998; Mann 2008; Nassaney 2008; Reitz 1990).

We know from ethnohistoric documents that the Central Rocky Mountains were witness to dynamic social changes during the nineteenth century, although the roots of social change probably lie in processes initiated in the previous century or even prior to that when Numic speakers first moved into the mountains. We see some evidence for social change in material inventories and artifact use, but most sites are not colonial outposts, trading posts, garrisons, or even rendezvous sites but day to day campsites where everyday materials were incorporated into the social lives of individuals. We believe that Mountain Shoshone (i.e., Sheep Eater) ethnogenesis began at least by the late eighteenth century because of the appearance of distinct wooden features (cribbed log catch pens, wooden drivelines, conical pole lodges) in the archaeolog-

ical record that may signal intensified hunting of bighorn sheep and other animals during the early contact period (Davis 1975; Frison et al. 1990; Keyser 1974; Loendorf and Stone 2006; Nabokov and Loendorf 2004) (Figure 2). Although communal hunting likely occurred prior to this time, it is not until the nineteenth century that a suite of hunting features occur together in these remote locations. We interpret hunting intensification as a key indicator of the significance of foodways and the mountain landscape in Mountain Shoshone ethnogenesis. The study of obsidian source use in the Greater Yellowstone area is important in this regard because we are tracing long-term material manifestations of migration, movement, and contact among groups, which ultimately resulted in a widespread Shoshone presence in documented times (see Reed [1985] for attempts to link obsidian sources to prehistoric Shoshone groups across the Snake River Plain in Idaho).

### Regional Obsidian Study and Methodology

For this study we conducted a regional literature survey of obsidian source analysis in the Greater Yellowstone area, Wyoming Basin, and Central Rocky Mountains (see Figure 1 for study area boundaries). These studies include site-specific excavations, syntheses of regional excavations, regional surface inventories, and site-specific surface inventories (Baumler 1997; Bohn 2007; Cannon 1993; Cannon and Hughes 1993, 1997; Clayton and Kunselman 2002; Connor and Kunselman 1995; Davis et al. 1995; Kunselman 1994; Kunselman and Husted 1996; Plager 2001; Smith 1999; Thompson et al. 1997).<sup>2</sup> We also included original data for approximately 200 artifacts from recently documented nineteenth-century Shoshone sites in the Absaroka Mountains east of Yellowstone National Park.

The dataset consists of 2,297 sourced obsidian artifacts from nearly 250 sites representing 34 chemically distinct sources from five states (Tables 1–2) and spanning more than 10,000 years. We collapsed both artifact/site locations and obsidian sources into broader categories for ease in interpretation. The data were thus classified according to subregion, source, source area, and age. Subregions include eastern Idaho, southeast Idaho, southwest Wyoming, northwest Wyoming, and



**Figure 2.** Bighorn sheep wooden catch pen and drivelines at Bull Elk Pass, Wyoming (48FR307). Photograph by Laura L. Scheiber.

southwest Montana.<sup>3</sup> The ten source areas represent geographically discrete areas where multiple, chemically distinct sources are found. Four obsidian source areas are located within the study zone (Yellowstone Plateau, Jackson Hole, Eastern Idaho/Centennial Mountains, and Southeast Idaho). Well-known individual sources include Yellowstone Cliff, Teton Pass varieties, Bear Gulch, and Malad (Table 1). The six additional source areas are located outside and to the west of our study area.

Age was determined by diagnostic artifact properties, excavated contexts with associated radiometric age estimates, or surface finds associated with Euro-American trade items. We follow the cultural chronology used by archaeologists working on the Northwestern Plains and adjoining Rocky Mountains (Frison 1991; Kornfeld et al. 2010), although distinct local variations exist for the Wyoming Basin, Northern Basin and Range, and the Snake River Plain (Butler 1978; Metcalf 1987; Plew 2008). Thirty-seven percent ( $n = 845$ )

Table 1. Documented Obsidian Sources by Source Area.

Source Area	Documented Sources in this Study
Yellowstone Plateau	Conant Creek, Gibbon River Flow, Grassy Lake, Obsidian Cliff, Park Point, Warm Creek
Jackson Hole, Wyoming	Engineers Quarry, Gros Ventre Butte, Teton Pass var. 1, Teton Pass var. 2,
Eastern Idaho (Centennial Mountains)	Bear Gulch, Kelly Canyon, Little Bear Creek, Mud Lake, Pack Saddle Pass, Reas Pass
Southeastern Idaho	American Falls, Chesterfield, Malad
Central Idaho	Big Southern Butte, Camas Prairie, Cannonball Mountain, Picabo Hills, Wedge Butte
South Central Idaho	Browns Bench, Coal Bank Springs
Southwest Idaho	Owyhee, Timber Butte
Northern Nevada	Double H Mountain, Paradise Valley, Summit Lake
Southeast Oregon	Beatys Butte, Burns, Coyote Wells
Central Utah	Mineral Mountain, Wild Horse Canyon

of the sample were unassigned to a known time period.

We measured regional temporal variation in obsidian source use with the Shannon diversity index (Beals et al. 2000). The purpose of the Shannon index is to normalize and quantify diversity within a sample and evaluate the sample's numerical structure. The index is based on two values: diversity and evenness. Diversity is built upon source richness (i.e., the number of individual sources represented within a sample) but takes into account the relative abundance of different sources and the equitability (i.e., evenness) with which the relative abundance is distributed across all identified sources. The diversity index describes the rarity or commonness of individual sources within a sample where a larger value indicates greater diversity. Evenness is normalized so the values of 1 equate to a scenario where the relative abundance is evenly distributed across all sources and 0 equates to dominance of a single source. High values of diversity and evenness are expected when the number of identified sources is large and the number of artifacts from each source area is evenly proportioned. Low values would occur, for example, in an assemblage dominated by one source with small contributions from other sources.

The methodology employed here is innovative in scope and design as it pools a large number of sourced samples from a geographically discrete area. It differs from other studies because it considers regional changes through time in the use of numerous obsidian sources. By comparing diversity in obsidian use, we compare the degree to which people from different geographic areas used

the obsidian that was more or less locally available. This is a geographic, age, and artifact specific study that is not a site-specific analysis and does not consider distance from site to source as the primary line of inquiry. As a regional synthesis we compare patterned spatial and temporal variation in how individual sources or source areas were used. This variability is important because chemically distinct obsidian sources provide a proxy for mobility and/or exchange that is not easily obtained with other lithic raw material types such as chert and quartzite (but see Lyons et al. [2003] and Pitblado et al. [2008] for attempts to do so). A thorough understanding of variation in lithic raw material assemblages can also provide insight into prehistoric foraging ranges (Jones et al. 2003). This is the first study to bring together obsidian data from several regions in the West, and we chose to concentrate on general temporal and spatial trends. Analyses that separate formal tools from lithic debitage have provided further informative patterns in the Great Basin (Eerkens et al. 2007).

The final sample is robust and we feel the patterns are clear and valid across the region, but the dataset is only as strong as correctly designated chronological assessments in original reports. For instance, it is often difficult to discern the age of non-diagnostic artifacts from multicomponent surface sites or undated subsurface contexts. In some cases the original analysts do not subdivide the long Archaic period (ca. 7,500–1,500 BP) into Early, Middle, or Late phases, which would provide a higher temporal resolution to the dataset. Temporal divisions between Late Prehistoric and Historic periods are also often ambiguous.<sup>4</sup> The Lewis and Clark

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Table 2. Number and Proportion of Obsidian Sources by Five Subregions.

	Eastern Idaho	Southeast Idaho	Southwest Wyoming	Northwest Wyoming	Southwest Montana	Total
American Falls	6 (.027)			1 (.001)		7 (.003)
Browns Bench	65 (.294)	7 (.058)	1 (.003)	1 (.001)		74 (.032)
Beatys Butte				1 (.001)		1 (.000)
Bear Gulch	22 (.100)	11 (.092)	51 (.140)	155 (.137)	283 (.611)	522 (.227)
Big Southern Butte	26 (.118)	6 (.050)		1 (.001)	4 (.009)	37 (.016)
Coal Bank Springs	4 (.018)					4 (.002)
Conant Creek				6 (.005)		6 (.003)
Chesterfield		2 (.017)		1 (.001)		3 (.001)
Cannonball Mountain	27 (.122)	1 (.008)				28 (.012)
Camas Prairie	2 (.009)					2 (.001)
Double H Mountain	1 (.005)	2 (.017)				3 (.001)
Engineers Quarry			2 (.005)			2 (.001)
Gibbon River Flow				2 (.002)		2 (.001)
Grassy Lake				5 (.004)		5 (.002)
Green River Pebble			21 (.058)			21 (.009)
Gros Ventre Butte			3 (.008)			3 (.001)
Kelly Canyon	1 (.005)	2 (.017)				3 (.001)
Little Bear Creek					1 (.002)	1 (.000)
Malad	8 (.036)	57 (.475)	146 (.401)	17 (.015)	1 (.002)	229 (.100)
Mud Lake				1 (.001)		1 (.000)
Mineral Mountain			5 (.014)			5 (.002)
Obsidian Cliff	2 (.009)	6 (.050)	13 (.036)	754 (.668)	162 (.350)	937 (.408)
Owyhee	19 (.086)	12 (.100)		1 (.001)		32 (.014)
Picabo Hills	16 (.072)					16 (.007)
Park Point				7 (.006)		7 (.003)
Pack Saddle Pass				4 (.004)	2 (.004)	6 (.003)
Paradise Valley	1 (.005)					1 (.000)

Table 2. Number and Proportion of Obsidian Sources by Five Subregions (continued).

	Eastern Idaho	Southeast Idaho	Southwest Wyoming	Northwest Wyoming	Southwest Montana	Total
Reas Pass				3 (.003)		3 (.001)
Teton Pass var. 1		2 (.017)	65 (.179)	92 (.081)		159 (.069)
Teton Pass var. 2			16 (.044)	31 (.027)		47 (.020)
Timber Butte	14 (.063)	12 (.100)		1 (.001)	7 (.015)	34 (.015)
Wedge Butte	1 (.005)					1 (.000)
Warm Creek				1 (.001)		1 (.000)
Wild Horse Canyon				1 (.001)		1 (.000)
Unknown	6 (.027)		41 (.113)	43 (.038)	3 (.006)	93 (.040)
Total	221	120	364	1129	463	2297
Diversity ( $H$ )	2.251	1.814	1.761	1.230	.851	
Evenness ( $E_h$ )	.795	.730	.734	.398	.275	

Corps of Discovery expedition through the Rocky Mountains in 1805 often marks the unofficial beginning of the Historic period (Lohse 1994). Obsidian artifacts from some eighteenth- or nineteenth-century occupations may easily be assigned to the Late Prehistoric because of the lack of associated metal artifacts or other trade goods. Because of difficulties in discerning the age of reported artifacts, the dataset is thus small for certain time periods (i.e., the Historic) and regions (i.e., southeast Idaho). Other factors affecting the data may include the nature of cultural resource management corridors that follow modern road construction and pipelines, investigator bias that targets large surface amateur collections for analysis, and the effects of large samples of sourced items from selected sites as part of research studies.

### Results

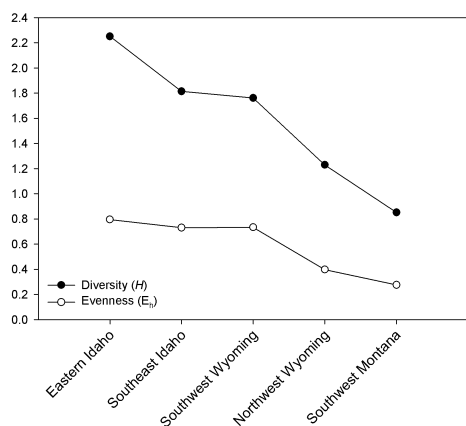
In the following analysis we present the results of the regional synthesis across space and through time. The spatial analysis is presented independent of time and considers general trends in obsidian source use throughout the five subregions within the study area (eastern Idaho, southeast Idaho, southwest Wyoming, northwest Wyoming, and southwest Montana). The temporal analysis con-

siders diachronic changes within each subregion. We present the diversity and evenness indices considering individual sources within site regions and further examine ratios by more general source areas.

#### *Across Space*

Regional patterns of obsidian source use vary across space, regardless of time, proximity of site to obsidian source, and proximity of site to other toolstone sources (Table 2, Figure 3). This pattern is also not dependent on the number of sources within each subregion, i.e., subregions with the most sources such as northwest Wyoming are not necessarily the most diverse. Two basic patterns emerge: diversity is relatively high with an even distribution in eastern Idaho, southeast Idaho, and southwest Wyoming; and diversity is low with an uneven distribution in northwest Wyoming and southwest Montana.

*Eastern Idaho* shows the greatest source diversity with sources relatively evenly distributed across the sample. High diversity in this area is directly related to the large number of chemically distinct obsidian sources that occur throughout the southern half of Idaho. Sources from within Eastern Idaho account for only 10 percent of the sourced artifacts. Yellowstone and Jackson Hole obsidian sources are



**Figure 3. Diversity and evenness indices for utilized obsidian sources by region.**

even more rare (< 1 percent) in the eastern Idaho sample. The *southeastern Idaho* pattern mirrors that for eastern Idaho (high diversity, evenly distributed). Southern Idaho sources are most common (including those within the subregion in southeastern Idaho), and Yellowstone and Jackson Hole sources are rare. Source diversity is also high with even distribution in *southwest Wyoming* where Southeast Idaho and Jackson Hole sources account for the majority of obsidian in the sample. Yellowstone Plateau obsidian accounts for less than 4 percent of the sample, and Eastern Idaho obsidian accounts for approximately 14 percent of the sample.

Source diversity is lower in *northwest Wyoming* and *southwest Montana* compared to other regions. Sixty-eight percent of sourced obsidian artifacts in northwest Wyoming are from Yellowstone sources, with an additional 42 percent coming from Eastern Idaho and Jackson Hole sources. Artifacts from northwest Wyoming also come from 21 different sources, the highest number of individual sources in all subregions, although evenness is low—artifacts are unevenly distributed among sources. Source diversity is lowest in *southwest Montana*, where there are no known obsidian sources. However, the Bear Gulch source occurs in the Centennial Mountains on the border between the states of Idaho and Montana, so residents of the upper Missouri river area in what is today southwest Montana would have had reasonable access to obsidian despite the fact that no sources exist in the state.

Only eight obsidian sources were documented in use through all time periods. Evenness likewise is low. Bear Gulch in Eastern Idaho (62 percent) and Obsidian Cliff in the Yellowstone Plateau (35 percent) are the two most common sources.

### *Through Time*

Obsidian source use also varies diachronically by subregion. All five subregions have at least one sourced obsidian artifact from the Paleoindian through Late Prehistoric periods. Sourced obsidian from identified Historic sites is currently only documented from northwest and southwest Wyoming. Diversity is generally lowest during the Archaic (especially Middle Archaic) and highest in the Late Prehistoric and Paleoindian (in cases with sufficient samples). The results from southwest Montana show some variation in this general trend however.

In *eastern Idaho*, source diversity is relatively low during the Paleoindian period, and samples are fairly evenly distributed across six identified sources (Table 3, Figure 4a). Both diversity and evenness are high during the Early Archaic. Diversity is much lower during the Middle Archaic, but this decline is directly related to sample size with only seven artifacts assigned to this time period. The Unspecified Archaic category is problematic in eastern Idaho and includes artifacts primarily associated with Middle and Late Archaic occupations ca. 5,000–1,500 B.P. Given that probable age assignment, source area diversity remains high in eastern Idaho throughout the Archaic with a slight diversity increase during the Late Prehistoric period. Distribution of sources is relatively even though all time periods.

Temporal patterns in *southeast Idaho* are largely the same as those from eastern Idaho (Table 4, Figure 4b). Only a single artifact from this area is assigned to the Paleoindian period and is thus not informative in this analysis. Like eastern Idaho, however, diversity is lowest during the Middle Archaic (with a slightly larger sample) and reaches its peak during the Late Prehistoric period. Evenness is lowest during the Middle Archaic and Unspecified Archaic, meaning that the sample is dominated by fewer sources.

In *southwest Wyoming* the highest diversity also occurs during the Late Prehistoric period (Table 5, Figure 4c). Only two samples are of known Pale-

Table 3. Number and Proportion of Obsidian Sources by Age, Eastern Idaho.

	Paleoindian	Early Archaic	Middle Archaic	Unspecified Archaic	Late Prehistoric	Total
American Falls	2 (.074)		2 (.286)	1 (.010)	1 (.016)	6 (.027)
Browns Bench	7 (.259)	6 (.261)	3 (.429)	36 (.353)	13 (.210)	65 (.294)
Bear Gulch	1 (.037)	1 (.043)		11 (.108)	9 (.145)	22 (.100)
Big Southern Butte	13 (.481)	2 (.087)	2 (.286)	6 (.059)	3 (.048)	26 (.118)
Coal Bank Springs				4 (.039)		4 (.018)
Cannonball Mountain	2 (.074)	6 (.261)		13 (.127)	6 (.097)	27 (.122)
Camas Prairie					2 (.032)	2 (.009)
Double H Mountain		1 (.043)				1 (.005)
Kelly Canyon					1 (.016)	1 (.005)
Malad	2 (.074)			6 (.059)		8 (.036)
Obsidian Cliff		1 (.043)			1 (.016)	2 (.009)
Owyhee		2 (.087)		4 (.039)	13 (.210)	19 (.086)
Picabo Hills		1 (.043)		10 (.098)	5 (.081)	16 (.072)
Paradise Valley		1 (.043)				1 (.005)
Timber Butte		1 (.043)		6 (.059)	7 (.113)	14 (.063)
Wedge Butte		1 (.043)				1 (.005)
Unknown				5 (.049)	1 (.016)	6 (.027)
Total	27	23	7	102	62	221
Diversity ( $H$ )	1.402	2.073	1.079	2.045	2.132	
Evenness ( $E_h$ )	.782	.865	.982	.853	.858	

oindian age, making the analysis uninformative for this period. In this dataset, diversity is high during the Early Archaic, but both diversity and evenness decrease through the Middle Archaic. Peak diversity in southwest Wyoming occurs during the Late Archaic and into the Late Prehistoric period while identified obsidian sources are evenly distributed across the samples. Both diversity and evenness are at low levels during the Historic period.

The dataset is the most robust for *northwest Wyoming*, with nearly half of the total artifact sample. Peak diversity occurs in the northwest Wyoming sample during the Paleoindian and the

Late Prehistoric periods, with a slight decline throughout the Archaic (Table 6, Figure 4d). Evenness remains fairly high for the northwest Wyoming sample through time but drops significantly during the Historic, as does diversity. Eighty-six percent of the Historic sample comes from the Yellowstone Plateau source area with 84 percent of the total sample originating from a single source at Obsidian Cliff.

*Southwest Montana* shows the overall lowest source diversity in the study (Table 7, Figure 4e). Excluding the Early Archaic, which is affected by a small sample size of three sourced artifacts, diver-

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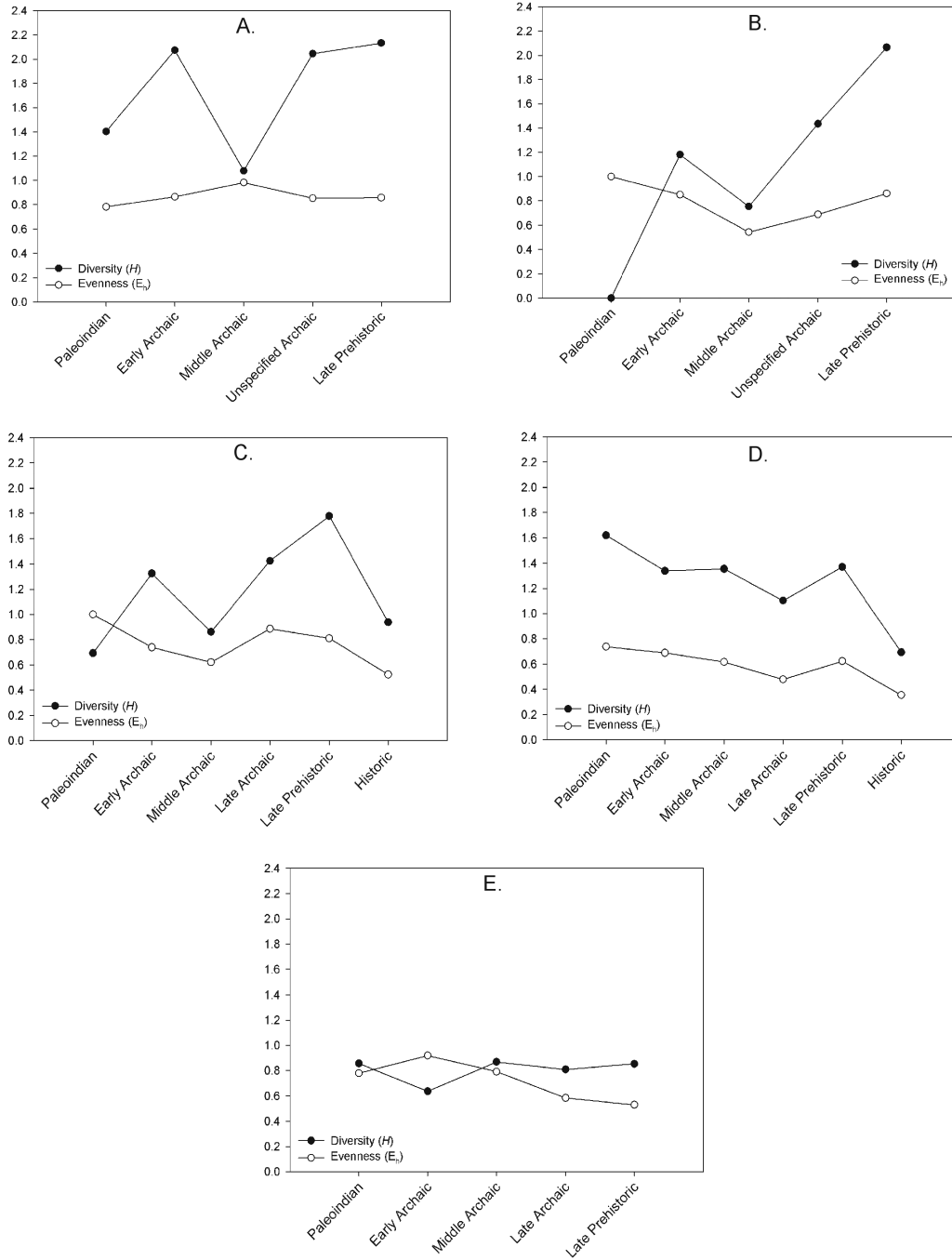


Figure 4. Diversity and evenness indices for utilized obsidian sources by major time period. 4a. Eastern Idaho; 4b. Southeast Idaho; 4c. Southwest Wyoming; 4d. Northwest Wyoming; 4e. Southwest Montana.

Table 4. Number and Proportion of Obsidian Sources by Age, Southeast Idaho.

	Paleoindian	Early Archaic	Middle Archaic	Unspecified Archaic	Late Prehistoric	Total
Browns Bench		1 (.062)		1 (.026)	5 (.100)	7 (.058)
Bear Gulch				1 (.026)	10 (.200)	11 (.092)
Big Southern Butte			1 (.071)	3 (.077)	2 (.040)	6 (.050)
Chesterfield				2 (.051)		2 (.017)
Cannonball Mountain					1 (.020)	1 (.008)
Double H Mountain			1 (.071)		1 (.020)	2 (.017)
Kelly Canyon					2 (.040)	2 (.017)
Malad	1 (1.00)	8 (.500)	11 (.786)	23 (.590)	14 (.280)	57 (.475)
Obsidian Cliff				4 (.103)	2 (.040)	6 (.050)
Owyhee		3 (.188)	1 (.071)	3 (.077)	5 (.100)	12 (.100)
Teton Pass var. 1					2 (.040)	2 (.017)
Timber Butte		4 (.250)		2 (.051)	6 (.120)	12 (.100)
Total	1	16	14	39	50	120
Diversity ( $H$ )	0.000	1.180	.753	1.434	2.065	
Evenness ( $E_h$ )	1.000	.851	.543	.689	.861	

sity is relatively constant (and low). Evenness declines through time reaching its lowest point during the Late Prehistoric period. In contrast to all other regions, diversity and evenness declines during the Late Prehistoric in southwest Montana. The temporal analysis from southwest Montana may be affected by the large number of temporally unassigned artifacts.

#### *Variation through Time and Space*

Taken together, this dataset shows significant spatial and temporal variation of obsidian source use in the Greater Yellowstone area and surrounding regions. The most prominent sources within the five geographic subregions are the ones locally available, and to some extent the number of chemically distinct sources that occurs within a specific geographic area drives diversity. This is particularly true for the eastern and southeast Idaho subregions where numerous obsidian sources are available. Another interesting facet of the dataset is the relatively low numbers with which Yellowstone Plateau

obsidian occurs outside of northwest Wyoming and southwest Montana. For instance, Yellowstone obsidian accounts for approximately five percent of sourced obsidian from southeast Idaho and only one percent from eastern Idaho. This pattern confirms other studies that demonstrate that Yellowstone obsidian, particularly that from Obsidian Cliff, was not as prized throughout the Rocky Mountain region as was once assumed (i.e., Davis et al. 1995).

From a temporal perspective, the Paleoindian sample is most robust in northwest Wyoming. Although it is tempting to view the large diversity and evenness values in the northwest Wyoming Paleoindian sample as a reflection of high rates of mobility and/or exchange typical for early raw material distributions (Frison 1991; Kelly and Todd 1988), we are not here evaluating distance to source, and in fact most Paleoindian sites in northwest Wyoming exhibit a pattern of primarily local lithic procurement (Frison and Bradley 1980; Frison and Todd 1987; Kornfeld et al. 2001; Todd and Frison

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Table 5. Number and Proportion of Obsidian Sources by Age, Southwest Wyoming.

	Paleoindian	Early Archaic	Middle Archaic	Late Archaic	Unspecified Archaic	Late Prehistoric	Historic	Unknown	Total
Browns Bench							1 (.013)		1 (.003)
Bear Gulch		4 (.087)	4 (.160)	12 (.245)	4 (.121)	17 (.133)	7 (.091)	3 (.750)	51 (.140)
Engineers Quarry						2 (.016)			2 (.005)
Green River Pebble				6 (.122)	2 (.061)	13 (.102)			21 (.058)
Gros Ventre Butte		2 (.043)			1 (.030)				3 (.008)
Malad		3 (.065)	18 (.720)	19 (.388)	6 (.182)	46 (.359)	54 (.701)		146 (.401)
Mineral Mountain			2 (.080)		1 (.030)	2 (.016)			5 (.014)
Obsidian Cliff	1 (.500)	2 (.043)	1 (.040)		1 (.030)	8 (.062)			13 (.036)
Teton Pass var. 1	1 (.500)	25 (.543)		2 (.041)	9 (.273)	15 (.117)	13 (.169)		65 (.179)
Teton Pass var. 2		10 (.217)			4 (.121)	1 (.008)	1 (.013)		16 (.044)
Unknown				10 (.204)	5 (.152)	24 (.188)	1 (.013)	1 (.250)	41 (.113)
Total	2	46	25	49	33	128	77	4	364
Diversity ( $H$ )	.693	1.324	.861	1.424	1.948	1.778	.937	.562	
Evenness ( $E_h$ )	1.000	.739	.621	.885	.887	.809	.523	.811	

1986). Paleoindian sample sizes for all other regions are relatively small, although sourced Paleoindian artifacts from eastern Idaho all come from Idaho sources.

Diversity is also high during the eastern Idaho Early Archaic period, with sourced obsidian coming from as far away as Northern Nevada. Otherwise, decreased Archaic source diversity after about 7,000 years ago mirrors the development of regionalization evident in other aspects of the archaeological record, what may be referred to as a settling in period (Larson 1997; Larson and Francis 1997; Smith and McNeese 1999). Use of other local toolstone such as chert and basalt also increases during this time (Beck et al. 2002; Jones et al. 2003). Beginning in the Archaic, Yellowstone Plateau was the dominant source area used at northwest Wyoming sites, while southwest Wyoming sites show a strong connection to Southeast Idaho sources. Regional use in Wyoming overlaps in Jackson Hole and Southern Idaho. Bear Gulch and Obsidian Cliff were the most prominent obsidian sources used during the Archaic in southwest Mon-

tana, and this pattern continues through all time periods.

Throughout most of the Greater Yellowstone area, Central Rockies, and Wyoming Basin, source diversity and evenness were highest during the Late Prehistoric period. From this we conclude that rates of regional mobility and/or exchange increased during the Late Prehistoric compared with the preceding Archaic period. While most sourced obsidian in eastern Idaho is of a local origin, sourced obsidian from southeast Idaho is from the Yellowstone Plateau, Jackson Hole, and Northern Nevada. Increased abundance of Jackson Hole and Eastern Idaho obsidian drives northwest Wyoming diversity during the Late Prehistoric, although sourced artifacts came from as far as Beatys Butte, Oregon. Greater diversity for contemporaneous sites in southwest Wyoming comes from larger proportions of Southeast and Eastern Idaho obsidian, although here, too, people moved artifacts over great distances. Distant sources represented in southwest Montana Late Prehistoric assemblages come from Central and Southwest Idaho (i.e., the

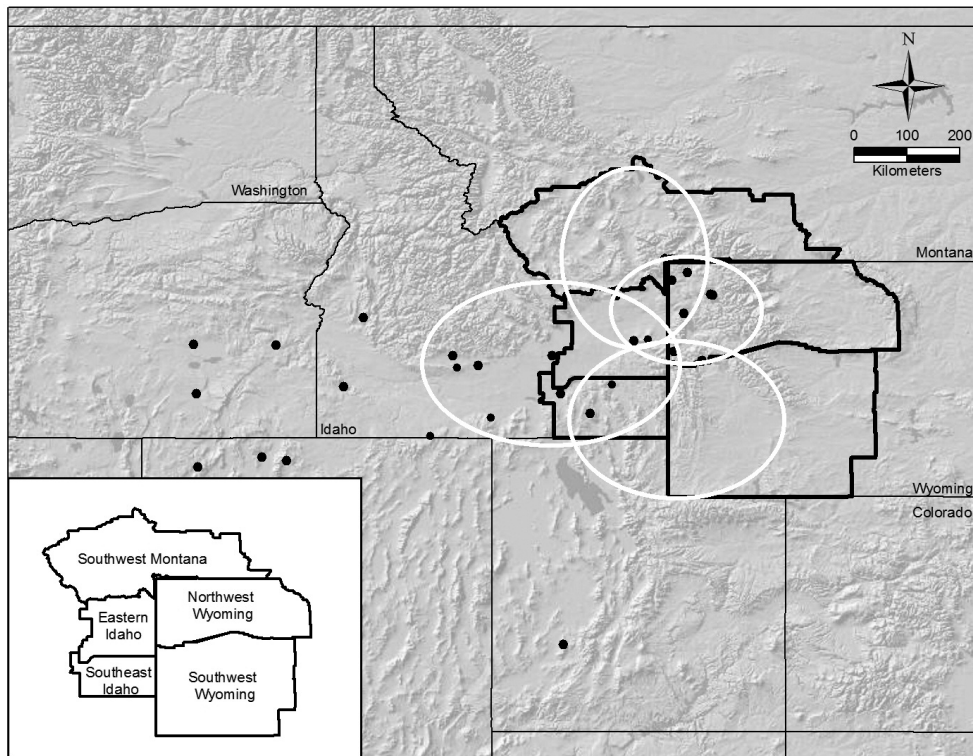


Figure 5. Possible regionalization of obsidian source use in the postcontact era for the Central Rocky Mountains.

Big Southern Butte and Timber Butte sources). One of the possible reasons for the greater diversity of sources throughout the Late Prehistoric is regular movement across the Continental Divide along the present Montana-Idaho border to hunt buffalo farther east and north on the Plains. These activities would have further facilitated obsidian transport and exchange among regions.

Of particular interest to this study, diversity and evenness dramatically decrease during the Historic period in both areas of Wyoming (the two areas in which we have sourced obsidian artifacts from post-contact period sites). Seventy percent of Historic period obsidian from southwest Wyoming originates in Southeast Idaho, whereas 90 percent of northwest Wyoming obsidian is from the Yellowstone Plateau (see Tables 5–6). No Yellowstone obsidian occurs in southwest Wyoming sites, and Southeast Idaho obsidian occurs only once in northwest Wyoming. Overlap continues in Jackson Hole and, to a lesser extent, Eastern Idaho. Historic patterns of obsidian source use in Wyoming are consistent with ethnographic accounts of regional local group distributions in which Mountain Shoshone

people frequented the high country of the Yellowstone Plateau and surrounding Mountains while Plains Shoshones traveled the valleys of southwest Wyoming and southeastern Idaho (Figure 5) (Hultkrantz 1961; Larson and Kornfeld 1994; Shimkin 1986). The overlap of these historic ranges occurred in Jackson Hole, which is also where we see overlap in obsidian sources of artifacts from archaeological sites. Although we have no representation of Historic period assemblages from eastern or southeast Idaho, as well as southwest Montana, we expect that source diversity and evenness would decline in these regions as well.

### Discussion

Our data indicate that precontact people living in the Rocky Mountains during the Late Prehistoric period likely enjoyed wide access to regional obsidian sources (see Reed [1985] for similar conclusions based on analyses of sourced obsidian desert side-notched projectile points in the Snake River Plain). This study does not contradict a series of Numic migrations into the Rocky Mountains by at

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Table 6. Number and Proportion of Obsidian Sources by Age, Northwest Wyoming.

	Paleoindian	Early Archaic	Middle Archaic	Late Archaic	Unspecified Archaic	Late Prehistoric	Historic	Unknown	Total
American Falls	1 (.016)								1 (.001)
Browns Bench			1 (.008)						1 (.001)
Beatys Butte						1 (.006)			1 (.001)
Bear Gulch	14 (.222)	4 (.083)	6 (.109)	10 (.096)		26 (.149)	2 (.020)	93 (.161)	155 (.137)
Big Southern Butte						1 (.006)			1 (.001)
Conant Creek			2 (.036)	2 (.019)				2 (.003)	6 (.005)
Chesterfield	1 (.016)								1 (.001)
Gibbon River Flow								2 (.003)	2 (.002)
Grassy Lake		1 (.021)				1 (.006)	2 (.020)	1 (.002)	5 (.004)
Malad	1 (.016)	1 (.021)		5 (.048)		5 (.029)	1 (.010)	4 (.007)	17 (.015)
Mud Lake								1 (.002)	1 (.001)
Obsidian Cliff	25 (.397)	23 (.479)	32 (.582)	74 (.712)	4 (.571)	100 (.571)	84 (.840)	412 (.714)	754 (.668)
Owyhee				1 (.001)					1 (.001)
Park Point			6 (.109)		1 (.143)				7 (.006)
Pack Saddle Pass						2 (.011)	2 (.020)		4 (.004)
Reas Pass	2 (.032)			1 (.010)					3 (.003)
Teton Pass var. 1	13 (.206)	15 (.312)	3 (.055)	4 (.038)		17 (.097)	7 (.070)	33 (.057)	92 (.081)
Teton Pass var. 2	4 (.063)	3 (.062)	3 (.055)	5 (.048)		13 (.074)	2 (.020)	1 (.002)	31 (.027)
Timber Butte				1 (.010)					1 (.001)
Warm Creek			1 (.008)						1 (.001)
Wild Horse Canyon								1 (.002)	1 (.001)
Unknown	2 (.032)	1 (.021)	1 (.008)	1 (.010)	2 (.286)	9 (.051)		27 (.047)	43 (.038)
Total	63	48	55	104	7	175	100	577	1129
Diversity ( $H$ )	1.619	1.338	1.353	1.103	.956	1.369	.692	.961	
Evenness ( $E_h$ )	.737	.688	.616	.479	.870	.623	.255	.401	

least the Late Prehistoric period. We certainly do not see any dramatic changes during the Late Prehistoric that would indicate massive influxes of new people. People in all five subregions were using a variety of obsidian sources after the Archaic,

choosing from a widespread obsidian landscape. Obsidian source diversity during the Archaic is much more limited throughout the study area.

While we acknowledge that obsidian artifacts may or may not be diagnostic to Shoshone/Numic-

Table 7. Number and Proportion of Obsidian Sources by Age, Southwest Montana.

	Paleoindian	Early Archaic	Middle Archaic	Late Archaic	Unspecified Archaic	Late Prehistoric	Unknown	Total
Bear Gulch	10 (.556)	2 (.667)	4 (.667)	28 (.406)	12 (.750)	63 (.724)	164 (.621)	283 (.611)
Big Southern Butte						4 (.046)		4 (.009)
Little Bear Creek							1 (.004)	1 (.002)
Malad							1 (.004)	1 (.002)
Obsidian Cliff	7 (.389)	1 (.333)	1 (.167)	39 (.565)	4 (.250)	16 (.184)	94 (.356)	162 (.350)
Pack Saddle Pass	1 (.056)			1 (.014)				2 (.004)
Timber Butte			1 (.167)			3 (.034)	3 (.011)	7 (.015)
Unknown				1 (.014)		1 (.011)	1 (.004)	3 (.006)
Total	18	3	6	69	16	87	264	463
Diversity ( $H$ )	.885	.636	.868	.808	.562	.852	.779	
Evenness ( $E_h$ )	.778	.918	.790	.583	.811	.529	.435	

speaking tool-makers, distinctive rock art known as the Dinwoody style is accepted as a distinctive manifestation of Shoshone identity (Francis and Loendorf 2002). Dinwoody-style rock art sites such as Legend Rock (48HO4) in northwest Wyoming have been dated to at least 3,000 B.P. and possibly to Early Archaic times (Francis 2010; Francis et al. 1993), which lends support to a long-term Numic presence in the Rocky Mountains by at least the Archaic. The obsidian data explored here do not refute this long-term presence.

Access to multiple sources of obsidian declined after contact sometime in the eighteenth and nineteenth centuries in southwest and northwest Wyoming. Extralocal obsidian, or that found outside of the local range beyond eastern Idaho and northwest Wyoming, is rare. We think Oregon or Utah sources probably represent exchanged items, although direct procurement from these other sources cannot be ruled out. Among the regions under investigation, mobility and/or exchange should be identified as movement of obsidian between source areas and nearby regions. Interestingly, Yellowstone obsidian is absent from southwest Wyoming, and southeast Idaho obsidian is absent from northwest Wyoming (Thompson et al. 1997). Likewise, Yellowstone obsidian is rare in eastern and southeast Idaho archaeological assemblages. While

Shoshone range size initially increased following acquisition of the horse in the early eighteenth century to include the Rocky Mountains from Saskatchewan to New Mexico, acquisition of the gun by Blackfeet forced a Shoshone retreat within a century to more or less the study area presented here (Heaton 2005; Murphy and Murphy 1986; Secoy 1953; Shimkin 1986; Stamm 1999).

Reduced range size or disruption in exchange relationships during the Historic period may help explain the lower diversity in source use compared to the Late Prehistoric assemblages. This does not mean that exchange did not occur during the Historic period, only that nonlocal obsidian may not have been a valued commodity. But to what extent is the Historic decline in source use a witness to the effects of culture contact on local indigenous groups?

We hypothesized that one effect of contact was range reduction initiated by expansion of neighboring indigenous tribes and Euro-Americans throughout the five subregions. Early historic accounts of the Plains Shoshone describe a once prominent tribe who retreated to the heart of their territory in southern Wyoming (Shimkin 1986; Stamm 1999). Likewise, tales of isolated Mountain Shoshone families of varying affluence living, although rare, occur in Historic period literature

(Russell 1955 [1914]). Based on a clear decline in the diversity of utilized obsidian sources in both southwest and northwest Wyoming, we cannot reject the hypothesis that contact with European traders, miners, and settlers was in part responsible for this trend. People continued to access traditional mountain resources into the twentieth century, but this is rarely documented either historically or archaeologically (Davis and Scott 1987).

What we can say is that postcontact Shoshone people, whether they were living in the mountains or the basins, and whether they were known as Sheep Eaters, Buffalo Eaters, or Salmon Eaters, continued to use obsidian after it was generally assumed that local groups exclusively adopted foreign technologies. Although we are here demonstrating that obsidian acquisition changed, Shoshone people in both the mountains and the plains of western Wyoming, at least, were still able to obtain European trade goods, perhaps in higher quantities than people in other subregions like Idaho where trade items are rarely found in archaeological sites (but see Holmer [1994] for an archaeological example from the Fort Hall Reservation). This may partially be a product of the close proximity of both the Rocky Mountain Rendezvous in the Green River and Wind River basins and of Fort Bridger along the Oregon Trail in southwestern Wyoming.

Historic trade might best express the introduction of foreign items during this time, but the presence of mixed precontact and postcontact period technologies demonstrates persistence of traditional material culture (Cobb 2003; Davis 1975; Holmer 1994; Scheiber and Finley 2010; Silliman 2004). While obsidian does not disappear from postcontact sites and was still used to make stone tools even after metal and firearms were available, source area diversity clearly does change. This measured characteristic marks the material effects of culture contact, and we would argue ethnogenesis, on indigenous social interactions in the Greater Yellowstone area and Wyoming Basin and probably beyond as well.

### Conclusions

In this study, we use obsidian source diversity in the Greater Yellowstone area and Central Rocky Mountains as a window into prehistoric and his-

toric patterns of mobility and/or exchange. Our ultimate interest lies in the impacts of Historic period pressures on native groups, and we hypothesize that postcontact reduction in foraging ranges is one consequence of culture contact. However, understanding patterns for one specific aspect of material culture (i.e., obsidian source use) for a single period in time (i.e., the Historic period) in one specific region (i.e., northwest Wyoming) requires a broad spatial and temporal analysis of that single phenomenon. Obsidian is well-suited to this endeavor because the Central Rocky Mountains and Idaho Snake River Plain are rich in chemically distinct sources, and archaeologists have made considerable efforts to source obsidian artifacts.

Our analysis of nearly 2,300 sourced obsidian artifacts indicates that the foundation for the historic patterns of obsidian source use were set during the Late Prehistoric and even during the preceding Archaic period. We see no evidence for widespread migration of Numic speakers during the later part of the Late Prehistoric period, probably indicating their long-term presence in the area. Obsidian source use reflects highly regionalized settlement patterns in the Central Rockies, where despite ethnographic evidence of large foraging territories (Shimkin 1947), obsidian use was a localized phenomena.

This study is the first regional synthesis of this type for the Central Rocky Mountains, a location that is too often partitioned into several culture areas and is marginalized as a unique region structured by mountain lifeways and mobility patterns (Husted 2002; Kornfeld 1999). We argue that the mountains were part of a pan-Shoshone world by at least the Late Prehistoric and probably by the Late Archaic. Loose separation into what would become recognized Shoshone bands began during the Late Prehistoric and intensified as a result of ethnogenetic negotiations during the contact period, as waves of new immigrants entered traditional Shoshone homelands. Studies of identity formation in the archaeological record are often dependent on the presence of diagnostic artifacts and detailed site-based analyses. In this study, we have examined chemical characterization of commonly used stone artifacts from a regional database to explore widespread changes in settlement strategies and exchange networks that speak to broader issues of migration, identity, and ethnogenesis in the past.



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## Notes

1. We recognize that technological change may also impact obsidian source use as Native people had increasing access to metal and firearms and chose to incorporate them into traditional material repertoires. Stone tools may be of reduced importance in the Historic period, and people may have chosen to invest less time traveling to stone sources. Similarly, not all kinds of stone tools represent the same investment in labor, although this is true throughout time.

2. We conducted a comprehensive search of the archaeological literature for sourced obsidian artifacts in regional journals (*Archaeology in Montana*, *The Wyoming Archaeologist*, *Tebiwa*, and *Yellowstone Science*), theses, and available contract reports. The most numerous contract reports were written for projects within Yellowstone National Park by Paul Sanders for the Office of the Wyoming State Archaeologist and by Ken Cannon for the NPS Midwest Archaeological Center. Some of the references we consulted are already regional syntheses of previously published raw data. We also contacted XRF specialists for assistance with identifying additional data and for clarifying some sources. In some cases, we could not accurately plot reported obsidian sources locations, and these have not been included on Figure

1. Authors of various articles and reports present the obsidian source data in multiple formats. Our dataset includes artifacts from at least 211 sites not counting several studies that report data from several sites without listing their site numbers, giving us a conservative estimate of 250 total sites. Due to the size of the literature database, not every reference or report is cited here. Please contact the authors for more information about the complete database.

3. The decision to subdivide space geographically followed a combination of county boundaries and geographic entities defined for the purpose of gathering federal statistics by the U.S. Office of Management and Budget. The regions we call eastern Idaho and southeastern Idaho are in fact in the

northeast and southeast parts of the state but are designated as such because of the particular shape of Idaho. See Figure 1 for the subregions as defined.

4. Because of the lack of a standard chronological separation between the Late Prehistoric and Historic periods across sites in the study area, we have not defined a separate Protohistoric period in this paper. We recognize that the Late Prehistoric-Historic transition was a dynamic time of extreme interest in the overall picture of culture contact, mobility, and source use.

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