Compositional analysis of Intermountain Ware pottery manufacturing areas in western Wyoming, USA

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ARTICLE INFO

Keywords:
Intermountain Ware
Shoshone
Neutron activation analysis
Petrography
Greater Yellowstone Ecosystem

ABSTRACT

In this study we examine 50 sherds from four archaeological sites to understand ceramic vessel source area variation in western Wyoming. Intermountain Ware ceramics are a diagnostic marker of Shoshone ethnicity, and our central hypothesis explores changing mobility during the Late Prehistoric and Historic Periods, ca. 1500–1870 CE. We use neutron activation analysis (NAA) for bulk paste chemical analysis and thin-section petrography to characterize clay and temper mineralogy. NAA places ceramic artifacts into eight groups with little overlap between sites in southwest and northwest Wyoming. Temper composition supports NAA groups indicating that ceramic vessels in this sample were made locally and not transported long distances before their eventual discard.

1. Introduction

More than a decade of drought, coupled with invasive bark beetle species, has left forests in the Greater Yellowstone Ecosystem (GYE) prone to major wildland fires that have burned vast stretches of remote wilderness. Archaeological discoveries in the aftermath of fires have documented significant archaeological sites, and many of those associated with complex bighorn sheep (Ovis canadensis) drivelines and catch pens (Frison et al., 1990) evidence a transitional material culture indicating that ceramic vessels in this sample were made locally and not transported long distances before their eventual discard.

In this study we examine 50 sherds from four archaeological sites to understand ceramic vessel source area variation in western Wyoming. Intermountain Ware ceramics are a diagnostic marker of Shoshone ethnicity, and our central hypothesis explores changing mobility during the Late Prehistoric and Historic Periods, ca. 1500–1870 CE. We use neutron activation analysis (NAA) for bulk paste chemical analysis and thin-section petrography to characterize clay and temper mineralogy. NAA places ceramic artifacts into eight groups with little overlap between sites in southwest and northwest Wyoming. Temper composition supports NAA groups indicating that ceramic vessels in this sample were made locally and not transported long distances before their eventual discard.
form. Soapstone bowls have been found widely throughout western Wyoming, with higher densities in the high altitudes of the GYE, commiserate with an increased numbers of known sources. However, they are rarely found on the western side of the continental divide, which is a topic that should be explored in more detail. In this study we further examine presumed social connections between the GYE and Wyoming Basin by focusing on the geological composition of Intermountain Ware pottery vessels. We present the results of a pilot provenance analysis of 50 sherds from four archaeological sites in both the Wyoming Basin and the Absaroka Range, two adjacent physiographic provinces with contrasting geological histories. Because of geological differences, we hypothesized that ceramics from these areas will have disparate chemical and mineralogical signatures and may thus provide evidence for movement of people and/or pottery between these areas. If Shoshone bands moved fluidly throughout western Wyoming (i.e., if groups residing in these two areas were not ethnically distinct) during the terminal Late Prehistoric and/or early Historic periods, Intermountain Ware ceramics should evidence diverse clay and temper mineralogy from both regions. Of course, ceramic vessels may have been transported over large areas as part of mobile domestic toolkits, a reasonable assumption given the results of sourcing studies in the northern Great Basin that demonstrate movement of ceramic vessels over great distances (Lyons and Cummings, 2002) and Adam's (2006) distribution of heavy steatite vessels at great distances from their sources. We also proposed that if mobility declined during the Historic period and Shoshone bands moved less frequently between the Wyoming Basin and Absaroka Mountains, clay and temper mineralogy of Intermountain Ware pottery should reflect only local manufacture. The purpose of this paper is to demonstrate the extent of chemical and mineralogical differences between ceramic assemblages manufactured in different physiographic provinces, as a baseline for future hypothesis testing. We use neutron activation analysis (NAA) to characterize trace element geochemistry and petrographic analysis to characterize the mineralogy of temper assemblages. Statistical analyses of these data do indicate regional differences in clay composition and temper mineralogy. We here provide a brief review of Mountain Shoshone archaeology and Intermountain Ware pottery in the Wyoming Basin and Absaroka Mountains, outline the geological basis for our hypothesis, and discuss the results and implications of our pilot study. Future research with larger sample sizes will help demonstrate whether pottery sourcing is a reasonable indicator for human mobility throughout the region during the period of interest.

2. Shoshone archaeology in the Central Rocky Mountains

Any investigation into the late period archaeological history of the Central Rocky Mountains and adjacent regions quickly exposes two diametrically opposed schools of thought regarding the antiquity of Shoshone occupations there. Many contemporary scholars attribute the source of this confusion to Sydney Lamb’s (1958) glottochronological hypothesis for a Numic origin in the far southwestern Great Basin ca. 1000 CE. Some argue that Numic speakers used ecological niches and new foods, thereby outcompeting and replacing extant populations (Bettinger and Baumhoff, 1982). Proponents of a recent migration (Butler, 1981; Wright, 1978) place the arrival of Numic speakers in the Northern and Central Rocky Mountains, the northern and eastern limits of Numic lands, approximately 750–500 years ago for this is in fact when the suite of material attributes recognized as Shoshone (i.e., Desert-side notched and Cottonwood triangular projectile points, beveled knives, and Intermountain Ware pottery) appear in the archaeological record (Larson and Kornfeld, 1994). Proponents of long-term Shoshone occupations in the Northern and Central Rocky Mountains (Finley et al., 2015; Francis and Loendorf, 2002; Holmer, 1994; Husted, 1995; Husted and Edgar, 2002; Nabokov and Loendorf, 2004; Scheibe and Finley, 2011b) see continuity in stone tool and rock art traditions, along with settlement and subsistence strategies as evidence for long-term occupations spanning at least the last several millennia.

While we do not attempt to add to this debate here, we clearly identify with those scholars who perceive long-term Shoshone occupations as part of the regional archaeological record. Barring a single mtDNA study from skeletal samples in the far western Great Basin (Kaestle and Smith, 2001), we know of no direct evidence in the Central Rocky Mountains archaeological record for a population replacement ca. 1250–1500 CE that would support a Numic population expansion. What is clear from the ethnoarchaeographic record is that at Euroamerican contact (typically associated with Lewis and Clark’s Corps of Discovery expedition of 1804–1806 CE) people with broadly similar language, social organization, and material culture lived from the High Plains and Rocky Mountains on the east to the Sierra Nevada on the west, and from the Bitterroot Mountains near the 45th parallel to the Mojave Desert on the south (Murphy and Murphy, 1986; Shimkin, 1986). From eastern California to central Wyoming, these Numic-speakers referred to themselves by a variety of food-related terms (i.e., Sheep Eater, Buffalo Eater, Salmon Eater, Seed Eater, Pine Nut Eater). We know that individual membership within these groups was fluid and contextual, and did not necessarily correspond to other material or social markers of difference. What remains unclear but central to our inquiry, however, is when distinct ethnic identities based on food ways emerged (Steward, 1938) and whether or not such an ethnogenesis was a product of colonial processes (Scheibe and Finley, 2010, 2011a, 2012). Furthermore, to what extent can material analysis, namely provenance analysis of ceramic and obsidian artifacts, contribute to our understandings of the emergence of Shoshone ethnicity and territoriality in the contact period archaeological record?

2.1. Intermountain Ware ceramics in the Central Rocky Mountains

Ceramic vessels are a rare component of archaeological assemblages in the North American Rocky Mountains, a fact largely due to the lifeways of mobile hunter-gatherer inhabitants. In the 60 years since Intermountain Ware pottery was first reported (Mulloy, 1958; Wedel, 1954) this unique artifact type has rarely been the focus of study. It is uncommon throughout the region, and usually occurs as small fragments representing single or few vessels. Because sherds are often small, undecorated, and do not vary much in form, they do not easily lend themselves to typological classifications (Finley and Boyle, 2014). Where such typologies have been proposed, they have only proven to fail the tests of spatial and chronological ordering (Larson and Kornfeld, 1994). Thus, Intermountain Ware ceramics remain at the least, temporal diagnostics of the Late Prehistoric period, and at best, markers of Shoshone identity (Janetski, 1991; Keehne, 1959).

It remains unclear whether the origin of ceramics in the eastern Great Basin, northern Colorado Plateau, and Central Rocky Mountains reflects population movement, diffusion from neighboring groups, or an in situ development of material culture (Eerkens and Lipo, 2014; Finley et al., 2017; Simms, 1994; Sutton and Rhode, 1994). These historical processes characterize our limited understanding of Numic archaeological history. Intermountain Wares are considered poorly made when compared with other ceramic traditions (Pippin, 1986). Construction techniques were varied, and vessel walls are thick with a wide range of temper abundance and grain-size. Firing occurred in both oxidizing and reducing environments and appears to have been executed with little temperature control. Vessels typically follow a classic “flower pot” form with flat, flanged bases, expanding and often shoul-dered walls, and straight to folded rims. Surface treatment is limited to fingernail or fingertip impressions on either shoulders or rims. Bases are often cut with little temperature control. Vessels typically follow a classic “flower pot” form with flat, flanged bases, expanding and often shoul-dered walls, and straight to folded rims. Surface treatment is limited to fingernail or fingertip impressions on either shoulders or rims. Bases are often cut with little temperature control.
is at least 800 years old yet high-intensity wildfires can reset the luminescence signal compromising the utility of ceramics as a chronometer for regional high-elevation occupations (Ideker et al., 2017; Finley et al., 2017).

2.2. The site sample

The four study sites are in the Wyoming Basin and Absaroka Mountains (a sub-area of the Central Rocky Mountains) physiographic provinces (Fig. 1). All sites contain a wide range of diagnostic Shoshone artifacts including tri-notched and un-notched projectile points, beveled bifacial knives, steatite, and Intermountain Ware pottery. Eden-Farson (48SW304) is located in the Wyoming Basin and dates to approximately 1700 CE (Prison, 1971). The site is a residential camp that includes butchering activities associated with a fall communal pronghorn kill. Fragmented ceramic vessels were found in surface and subsurface contexts associated with several distinct lodges. The Bugas-Holding site (48PA563) is a winter camp in the Sunlight Basin of the Absaroka Mountains dating to approximately 1540 CE (Rapson, 1990). Numerous broken ceramic vessels were found around hearths in what is estimated to be a single, five-month occupation. The Platt site (48PA484) is a multi-component campsite located in the foothills of the Absaroka Mountains near Cody, Wyoming. Ceramics from this site come primarily from a surface context, although limited excavations have recovered ceramics, worked glass, and tri-notched projectile points in several undated subsurface contexts (Platt and Hughes, 1986).

A radiocarbon age of 800–920 cal yr BP$^1$ (CSI-PS-30) on residue from one excavated sherd and SG-OSL ages of 670 ± 140 yr BP$^2$ and 780 ± 80 yr BP$^2$ respectively (Ideker et al., 2017), are several centuries earlier than the other sites. The Boulder Ridge site (48PA2665) is one of numerous Shoshone sites exposed by recent wildfires in high-elevation wilderness areas in the Absaroka Mountains southeast of Yellowstone National Park (Eakin, 2005; Scheiber and Finley, 2010; Todd, 2015). The site contains an extensive campsite associated with communal bighorn sheep trapping. Ceramic sherds are associated with a lodge in a discrete concentration that likely represents a single vessel. Radiocarbon ages from an excavated hearth from the ridge range from 960 to 530 cal yr BP, an age inconsistent with the stone, metal, and glass artifacts found on the site. Glass trade beads, for instance, likely date to the 1820s. While both IRSL and SG OSL analysis returned near-modern ages for a sample of the sherds we report here (Ideker et al., 2017), the Boulder Ridge occupation clearly dates to the late precontact or early contact period of the late AD 1700s or early 1800s and the radiocarbon ages represent an old wood problem common at high elevation archaeological sites in the Central Rocky Mountains (Morgan et al., 2012). Acknowledging known probability errors of various dating methods, the ceramics from the Platt site are the earliest in this study, possibly dating as early as the AD 1000s or 1110s. Bugas-Holding was likely occupied in the early 1500s, followed by Eden-Farson in the early 1700s. No items of Euroamerican manufacture were found at Bugas-Holding or Eden-Farson, or in known association with the ceramics at the Platt site. The Boulder Ridge artifact signature however indicates definite engagement with non-Native materials, in the early 1800s.

3. A geoarchaeological provenance model

Northwestern Wyoming’s Absaroka Range is unique in the Central Rocky Mountains due to its Tertiary volcanic origin. The Absaroka Volcanic Province (AVP) formed during the Eocene Epoch ca.

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$^1$ All radiocarbon ages are reported as two-sigma calibrated age ranges in years BP.

$^2$ Luminescence ages are reported as the mean calculated age using a Central Age Model Unlogged (CAMIL) corrected to the year 2010 CE when most samples were collected in the field (Ideker et al., 2017).
University of Missouri Research Reactor (MURR). Sample preparation and data collection followed standard procedures in use at MURR (Glascock, 1992). The results produced elemental concentration values for 33 elements. Groups were generally identified using visual inspection of bivariate plots of the different elements, coupled with some use of hierarchical cluster analysis. Some analytical techniques (including groups membership probabilities based on Mahalanobis Distance projections) require large group memberships not possible in this study.

The 50 analyzed sherds form eight distinct compositional groups that separate particularly well in bivariate plots with chromium and antimony (Fig. 2). Group 1 was originally formed due to similar concentrations of iron and chromium, but additional bivariate plots as well as a hierarchical cluster analysis revealed internal groupings designated 1a, 1b, and 1c. The four Group 1a members are from Bugas-Holding. Based on NAA alone it is difficult to determine whether or not this group was locally made because the sample size is small and the ceramics from the site are the most compositionally diverse. Groups 1b and 1c are fairly tight clusters of samples from the Eden-Farson site. While Groups 1b and 1c share a chemical relationship with Group 1a, the groups are restricted to geographically distant areas and are completely separate compositional groups. A bivariate plot of antimony and scandium shows the separation of Groups 1a, 1b, and 1c (Fig. 3). Group 1c is one of only two groups with members from more than one site. Three of the four samples come from Eden-Farson, while the fourth sample comes from the Platt site. The Platt site sample is the least similar to others in this group.

Group 2 is perhaps the most interesting in this study (Fig. 2). It is a very tight cluster exclusively containing all 20 samples from Boulder Ridge. Some slight internal variability exists within Group 2, so additional samples might help determine if two separate compositional

Fig. 1. Location of study area and four archaeological sites sampled for NAA and petrographic analysis.
Source: Esri DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community, Sources; Esri, USGS, NOAA.
groups exist. Group 3 is by far the least cohesive. It has the largest ellipse in almost any bivariate plot; it is the only group split apart in the cluster analysis; and its members come from both regions and three of the four sampled sites. Aside from being low in chromium, there is little that ties this group together. A much larger sample size may aid in splitting Group 3 into meaningful groups. Group 4 consists of only four members, all from Bugas-Holding. Groups 5 and 6 consist of a pair of samples each that may form stronger compositional groups given a much larger sample. Both Group 5 members are from Bugas-Holding, and since the two samples plot so closely it is possible they are from a single vessel. The two Group 6 samples are from the Platt site and also may represent a single vessel. The two Group 6 samples are from the Platt site and also since the two samples plot so closely it is possible they are from a much larger sample. Both Group 5 members are from Bugas-Holding, samples each that may form stronger compositional groups given a much larger sample size may aid in clustering variation in NAA chemical Group 1 subgrouping.

As a pilot study, this project has an abnormally low number of unassigned samples with only two samples (4% of the total sample) unassigned to source groups. Typically in many ceramic NAA projects as much as 20–30% of the sample may remain unclassified in order to statistically differentiate some of the compositional groups. The MURR ceramic database does not have any other samples related to the ones in this study. Both unassigned samples are unique outliers rather than intermediate between other groups. This lack of intermediate unassigned samples attests to the incredible compositional variability present in the two regions.

4.2. Temper petrology

While Neutron Activation Analysis detects the elemental composition of the clay used to make pottery, temper petrology focuses on elements added to the clay to keep pots from shrinking and cracking during firing. Crushed rock and sand, composed of individual minerals, are common temper types. Petrographic temper analysis provides key data that complements bulk paste NAA compositional groups (Eerkens, 2003; Ownby et al., 2014; Rice, 2015). Thirty-five of the 50 sherds were used in the petrographic analysis, which included all sherds from the Eden-Farson, Bugas-Holding, and Platt sites, and five sherds from Boulder Ridge. Sherds were broken into multiple pieces and set into epoxy resin blocks. Thin sections were cut from each block, mounted on a glass slide, and stained to highlight calcite and potassium feldspar grains. We examined the slides under 5× and 10× magnification using a polarized light microscope and described each slide according to temper abundance, shape, and mineralogy (Table 1). We focused on relative proportions of distinct minerals such as calcite, quartz, potassium feldspar, plagioclase, and biotite, as well as distinct rock aggregates diagnostic of specific geological provinces. These descriptions are qualitative only, and we have not conducted quantitative mineralogical point-counting at this time.

Based on shared temper characteristics, the sample can be divided into 10 temper groups that compare favorably with the NAA compositional groups. After the first assignment of samples to temper groups, we reached a 71% correspondence between NAA and temper groups. We reexamined samples where NAA and temper groups did not agree and often reassigned them to corresponding NAA groups based on shared attributes. For example, NAA Group 1a includes four Bugas-Holding samples designated as temper group 5. From a petrographic perspective, temper is extremely abundant and relatively well sorted with mostly subangular to rounded grains ranging in size from medium to coarse sand. Temper group 5 mineralogy is dominantly mono- and polycrystalline quartz and plagioclase with common biotite (Fig. 4a). Rock aggregates are rare but include well-rounded grains of devitrified glass rods with plagioclase phenocrysts (Fig. 4b). These aggregates are extremely important to this study as they are diagnostic of porphyritic (feldspar) andesite common to the AVP and are diagnostic mineralogical markers of ceramics manufactured in the Absaroka Range. The dominant mineralogy of temper group 5 (i.e., common quartz, feldspar, and biotite), however, indicates a likely source area close to pre-Cambrian calc-alkaline granites as well as AVP andesite. Based on the combined mineralogy of this group, we conclude that pots belonging to NAA Group 1a/temper group 5 were likely made in an area close to an igneous, granitic center with limited influence from an alluvial AVP source. This describes the Sunlight Basin where the Bugas-Holding site is located. Hence we also conclude that NAA Group 1a/temper group 5 vessels were made, used, and discarded close to the source area.

As another example where petrographic analysis provides complementary yet contrasting data, NAA groups 1b and 1c, all from Eden-Farson, include seven sherds with the same temper mineralogy (i.e., temper group 7). Temper is dominantly aggregated olivine and opaque mineral clasts, abundant plagioclase, and common biotite; quartz is absent (Fig. 4c). This distinct temper is characteristic of extrusive igneous rocks different from AVP rocks. The former may originate from localized Plio-Pleistocene volcanism along reactivated Laramide and Tertiary faults in southwest Wyoming, namely the Leucite Hills volcanic field, which is in fact where the Eden-Farson site is located. Petrographic analysis identifies mineralogical markers of the AVP and ceramics made in that particular geological province. It also reveals distinct mineralogical markers of ceramics made locally in the Wyoming Basin. As with the Bugas-Holding artifacts, the ceramics belonging to NAA Groups 1b and 1c/temper group 7 appear to have been made, used, and discarded close to their source.

Temper analysis also allows us to evaluate samples that share statistical membership in compositional groups but do not otherwise fit.
<table>
<thead>
<tr>
<th>Temper group</th>
<th>NAA group</th>
<th>Site</th>
<th>Thin section #</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>48PA2665</td>
<td>WDO-31, WDO-32, WDO-33, WDO-34, WDO-35</td>
<td>Low volume of temper, high quantity of clay matrix; mineralogy dominantly aggregates of iron and devitrified glass typical of AVP; quartz and feldspar common and occur in large, angular grains; rare biotite</td>
</tr>
<tr>
<td>2</td>
<td>6, UNAS</td>
<td>48PA848</td>
<td>WDO-25, WDO-27</td>
<td>Abundant temper ranging from very fine to very coarse, most grains angular to subangular; mineralogy dominantly quartz and plagioclase with rare biotite; contains many aggregates of iron and devitrified glass with plagioclase phenocrysts; volcanic glass typical of AVP</td>
</tr>
<tr>
<td>3</td>
<td>UNAS</td>
<td>48PA848</td>
<td>WDO-29</td>
<td>Abundant temper ranging from very fine to very coarse, most grains angular to subangular; mineralogy dominantly mono- and polycrystalline quartz and plagioclase with rare biotite; common lithics contain plagioclase phenocrysts but mineralogy is not typical of AVP; source is possible arkose sandstone proximate to source area</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>48PA563</td>
<td>WDO-17, WDO-24</td>
<td>Abundant temper ranging from very fine to coarse, most grains angular to subangular; diverse mineralogy with very common mono- and polycrystalline quartz and plagioclase and rare biotite; aggregates typical of AVP are absent; probable plutonic source in Cody Anticline or Beartooth Plateau</td>
</tr>
<tr>
<td>5</td>
<td>1a</td>
<td>48PA563</td>
<td>WDO-14, WDO-15, WDO-21, WDO-22</td>
<td>Extremely abundant well-sorted temper ranging from medium to coarse with angular to rounded grains; mineralogy dominantly mono- and polycrystalline quartz and feldspar with common biotite; lithics are rare but include well-rounded grains of aggregated iron and devitrified glass rods that may have originated in AVP; likely source is close to calc-alkaline igneous granites with some limited influence from alluvial AVP source</td>
</tr>
<tr>
<td>6</td>
<td>4</td>
<td>48PA563</td>
<td>WDO-13, WDO-18, WDO-19, WDO-20</td>
<td>Extremely abundant temper ranging from fine to coarse with angular to rounded grains; mineralogy dominantly mono- and polycrystalline quartz and feldspar with common biotite; feldspar grains very angular and more abundant than other samples; contains numerous large, angular aggregates of iron and devitrified glass with porphyritic feldspar grains typical of AVP source area; likely source area close to plutonic center with definite influence from AVP source areas</td>
</tr>
<tr>
<td>7</td>
<td>1b, 1c</td>
<td>48SW304</td>
<td>WDO-2, WDO-4, WDO-6, WDO-7, WDO-9, WDO-10, WDO-11</td>
<td>Moderate to abundant temper ranging from fine to medium, well-rounded clasts with rare coarse grains; mineralogy is dominantly medium, subangular to rounded grains (unidentified); abundant feldspar with classic simple twinning and common biotite; quartz is rare to absent; some coarse grains are a conglomerate of very fine sand with some quartz</td>
</tr>
<tr>
<td>8</td>
<td>3</td>
<td>48SW304</td>
<td>WDO-1, WDO-3, WDO-5, WDO-8, WDO-12</td>
<td>Moderate temper ranging from very fine to coarse with many subangular to angular elongated grains; mineralogy dominantly mono- and polycrystalline quartz, common feldspar, and rare biotite; may contain some grog temper fragments and few large calcite grains; possible source area is arkose sand near plutonic center</td>
</tr>
<tr>
<td>9</td>
<td>3</td>
<td>48PA563</td>
<td>WDO-16, WDO-23, WDO-30</td>
<td>Extremely abundant, tightly packed temper ranging in size from very fine to coarse with angular to subrounded shape with few well-rounded grains; mineralogy dominantly mono- and polycrystalline quartz, feldspar, and common biotite; feldspar grains show wide size range with very angular shape; rare coarse aggregated grains of polycrystalline quartz, feldspar, and unidentified clast; likely plutonic source distant from AVP since no typical AVP aggregates occur</td>
</tr>
<tr>
<td>10</td>
<td>1c</td>
<td>48PA848</td>
<td>WDO-28</td>
<td>Extremely abundant temper with well-sorted very fine, angular grains; mineralogy dominantly mono- and polycrystalline quartz, feldspar, and common biotite; possible plutonic source with no influence from AVP</td>
</tr>
</tbody>
</table>
One sample from the Platt site was assigned to NAA compositional Group 1c, otherwise composed of Eden-Farson sherds. While the single northwestern Wyoming sherd from the Platt site shares some trace element composition similarities with sherds from the Wyoming Basin site, the temper mineralogy is completely different. Quartz sand is abundant in the Platt site sherd, which is absent from the mafic mineralogy of Group 1b and 1c Eden-Farson samples (Fig. 4d). One of two samples unassigned to clay groups, also from the Platt site, has unique temper mineralogy and is the only member of that particular temper group. That said, qualitative temper analysis provides an important means to examine variations in mineralogical properties of vessels assigned to specific NAA compositional groups. This combined analytical approach is particularly helpful in small studies that preclude more detailed group membership assessments based on multivariate statistics requiring larger group sizes to assess statistical validity.

5. Regional comparisons and conclusions

While brownware pottery, the broader equivalent of Intermountain Ware, occurs throughout the North American Great Basin and into the adjacent Colorado Plateau and Central Rocky Mountains, detailed compositional analyses have been limited to southwestern Great Basin archaeological sites (Eerkens et al., 2002a, 2002b; Eerkens, 2003). Two primary questions addressed in these Great Basin studies are whether brownware pots were made locally and to what extent chemical characterization informs otherwise poorly developed brownware typologies. Eerkens et al.’s (2002a) preliminary work demonstrated that while Death Valley brownwares were not distinctly different from those found in Owens Valley or other parts of eastern California, some internal variation could be found within Death Valley assemblages themselves. In a companion study, Eerkens et al. (2002b) focused on chemical typologies of Owens Valley brownwares. According to Steward’s (1938) ethnographic account, the Owens Valley Paiute were an exception to then accepted notions of land tenure and resource ownership among foraging societies. Central to Eerkens et al.’s (2002b) inquiry was Steward’s assertion that specific women owned, made, and distributed pottery vessels throughout the area. In a detailed analysis of nearly 400 whole or fragmented pots and clay reference samples from throughout eastern California, Eerkens et al. (2002b) found considerable variability in brownware chemical groups, indicating that residents of the southwestern Great Basin accessed clay resources from throughout the entire area. Rather than the byproduct of centralized production and an economy of exchange as Steward (1938) suggested, brownwares were part of mobile, curated tool kits used in foraging expeditions as part of a seasonal round or while visiting groups in nearby territories.

Eerkens et al.’s (2002a, 2002b) studies are models for analysis of Wyoming ceramic assemblages, as well as the contributions chemical
analysis can make to understanding complex social processes among foraging societies. Pottery is even more uncommon in the southwestern Great Basin (Finley and Boyle, 2014). Regional typologies based on design and construction attributes are problematic, with over 16 different classifications. Particularly problematic are brown and gray ware categories, which may represent either Shoshone groups or earlier Fremont populations in the Wyoming Basin (Finley et al., 2017; Smith, 1992). Chemical and mineralogical typologies provide a reliable, quantitative alternative to those based on design attributes alone. This is perhaps the greatest contribution of our study: the value of regional ceramic assemblages is not in their aesthetic as a unique artifact class, but rather as a source of socially meaningful geological data.

As a method of study for examining potential source areas for Intermountain Ware in western Wyoming, the combined approach of NAA and thin-section petrology shows a great deal of promise. The primary goal of this study was to examine differences in Intermountain Ware ceramic composition between the Absaroka Mountains in north-west Wyoming and the Wyoming Basin to the south. We hypothesized that ceramics from these areas would have disparate chemical and mineralogical signatures, and the two regions are indeed different in their ceramic raw material use. Eight clay compositional groups are distinct in a way rarely seen in such pilot studies. Based on the clay chemical analysis alone, we conclude that no significant regional overlap in manufacture of Intermountain Ware vessels occurs between the Wyoming Basin and Absaroka Range. A thorough consideration of clay chemical properties inherited from geological parent materials should inform the sampling strategy. Temper petrology highlights variation in raw material sources by identifying mineralogical suites that are distinctive of geologically unique areas such as the AVP or the Leucite Hills. While temper analysis helps refine potential raw material source locations, it is still not possible in all cases to say exactly where vessels were produced. Temper for vessels manufactured in the Absaroka Range and derived from AVP source areas is unique, which we see at Boulder Ridge, the Platt site, and Bugas-Holding. Regardless, samples from the Platt site and Bugas-Holding were made with materials that originated from granitic sources, which could come locally from either the Cody Anticline or Beartooth Plateau. A detailed regional petrofacies model that considers the characteristics of formation-specific mineralogical assemblages (Miksa and Heidke, 2001) can further refine temper sources. A combined clay chemical and temper petrofacies reference collection will further define source areas throughout the Wyoming Basin and Central Rocky Mountains, which will in turn allow for a greater understanding of regional manufacture, use, and discard of Intermountain Ware vessels that will come with additional compositional analysis.

We also hypothesized that ceramics may provide evidence for movement of people and/or pottery in the Rocky Mountains and surrounding areas. The hyper-local pattern does not in fact lend itself to discussions of regional differences in mobility. Of the eight composition groups, all but two are limited to a single site. These results were unexpected for highly mobile people using ceramic technology, especially given previous studies that indicate that obsidian, and to some extent steatite, both were involved in large scale artifact movement that likely followed human movements both east-west and north-south. The study of different object types (such as ceramics, obsidian, and steatite) clearly provides varying information about Shoshone subsistence economies and settlement strategies throughout the Late Prehistoric and Historic periods. Although we proposed that clay and temper mineralogy of Intermountain Ware pottery should reflect local manufacture if mobility declined and/or if Shoshone bands moved less frequently between the Wyoming Basin and Absaroka Mountains, pottery production appear so be incredibly localized with site-specific production and discard and little exchange. They are not part of mobile domestic toolkits, as is the case in the Great Basin.

The results of this study are extremely promising, although we do not yet have the data necessary to refute our central hypothesis regarding terminal Late Prehistoric and Historic mobility, exchange, and ethnogenesis among native Shoshone bands. The preliminary results support distinct regional chemical and mineralogical differences, and all evidence indicates that ceramic vessels were discarded close to their source areas. Our results warrant an expanded study to include more sampled sites and vessels throughout western Wyoming and into eastern Idaho and southwestern Montana, areas all part of ethnographic Shoshone ranges and connected to the archaeological record via obsidian provenance analysis (Finley et al., 2015; Scheiber and Finley, 2011b). Consideration of contact period cultural processes requires a detailed chronological analysis, which may also come as direct luminescence ages of Intermountain Ware vessels themselves (Ieder et al., 2017; Finley et al., 2017). A combined characterization of clay chemistry and temper mineralogy, along with luminescence geochronology, holds a great deal of promise for understanding Shoshone interactions throughout the Central Rocky Mountains, as well as potential responses to American colonialism, culture contact, and culture change at a critical time in tribal histories.

Acknowledgements

The George C. Prision Institute of Archaeology and Anthropology at the University of Wyoming, the Wyoming Bureau of Land Management Rock Springs Field Office, and the Absaroka Chapter of the Wyoming Archaeological Society provided collections used for analysis in this study. Additional support came from the University of Wyoming Archaeological Repository, the Office of the Wyoming State Archaeologist, and the USFS Shoshone National Forest. Indiana University’s Office of the Vice President for Research and the University of Missouri Archaeometry Laboratory Research Reactor (through NSF grant #0504015) generously funded this study and supported laboratory analysis. Carol Dehler (Utah State University Geology) assisted with thin section photomicrographs. Molly Cannon (Utah State University Museum of Anthropology) assisted in map production.

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