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Tables, Figures, and Illustrations:

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Cover: Photo of Tipis petroglyph boulder taken by Julian Steward in the 1930s. Photo courtesy of Mountain West Digital Library, Frank A. Beckwith Collection (see page 74 this volume).

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Message from the Editor

Over the past three years, I've had the privilege of serving as the editor of *Utah Archaeology* (*UA*). It has given me an opportunity to rub elbows with so many people in our state and beyond. Without a doubt, we have a stellar network of incredible archaeologists, both in professional and avocational positions. I would like to thank the current Utah Professional Archaeological Council and its Executive Committee for all their support as we have worked to keep *UA* a viable and enduring source for archaeological research. I also want to thank Brigham Young University for their support on a decade's worth of issues of *UA* (2006-2015). They have donated hundreds of hours of work in the form of graphical and technical editing and the printing of the journal. In particular, Scott Ure (Technical Editor) has maintained a standard of production that is nothing less than the highest quality. Finally, the journal would not exist without the contributors and reviewers. May we all continue to share our love for Utah archaeology by working to disseminate our findings with each other and the public.

The Editor

Michael T. Searcy

Landscape Use of the First Transcontinental Railroad: Perspectives from the Ruby Pipeline Project

Jack E. Pfertsh
Alpine Archaeological Consultants, Inc.

The history of the first Transcontinental Railroad is well documented because of its importance to the transportation history of the United States. Less understood is the use of the landscape and the infrastructure that supported the function of the railroad. During the Ruby Pipeline Project, several linear sites associated with the railroad were documented. Because pipeline construction could not avoid these sites, each required mitigation through additional data collection to thoroughly record their physical remains to provide a permanent record of the site. This was accomplished through a data-collection method that employed detailed descriptions, archival-quality photodocumentation, GPS mapping, and scaled illustrations. Collectively, these data improve our understanding of the extent of the Transcontinental Railroad's function and the role it played in shaping the historic landscape of northwestern Utah.

Nearly 70 years after the final abandonment of the Promontory Branch of the Transcontinental Railroad, Ruby Pipeline, LLC (Ruby) began construction on the Ruby Pipeline, a 680-mile-long natural gas transmission pipeline extending from southwestern Wyoming to southern Oregon. The pipeline, which is now owned by Kinder Morgan, Inc., traverses the width of northern Utah, a distance of 183 miles, across Rich, Cache, and Box Elder counties. Alpine Archaeological Consultants, Inc. (Alpine) completed an archaeological inventory of the Utah portion of the Ruby Pipeline in 2009 to help Ruby meet their obligations under Section 106 of the National Historic Preservation Act (NHPA) and the National Environmental Policy Act (NEPA). The inventory resulted in the documentation of 135 historical and prehistoric archaeological sites and 436 isolated finds. Of the 135 sites, 100 are historical sites and 35 were prehistoric sites (Table 1). No cultural affiliation could be assigned to the vast majority of the prehistoric sites; however, 15 of the sites have Archaic components, seven had Formative components, and six had Late Prehistoric or Protohistoric components. The 436 isolated finds consisted of 325 historical components, 108 prehistoric components, and three with both historical and prehistoric components.

Among the historical sites, linear sites associated with the Promontory Branch of the Transcontinental Railroad are of particular interest. The sites consist of linear infrastructure such as wagon roads, aqueducts, and communication lines that directly connect to railroad stations and sidings yet extend for a great distance beyond the path of the railroad (Figure 1). Such sites are often taken for granted since they are of simple construction and used with little fanfare. Consequently, the significance of their past contributions to history is invariably overlooked, even though understanding a site's historical context is crucial to properly understanding its significance. One of the primary benefits of documenting historic linear sites associated with the Transcontinental Railroad is that it has significantly enhanced our understanding of the railroad's history and

Table 1. Site Types Documented along the Utah Portion of the Ruby Pipeline.

No.	Site Type
	Historical Sites
29	Artifact scatters or areas of refuse discard
18	Segments of roads depicted on General Land Office maps
15	Large-volume primary irrigation ditches or canals
5	Isolated structures typically representing outbuildings
6	Segments of railroads
1	Railroad siding
5	Buried aqueducts
3	Arborglyph sites consisting of carved inscriptions on aspens
1	Segment of a trail
2	Railroad town sites
6	Habitation/homesteads sites
1	Site consisting of ancillary features associated with a cement factory
1	Historical highway
2	Historical pipelines
1	Corral complex
1	Kelton to Park Valley telephone line
1	Utah Power and Light Company's Grace Terminal Transmission Line
2	Historical campsites
	Prehistoric Sites
29	Open lithic scatters
2	Open camps
2	Lithic prospecting or procurement sites
2	Rockshelters

function, which has resulted in a more concise definition of the extent of the historic landscape use by the railroad.

The cultural resource inventory resulted in the identification of 75 cultural resource sites and 183 isolated finds. Fifty-six of the sites were documented for the first time by Alpine, and the remaining 19 were previously recorded sites. The sites include 57 historical sites and 18 prehistoric sites. None of the sites had both historic and prehistoric components, though one site had a prehistoric isolate within a historic site boundary. Isolated cultural artifacts include 48 prehistoric isolated finds and 135 historic isolated finds. The 57 historic site components date from the late nineteenth century to the 1960s.

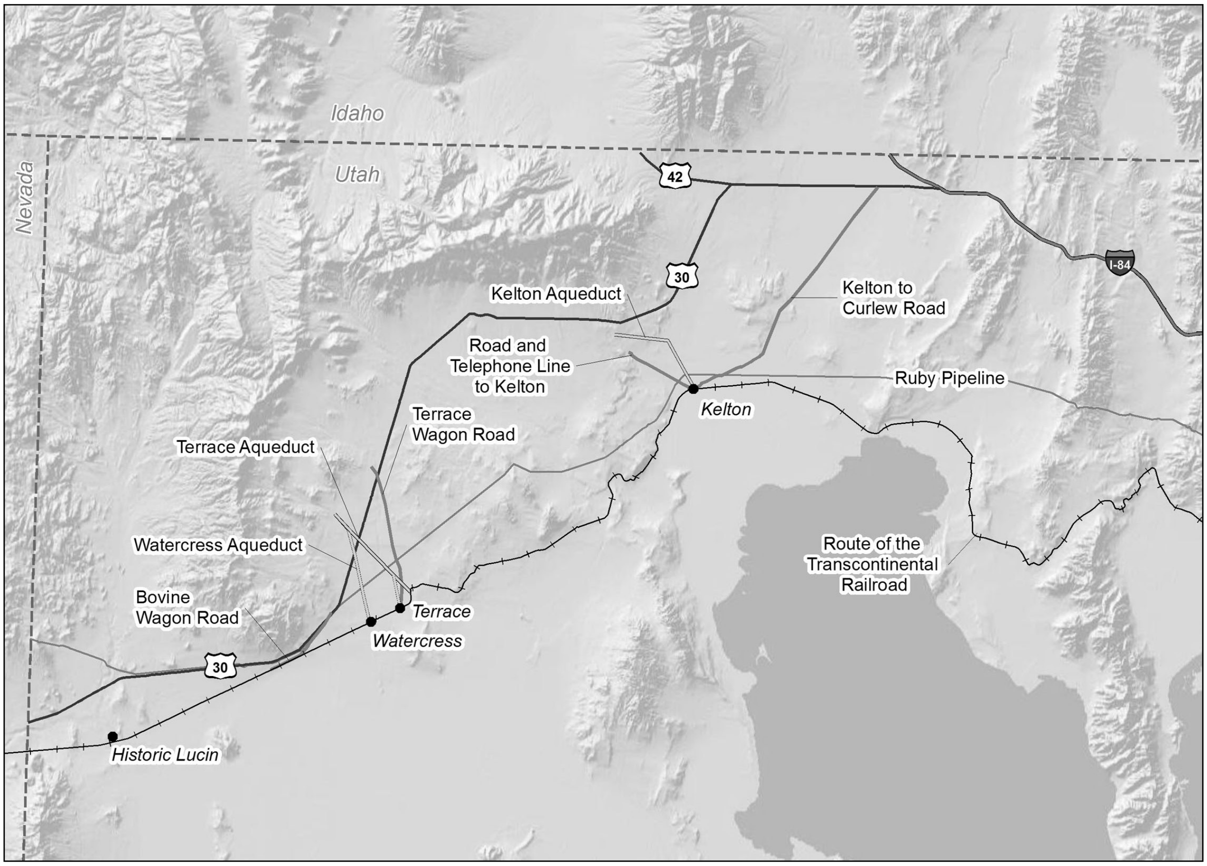

Figure 1. Project area map showing linear infrastructure sites associated with the use of the Transcontinental Railroad.

Historical Background

Lands in the northwestern reaches of Utah remained largely unsettled even after the influx of Latter-day Saints (Mormons) began expanding settlements into Box Elder County by the early 1850s. This was primarily due to the isolation of the area and the stark landscape, made up chiefly of greasewood-covered alkali flats that were once the bed of prehistoric Lake Bonneville. The aridness of the area made it unfit for farmland and the landscape remained nearly unaltered by human hands until the coming of the Transcontinental Railroad in the late 1860s. Aside from its effect on the landscape, the construction of the rail would also forever change the solitude of the Mormon state, thus breaking the insulation the group had from the rest of the world. Though not completely reticent to the transportation revolution passing through Utah, Mormon leader Brigham Young worried about the potential effect the influx of unsavory characters and ideas would have on the Mormon concept of Zion within the Great Basin. In time, Young came to see the economic benefits the railroad would bring to the Mormon people by way of jobs and lower shipping costs for importing and exporting goods. He also saw the benefits of transportation in the form of new religious converts arriving in Utah from Europe and various parts of the United States. When Young realized that self-sufficient isolation was not completely achievable, he set out to get a contract with the Union Pacific to help build the railroad from Echo Canyon, northeast of Salt Lake City, to the eastern shores of the Great Salt Lake in 1868. Later that same year, Young would enter into another contract with the Central Pacific to survey and construct portions of the railroad into western Utah (Stevens 1972). Because so many Irish and Chinese immigrants were already at work building the railroad, in acquiring these contracts Young was attempting to stave off an additional influx of non-Mormon labor within the state of Utah (Arrington 1966). The Central Pacific railroad, built west to east beginning at Sacramento, California, was joined with the Union Pacific Railroad built east to west from Council Bluffs, Iowa, by a golden spike driven at Promontory Summit, Utah, on May 10, 1869 (Powell 1994). With the symbolic driving of the golden spike, not only would the landscape of northern Utah continue to be altered by the railroad itself, but it would be further changed by the infrastructure necessary to support its function. Accompanying the completion of the railroad, sidings and section stations were constructed, with each section station servicing 10 to 12 miles of the rail (Raymond and Fike 1981). Many of these stations would eventually morph into town sites serving as major shipping ports for mining, farming, and ranching and as travel connections going both east and west. It was not long after the completion of the railroad that a major network of wagon freighting routes were established to distribute goods shipped in by rail. It would also become necessary to build an infrastructure to support not only the railroad, but also the growing populations of people drawn to its towns seeking economic advantage. In addition to freighting routes, needed infrastructure would include hundreds of miles of communication lines, as a way not only to communicate, but also for the safety of the railroad. The infrastructure would also include several miles of water aqueducts to transport water to an otherwise parched landscape.

The Transcontinental Railroad, once completed, served to physically unite a previously divided and sporadically settled nation. In doing so, it also stimulated immigration and settlement of the western United States in an area that was once only accessible by wagon and horseback. The linking of the east and west was critical to the dawning of a new era following the Civil War and would play a pivotal role in spawning the Industrial Revolution. In this sense, it opened up a ready supply of raw materials for factories, thereby dramatically lessening the time it took to receive these supplies. The rail also played a major role in stimulating mining and agriculture, giving these industries the means to achieve new levels of success by opening up fresh markets for manufactured and agricultural goods (Hillstrom and Collier Hillstrom 2005). As the demand for agricultural goods increased, farmers found that they had access to the most innovative equipment of the time to meet these demands. In no small way, the railroad resulted in rapid change, whereby a sudden improvement in transportation and access to products forever transformed society and the economy. Moreover, the advancements in product availability facilitated access to new technologies as they became available. In a real sense, the railroad was responsible for fostering the rapid momentum of evolving technologies in the western United States.

At the time of its original construction, the only route available for the Promontory Branch of the railroad was around the northern end of the Great Salt Lake, near the eastern terminus of the Grouse Creek Mountains and the southern terminus of the Raft River Mountains. As time went on, the restrictiveness and high relief of the route became increasingly problematic. Accordingly, a new route was sought, leading to the abandonment of the Promontory Branch in 1904 after the construction of the Lucin Cutoff. The newly constructed alignment of the Cutoff was 40 miles shorter and would bridge the rail directly across the Great Salt Lake. Although the Cutoff shortened the time necessary to travel around the lake and alleviated the resources required to help engines over the Promontory Summit, it also brought about the eventual end of town sites and section stations established on the Promontory Branch. For a while after the Promontory Branch was abandoned, the larger town sites, such as Kelton and Terrace, continued to function as shipping ports until the iron rails were completely removed in 1942 to supply much-needed iron for World War II (Huchel 1999). Prior to the abandonment of the Promontory Branch, an automobile route would be built roughly parallel to the branch line. The automobile route later became a portion of the Midland Trail designated through Box Elder County in 1913, which itself later became part of US Route 30 (Huchel 1999)

Project Background

Alpine conducted a comprehensive archaeological survey along the entire length of the Ruby Pipeline corridor as it passed through Utah, recording any evidence of human activity 50 years or older. This effort resulted in the identification of numerous historical sites, all of which were thoroughly documented. Alpine assessed the significance of the sites using the four criteria for the National Register of Historic Places. Following the field phase of the project, sites determined to be significant under these criteria were avoided, if possible, or mitigated in some manner prior to project impacts. Although Ruby engineered the pipeline route to avoid the route of the Transcontinental Railroad, the magnitude of the historic railroad's use of the landscape made complete avoidance impossible. Because of this, pipeline construction could not avoid the linear sites, which required mitigation through additional data collection. Given the research importance of the linear sites, the primary goal of the additional documentation was to thoroughly record their physical remains to provide a permanent record of the sites. Typically, past documentation of similar historical resources would involve the completion of a Historic American Buildings Survey (HABS) or a Historic American Engineering Record (HAER). Even though these documentation methods are comprehensive, they are also arduous and expensive, employing a three-part process, with professionally executed architectural drawings, historic documentation, and archival photography. Both HABS and HAER documentation were determined to be well beyond the necessary documentation needs of simply constructed, linear resources that do not possess architectural or aesthetic qualities. This is not to say, however, that linear sites are less important or undeserving of preservation than architectural sites. Rather, HABS-HAER methods were simply not appropriate for documenting the linear features encountered during the Ruby Pipeline project. Instead, an alternative preservation technique was proposed for documenting significant linear sites recorded during the project that would follow the systematic, hierarchical methodology (Levels I-III) originally devised by Athearn (1990). The most rudimentary of these levels, Level I, consists of a basic site record, consisting of a description and baseline photography. Level II documentation requires the expansion of Level I methods to include archival quality photodocumentation and plan and profile drawings, but not to the HABS/HAER level (Level III).

Documentation Methods

Level II documentation was chosen for the project largely because of the advantages of producing archival-quality photographs, which involve the use of a medium-format camera using black-and-white roll film. Currently, digital photography has been accepted as an alternative method to medium format. During the Ruby project, photographs were taken in such a manner as to convey the detail of each linear site's unique construction method. Each photograph also illustrated the relationship of the historical resource to the environmental setting to demonstrate its placement and use of the landscape (Figure 2). In addition to photography, Level II documentation also included detailed mapping of each linear site using a hand-held GPS unit and a detailed description of each site along with scaled illustrations. The purpose of the scaled illustrations—which involved measured

Figure 2. An example of a medium-format photograph taken during the Ruby project. The photograph shows a section of the Terrace Wagon Road visible as a linear depression in the center of the photograph further defined by vegetation.

top-view (plan) and cross-section (profile) drawings—was to dimensionally represent each resource; examples are shown in Figure 3 and 4. By completing the scaled drawings, it was possible to extract more specific data concerning construction methods, materials, techniques, and the various levels of technology employed in the construction.

Historical research was completed on all linear sites after they were documented during the inventory phase of the project. For the Level II documentations, Alpine conducted additional research after the fieldwork to augment the original histories. The additional research included archival research, secondary research, cartographic research, oral interviews, and online research. Cartographic research was accomplished through the examination of General Land Office (GLO) maps from the late 1800s. These maps were produced during cadastral surveys of the public domain. The surveys yielded a wealth of information, resulting in maps depicting various types of linear infrastructure sites. The GLO map data were crucial in determining the function of many of the linear sites and provided information about beginning and ending points. They also provided names for several of the sites, which were used to further the historic research. Alpine carried out the archival research through the examination of numerous records that will not be detailed here, but ranged from railroad company records housed at the California State Railroad Museum in Sacramento, to old newspapers and miscellaneous county courthouse records. Secondary research included the examination of local histories and transcribed oral interviews.

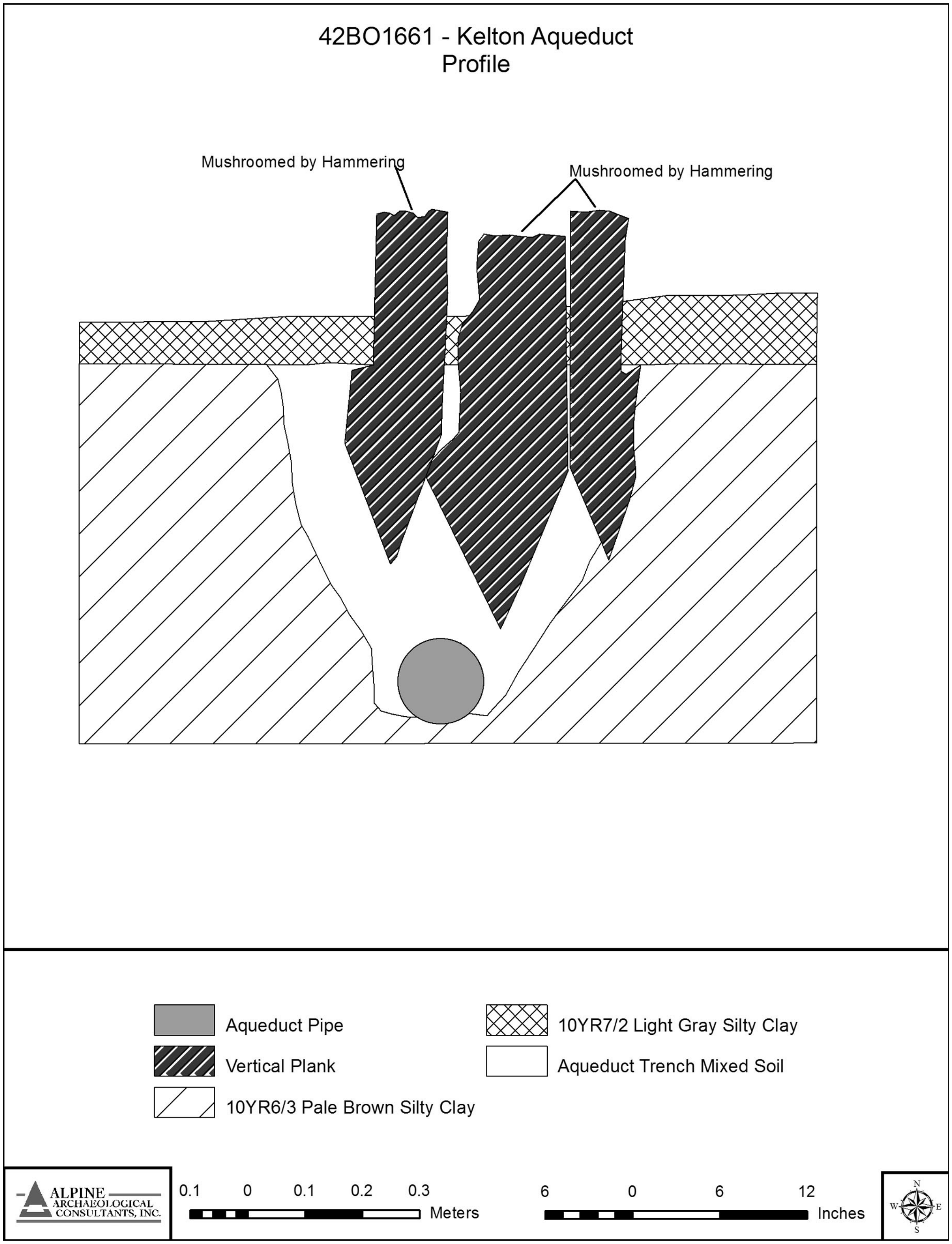

Figure 3. Example of a profile illustration completed for the Kelton Aqueduct.

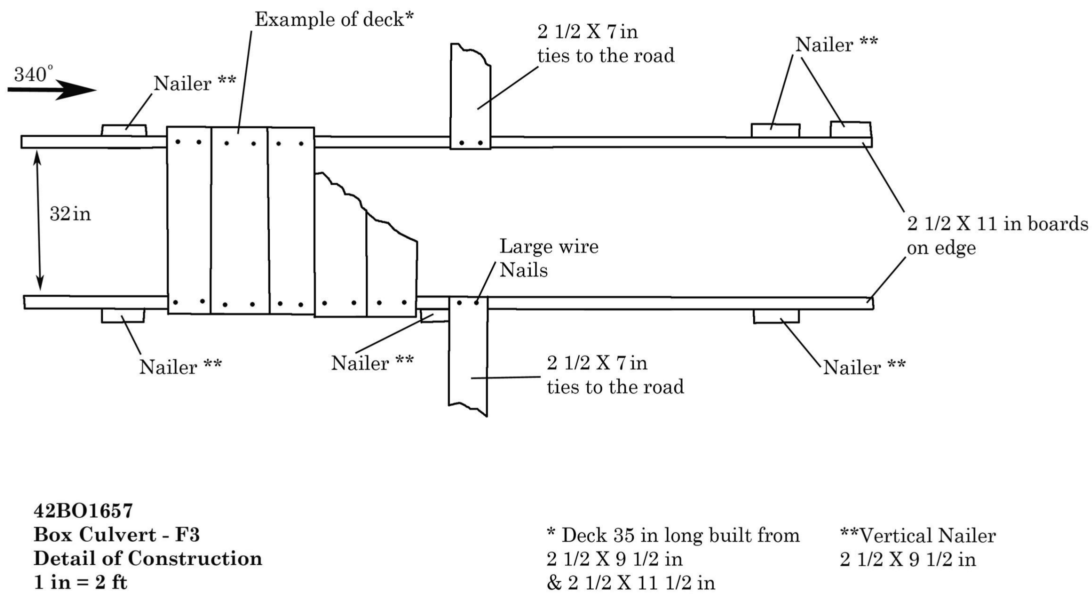

Figure 4. Example of a plan view illustration completed during Level II documentation.

We gleaned additional information from oral interviews carried out by the author with pioneer families and longtime residents of Box Elder County. We augmented the collected historical data with internet research that included the Library of Congress's digital newspaper collection, freighting and stage company histories, and county histories. The data resulting from fieldwork and subsequent research were organized into individual, stand-alone archival documentation report packets that were submitted to the Antiquities Section of the Utah Division of State History.

Documentation Results

One of the primary benefits of documenting historical linear sites for the Ruby project is a significantly enhanced understanding of the history and function of the Transcontinental Railroad. The remains of these sites, coupled with their histories, have helped define the extent of landscape use attributed to the railroad. Eight of the historical sites documented during the project can be directly linked to the use of the Transcontinental Railroad, including three aqueducts, four wagon freighting roads, and a telephone line. Collectively, the freighting roads formed a network of transportation corridors linking the railroad to outlying communities for the movement of people, goods, and services. In a similar vein, the telephone line would have served as a vital communication link to outside communities, consequently connecting individuals living in rural railroad towns to larger established towns. The aqueducts allowed a supply of water to be transported to several railroad centers that otherwise would have been unable to support populations due to a scarcity of readily available water. These historic linear sites offer a more complete representation of

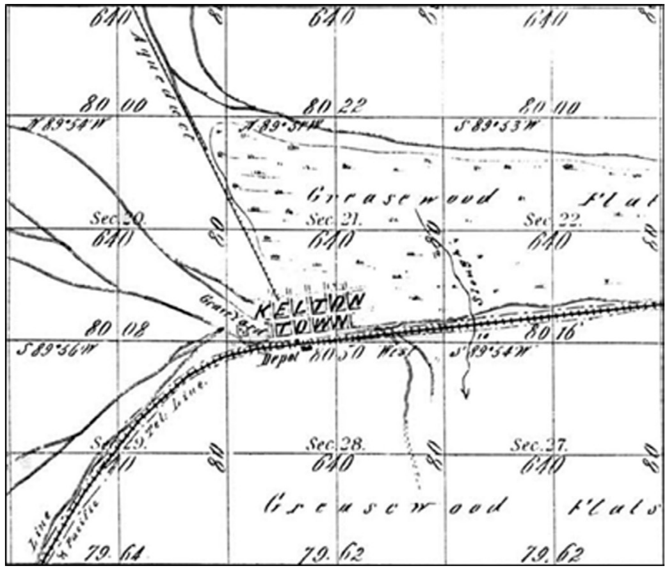

Figure 5. Example of an 1873 GLO map showing roads in and out of Kelton and the Kelton Aqueduct labeled as "Aqueduct."

the inner workings and function of the railroad, which, in effect, provide a unique landscape perspective, whereby intensified modification and utilization of lands in northern Utah by the Transcontinental Railroad can be better understood. Landscape use has long been the subject of study and interpretation by historians and archaeologists alike. In terms of historical land use, Hardesty (1991:4) phrased it best when he stated: "landscapes have to be considered as the key to understanding the material expression of culture in the American West." With this in mind, the overall research objectives for the project focused on the eight above-mentioned linear resources as elements that formed a system critical to the definition and interpretation of the Transcontinental Railroad landscape.

Not surprisingly, the railroad fostered the construction of a network of wagon freighting roads for the movement of goods, both in and out of Utah. The progression of this network, which was discovered during the historic research, was distinguishable as the roads were added to GLO survey maps and county road maps beginning in the early 1870s and continuing into the early 1900s (Figure 5). The roads were progressing through shifting use patterns, some of which were motivated by historical events. The majority of the roads were likely constructed shortly after the 1869 completion of the Transcontinental Railroad as supply routes for the rising mining market in Idaho and Montana. Following the early 1870s discovery of silver in southern Idaho, these roads were then used on the return trip to freight mineral ore back to the railroad to be shipped to refineries (Salt Lake Herald, May 11, 1896). Freighting travel along the routes likely continued with regularity until two events occurring two decades apart began to reduce the amount of freight shipped via the Transcontinental Railroad. The first of these events was the construction of the Utah Northern Railroad (UNR) in 1874. Following its construction, a portion of the supply business for Montana and Idaho-bound freight originally monopolized by the Transcontinental Railroad, was now being carried by the UNR.

The second event contributing to the decline of freighting was the 1893 silver panic, resulting in a dramatic drop in the price of silver. Following the latter event, silver prospecting ended, mines were abandoned, and the demand for supplies dwindled significantly (Deseret Evening News, August 11, 1900). The final blow to the freighting business came when the Promontory Branch of the Transcontinental Railroad was abandoned after 1904, following the construction of the Lucin Cutoff. Even with the sharp drop in supply trains after the construction of the 1904 cutoff, some of the roads would still have been used periodically by locals as transportation corridors to and from the rail and possibly for periodic livestock shipping (Raymond 1979).

During the recording process it became apparent that the roads followed a progression of use, whereby the hierarchy of importance of each could be identified based on the method of construction employed. For example, most of the roads display little construction fabric and lack construction features or material surfacing, indicating informal use as simple travel corridors. The surface manifestations of this class of road are restricted to shallow, linear depressions or swales created as wagons traversed them, but were not formally constructed or maintained. Conversely, two of the roads were found to have evidence of formal construction methods, such as raised road beds and rock surfacing. The rock surface of the roads consists of unmodified lava rock and water-worn pebbles. The importance of these two roads was further verified by the presence of construction features, such as wooden box culverts and masonry wall features built along road edges to retain the soil making up the bed of the road. Collectively, this indicates that this class of road served as an essential travel corridor and was traversed often, even during the wet seasons. In addition, several artifacts identified along these roads date to the 1930s, which also demonstrates the roads' importance through continuity of use.

The completion of the railroad brought about rapid change in transportation fostering reliable and more rapid access to products. This new pattern of acquisition would forever alter society and with it the economy. By connecting cities, towns, and small rural communities, the railroad would also allow access to new technologies, thus establishing a succession of evolving technologies. Interestingly, Alpine discovered evidence for this type of technological evolution in the course of documenting the aqueducts. As the historical research revealed, the aqueducts played a central role in the function of the railroad by supplying water to the towns of Kelton and Terrace and the section station of Watercress, for both locomotive and domestic use. To meet these needs, water was collected from high volume springs near the base of the Grouse Creek Mountains and the southern terminus of the Raft River Mountains and piped for distances between 7.8 and 8.6 miles southward through underground aqueducts. The remains of these aqueducts demonstrate the use of different stages of pipe technology as the demand for larger volumes of water increased. Alpine identified a bored-log pipe, one of the earliest types of pipe technology (Figure 6). The technology was simple and was limited to small diameters and short lengths. Bored-log aqueducts were likely built during the establishment of the railroad town sites and section stations in 1869. Bored-log pipe was known to have been produced as late as 1901, but was eventually phased out due to the need for larger diameter pipe. The limitations of bored-log pipe led to the development of fabricated pipe built from wood staves (Figure 7). This type of pipe is often referred to as wire-wound or machine banded and was also documented during the course of the project (Cunningham 1954). The documented pipe—which was part of the Rosebud Creek to Watercress aqueduct—was built from four-inch wide redwood staves. The use of redwood indicates that the pipe was shipped from the Pacific Northwest. The expansion of the staves was restricted by wire wound around the exterior of the pipe. Because the wound wire was found to be embedded into the surface of the staves, it was determined to have been wound by a banding machine. This type of pipe was built and shipped in sections and dates after the patent of a mechanized wire banding machine by

Figure 6. A section of bored-log pipe used in the construction of the Terrace Aqueduct associated with the Transcontinental Railroad.

Figure 7. Section of wire-wound, wood-stave pipe used in the construction of the Rosebud Creek to Watercress Aqueduct associated with the Transcontinental Railroad.

Figure 8. Longitudinally riveted sheet-metal pipe used in the construction of the Rosebud Creek to Watercress Aqueduct associated with the Transcontinental Railroad.

Merrill F. Wilcox on December 10, 1901 (Patent No. 688,372). The technology continued to be used to convey water for railroads into the 1920s (Knowles et al. 1922).

Alpine identified another stage in aqueduct technology during the documentation process that is represented by sections of riveted sheet-metal pipe (Figure 8). This pipe type is referred to as longitudinally riveted or fully riveted pipe. It was manufactured by cold-forming plates of steel into the desired pipe diameter, with the vertical ends of the sheet overlapped and riveted (Cates 1971). Nearly all of the riveted water pipe manufactured between 1858 and 1900 used this technique. A steady decline in the installation of riveted pipe occurred by the early 1910s and the style was nearly absent by the mid-1910s. The decline was attributed to the development of the lock-bar seam and the electric welding process. Both of these techniques made pipe riveting obsolete and costly (Cates 1971). Steel pipe may have replaced wood-stave pipes because wood was subject to leakage and decay in the alkaline soils prevalent in the region.

Conclusions

Alpine completed detailed documentation of 15 historical linear sites encountered during the Ruby Pipeline project to mitigate the adverse effects of pipeline construction. Eight of the linear sites were found to be directly associated with the operation and function of the Transcontinental Railroad. The goal of the documentation process was twofold: 1) to preserve baseline data on the linear resources by compiling a permanent record, and 2) to further our understanding of historic landscape use by the Transcontinental Railroad through the documentation of associated elements and infrastructure. As the study revealed, there is an explicit relationship between material culture, human modification of the landscape, and the natural environment. It is often assumed that the greater the modification to the landscape, the more culturally and historically significant the infrastructure. Certainly there is some truth to this, but it is not always the case that simple construction and unassuming appearance reflect insignificance. In this study, all of the documented linear resources were placed into their proper historical context, which was forged by the construction, operation, and later abandonment of the Promontory Branch of the Transcontinental Railroad. It was only by considering these linear sites in light of their historical context that a clear picture emerged that details not only the scars the railroad and its associated infrastructure left on the natural environment but also how they influenced commerce and economic change in northern Utah.

Through field documentation, Alpine gathered a wealth of information that allows a comprehensive understanding of the role and history of each linear site. Collectively, the data better our understanding of the extent of the Transcontinental Railroad's function and the role it played in shaping the historic landscape of northwestern Utah. Prior to the Ruby project, the magnitude of the operations necessary to keep the railroad functioning had never been fully realized or documented in Utah. Though it had been assumed that the railroad played a key role in the economic growth of Utah, through Alpine's work a more comprehensive understanding of its effects can be realized. ■

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Analysis of 42TO3974 Rattler Ridge: An Upland Fluted and Stemmed Projectile Point Site in the Cedar Mountains, Utah

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The discovery of site 42TO3974 marks the first documented Pleistocene/Holocene Transition (PHT) site with a Great Basin Fluted (GBF) component on Dugway Proving Ground, Utah. The majority of PHT sites in the area are associated with remnant channels of the Old River Bed and adjacent wetlands. The location of the site in an upland, mountainous setting unaffiliated with lowland/marsh areas is exceptional. Analysis conducted on the artifact assemblage of Site 42TO3974 provides some unique insights into the nature of human adaptations in the Bonneville Basin during the PHT.

This paper presents site 42TO3974, a Pleistocene-Holocene Transition (PHT) hunting site in the Cedar Mountains of western Utah. Prior to the discovery of 42TO3974 the majority of PHT sites on Dugway Proving Ground have been associated with the remnant deltaic channels of the Old River Bed and adjacent wetlands (Schmitt et al. 2007). These sites are made up of Great Basin Stemmed Series (GBSS) tool assemblages. The discovery of 42TO3974 marks the first documented PHT site with a Great Basin Fluted Series (GBFS) component on Dugway Proving Ground, Utah. Furthermore, this site is unique to the area in that it occurs in an upland, mountainous setting, unaffiliated with wetland resources and may indicate one of the earliest occupations of the region.

First, we will discuss the site's natural setting and archaeological assemblage. Then, we report the results of lithic analysis, geochemical sourcing, obsidian hydration, and protein residue of a sampling of artifacts from the site. This will be followed by a discussion of the possible site function(s) and activities conducted at the site. We end with a discussion of the implications of this site for our understanding of early period human subsistence and settlement patterns in the eastern Great Basin.

Natural Setting

Site 42TO3794 is located in the eastern Great Basin, at the southern end of the Cedar Mountains, Tooele County, Utah (Figure 1). The Cedar Mountain Range is a large north-south trending desert mountain range with the highest peaks ranging above 2316 meters (7600 ft). This range is bordered on the east by Skull Valley and on the west by Dugway Valley and is composed of late Paleozoic sedimentary rocks overlain by a tertiary cap of extruded igneous rocks (Hintze 1975). For the purpose of this report, it is important to highlight the local availability of toolstone-quality chert, fine-grained volcanics (FGVs), and quartzite (Mullins and Parrish 2011).

The site is situated on a narrow ridge that runs along the top of one of the most prominent hills at the southern end of the Cedar Range, at 1761 meters (5780 ft) elevation (Figure 2 and 3). The

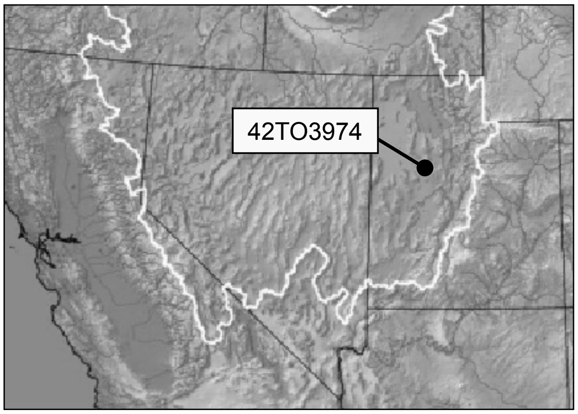

Figure 1. Location of site 42TO3974 within the Great Basin.

Figure 2. Overview of Rattler Ridge (42TO3974).

northeastern side of the ridge is a steeply sloped scree field that leads into a narrow canyon below. To the east, the ridge overlooks a series of mid-elevation valleys that support dense stands of perennial grasses.

Historically, these mid-elevation valleys were used as pastures to support large herds of sheep and cattle (Blanthorn 1998:55, 58). Currently, these valleys support populations of antelope and deer. The western side of the ridge is a steep slope, covered with large basalt outcrops which eventually recede to the more xeric alkali flats of the Dugway Valley (Figure 4).

Along the ridge soil deposition is limited. The sediments consist of sub-angular gravels and cobbles derived from exposed outcrops of basalt that dot the ridge. A bulldozed exposure created by a past fire break indicates that deposition is very shallow across the site and likely measures less than 10 cm (Mullins and Nelson 2009). Vegetation in the area consists of relatively xeric species which include sagebrush (*Artemisia tridentata*), rabbit brush (*Chyrsothamnus nauseosus*), and various grasses covering approximately thirty percent of the surface of the slope. Numerous game trails suggest that the ridge is periodically used by animals traveling between valleys.

Site Description

The artifact assemblage is distributed on the ridge and the site measures approximately 230 by 80 meters. The site is defined by two prominent artifact concentrations (AC 1, AC 2). AC 1 is a relatively large artifact concentration (roughly 65 x 25 meters) located on the northeastern end of the ridge; AC 2 is a smaller (roughly 30 x 10 meters) concentration of artifacts located near the northwestern edge of the site (Figure 5).

The vast majority of artifacts are located within AC 1 and AC 2. AC 1 contains 139 pieces of lithic debitage and 23 tools. AC 2 contains 27 pieces of lithic debitage and eight tools. The artifact assemblage includes lithic debitage (n=191), and formal and informal tools (n=44). Debitage is made from chert, obsidian, and chalcedony. Although the majority of the debitage consists of late stage biface reduction flakes (63 percent), all flaking stages are represented in the assemblage (Table 1).

The tool assemblage contains 19 modified flakes, 15 bifacial tools, six projectile points, a utilized blade, a chopper, a crescent scraper and a core. Of the 44 tools, 25 (57 percent) are made of locally available chert and chalcedonies. The majority of modified flakes are made using locally available chert (n=10), six are made from

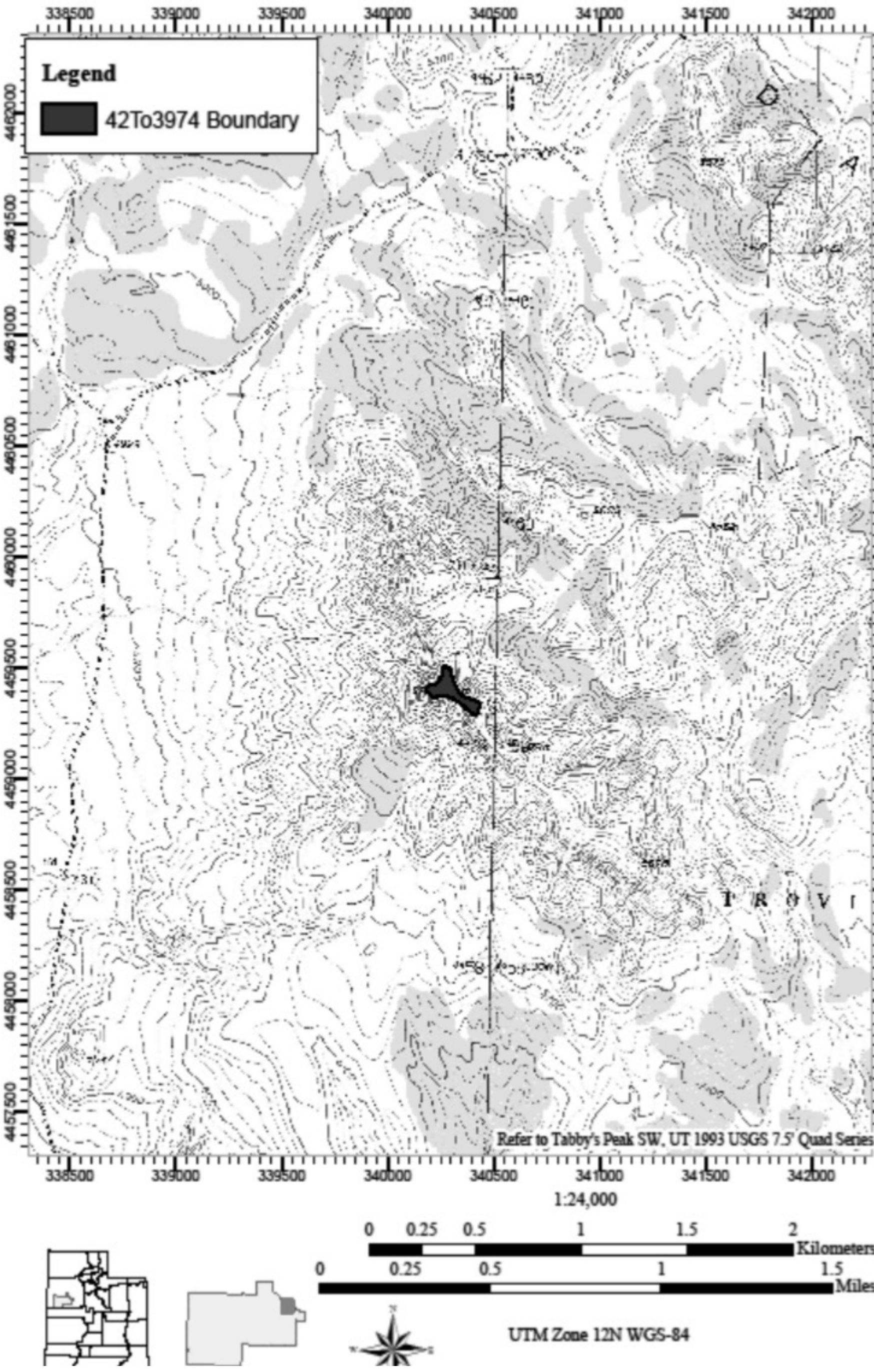

Figure 3. Site overview of Rattler Ridge (42TO3974).

Figure 4. View of Dugway Valley from the site, facing southwest.

obsidian, and three from chalcedony. The scraper assemblage is made entirely of chert, with four end scrapers, one steep-edged scraper, one thumbnail scraper, and one crescent shaped scraper. Of the fifteen bifacial tools, three are unfinished GBF fluted biface fragments (one obsidian, one chert, one chalcedony), two are distal biface fragments (one chert, one chalcedony), and an obsidian biface fragment that is likely a GBSS base. The remaining bifaces are three early-stage (two chert, one obsidian), and six mid- to late-stage fragments (four obsidian, two chert). The projectile point assemblage consists of an obsidian GBSS, and five GBFS (four obsidian, one chert). The remaining tools include a chalcedony utilized blade, a FGV chopper, and a chert unidirectional core.

Site 42TO3794 Analysis

All artifacts were collected from the surface of the site (Mullins and Nelson 2009). Several types of analysis were conducted on the artifact assemblage. This includes lithic debitage analysis, geochemical sourcing of obsidian and FGV artifacts, obsidian hydration, and protein residue.

Lithic Debitage Analysis

A total of 191 pieces of lithic debitage were collected from the site and initially analyzed by Jennifer DeGraffenried and Frank Parrish. Debitage was categorized using a standardized classification key (Silva 1997). The lithic debitage assemblage is dominated by locally available chert (n=113, 59 percent), obsidian (n=57, 30 percent), chalcedony (n=19, 10 percent) and quartzite (n=2, 1 percent) (Figure 6).

Table 1. Site 42TO3974 Debitage

	Flaking Stages*		
% Cortex	Tertiary	Secondary	Decortication
0%	121	54	12
1–33%	0	2	0
33–67%	1	1	0
67–100%	0	0	0

*Tertiary = <1.5 cm; Secondary = 1.5–3.0 cm; Decortication= >3.0 cm

The majority of the debitage and formal tools are made from the locally available chert and are likely associated with the manufacture of the various expedient and formal chert tools and core found at the site. The debitage assemblage consists primarily of broken or fragmented pieces, with only a small percentage (>10 percent) of intact flakes. Most of the debitage appear to be late-stage biface reduction flakes. The assemblage includes 49 distal flake fragments, 35 medial flake fragments, 29 proximal flake fragments, 19 proximal biface thinning flake fragments, 17 biface thinning flakes, 14 complete flakes, 13 split flakes, nine shatter/debris flakes, and six bipolar flakes (Figure 7). Further analysis was conducted on the assemblage by Michael Rondeau and Nathaniel Nelson. The results of this study indicate the assemblage contains two blade-like flakes and one possible fluting flake (Rondeau and Nelson 2013).

Geochemical Sourcing

All obsidian artifacts on site 42TO3974 were geochemically sourced. It is postulated that if toolstone sources are localized and identifiable then the analysis of raw materials from those sources can create a series of references. All of

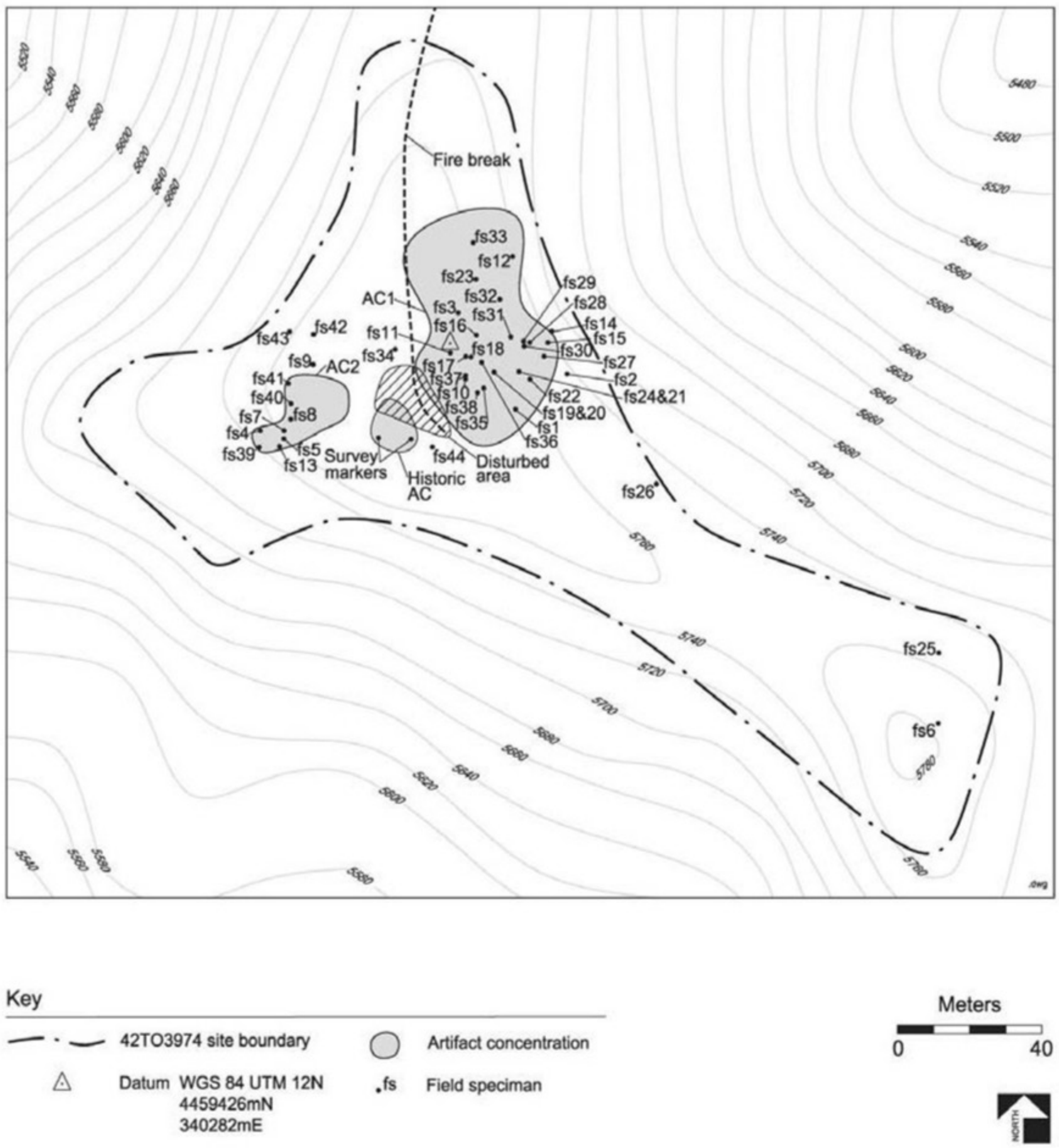

Figure 5. Map of site 42TO3974.

the lithic sources in this assemblage meet these criteria (Weigand et al. 1977). The artifacts were analyzed in the Dugway Archaeological Research Lab using X-ray Fluorescence (XRF). The instrument used in the comprehensive analysis was a Bruker SD Tracer III Field-Portable XRF (FPXRF). Bruker has recently released a world-wide obsidian library established by the University of Missouri Research Reactor and Bruker Elemental (Glascock and Ferguson 2012). A cursory examination of data generated using this calibration suggests high degrees of accuracy, precision, and reproducibility (Speakman and Shackley 2013). Furthermore, samples of 20 obsidian artifacts (some debitage and all obsidian tools) were analyzed by David

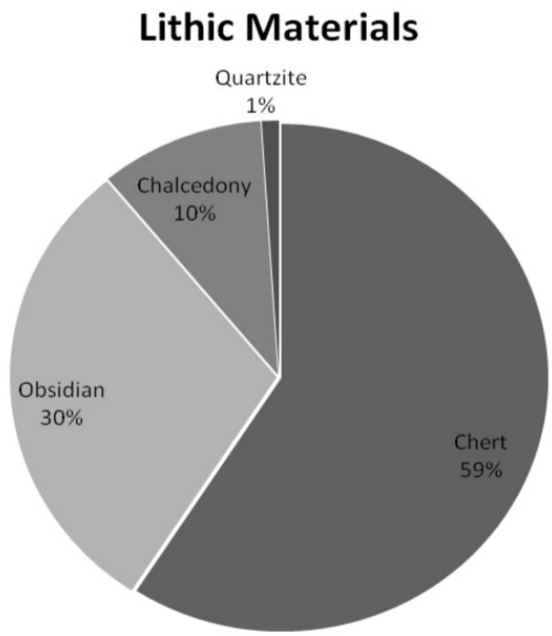

Figure 6. Percentages of lithic materials.

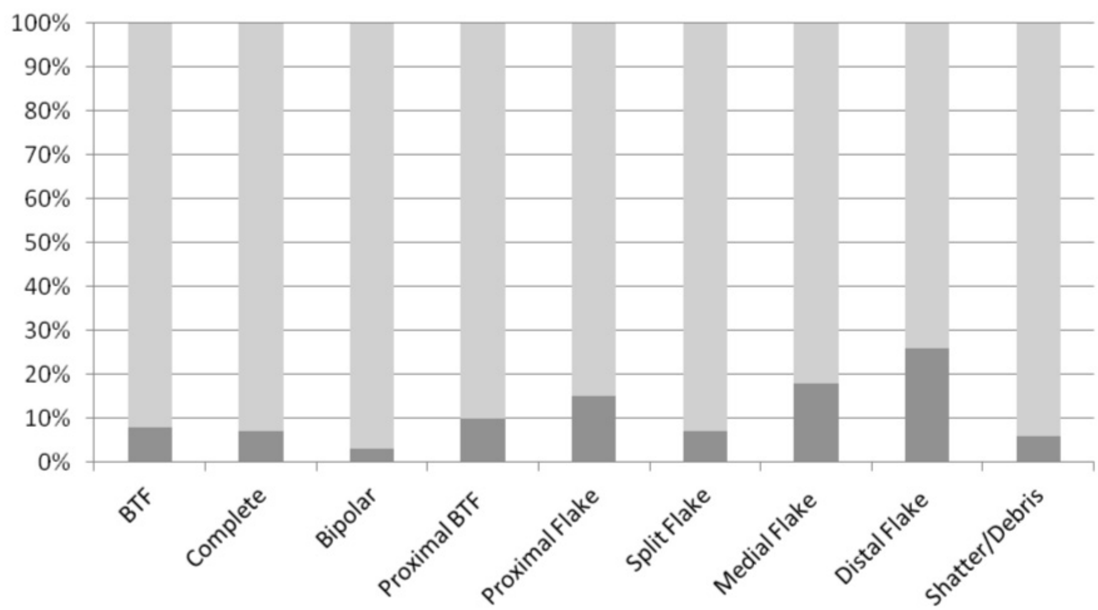

Figure 7. 42TO3974 debitage analysis.

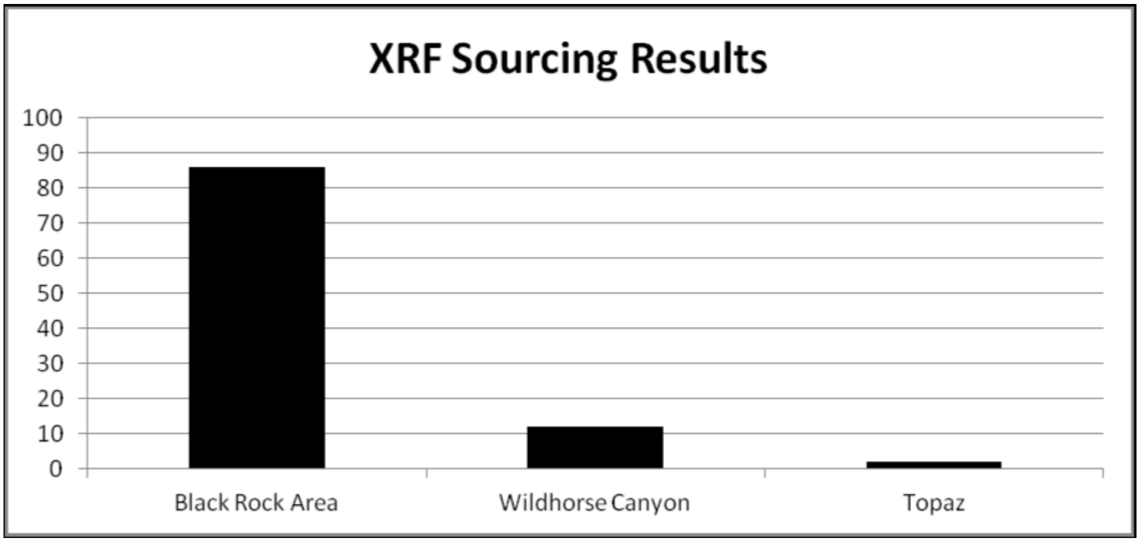

Figure 8. Obsidian XRF results.

Page, Desert Research Institute (DRI) using a Niton XL3t 900 PXRF elemental analyzer, the results of which produced the same outcome.

Analysis was conducted at the recommended instrument settings provided by Bruker, at 40keV, 10UA utilizing a 0.006" Cu/ - 0.001" Ti/ - 0.012" Al sandwich filter in the X-ray path for a 180 second live time count. The unit was calibrated using the world-wide obsidian library established by the University of Missouri Research Reactor and Bruker Elemental (Glascock and Ferguson 2012). Several elements were examined in the results including manganese (Mn), iron (Fe), zinc (Zn), gallium (Ga), thorium (Th), rubidium (Rb), strontium (Sr), yttrium (Y), zirconium (Zr) and niobium (Nb). For the analysis of igneous materials five trace elements: rubidium (Rb), strontium (Sr), yttrium (Y), zirconium (Zr) and niobium (Nb) help determine the deposition and petrogenesis of a lava flow. For each sample the analysis produced a raw elemental spectrum. The data was then converted into parts per million (PPM) in which the geochemical results could be delineated and assigned to a specific source.

A total of 75 obsidian artifacts were geochemically sourced: 57 pieces of debitage, eight modified flakes, four projectile points (three GBFS, one GBSS), and six bifaces. Results show that 64 (86 percent) artifacts were sourced to the Black Rock Area (BRA), located roughly 165 kilometers to the south of the site. Nine pieces of debitage (12 percent) are made from the Wild Horse Canyon source (~200 kilometers to the south). Only two artifacts (2 percent), a GBFS and GBSS were made from Topaz Mountain obsidian, the closest obsidian quarry located approximately 60 kilometers to the southwest of the site (Figure 8 and 9).

Obsidian Hydration Analysis

Four of the geochemically sourced obsidian projectile points were also analyzed for obsidian hydration by Northwest Obsidian Research Laboratory (NWORL) (Table 2). Two GBFS projectile points returned readings of 11.1 and 9.9 microns. One GBFS point returned two rim readings of 6.3 and 8.5 microns. The GBSS returned a measurement of 7.9 microns. These measurements are within the established range of PHT sites for the eastern Great Basin (Duke 2008: 89) (~13,100-8,300 cal BP) (Beck and Jones 1997; Jones and Beck 1999). Although the sample is limited, evidence suggests the GBFS forms may predate the GBSS point.

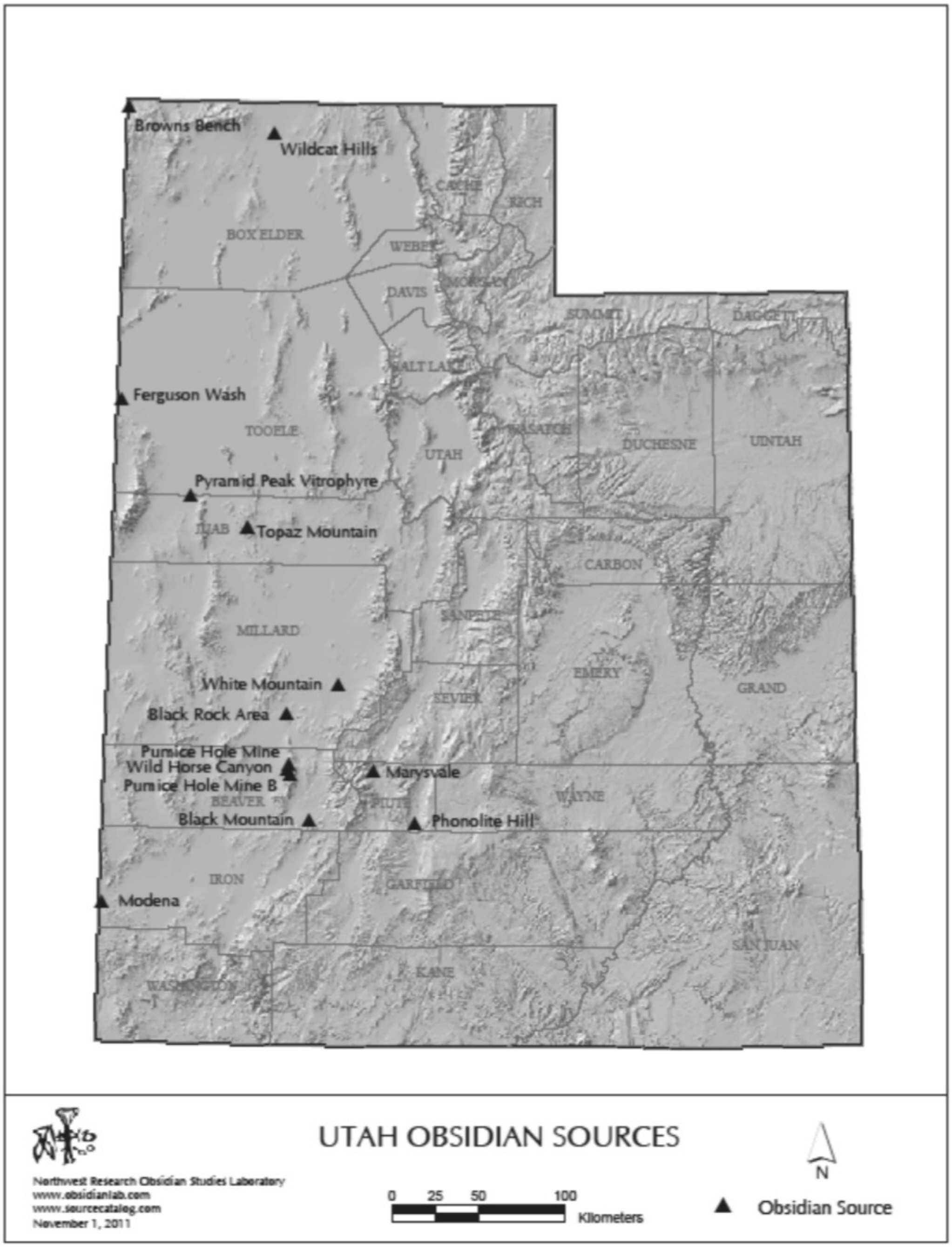

Figure 9. Utah obsidian source locales.

Table 2. OHD and Sourcing

FS No.	Artifact Type	Source	Rim 1	Rim 2
1	GBFS base	Topaz	11.1 ±0.1	NM ± NM**
3	GBFS base	*BRA	6.3 ± 0.1	8.5 ± 0.1
23	GBSS/Silver Lake	Topaz	7.9 ± 0.1	NM ± NM**
35	GBFS base	*BRA	9.9 ± 0.1	NM ± NM**

BRA=Black Rock Area; **NM=no measurement

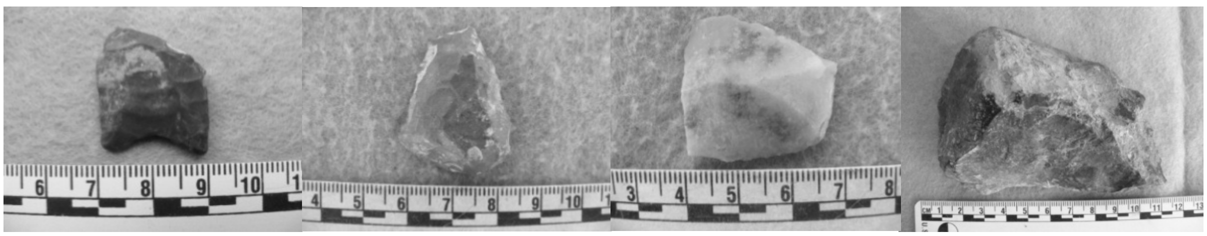

Figure 10. Artifacts with positive protein residue results.

Furthermore, obsidian hydration results suggest repeated occupation of the site over a long period of time, perhaps spanning thousands of years.

Protein Residue Analysis

Protein residue analysis was conducted on thirteen artifacts. Analysis was conducted by PaleoResearch Institute in Golden, Colorado. Recent studies have demonstrated that biochemical and immunological methods provide the potential for reconstructing prehistoric subsistence and tool use patterns. Artifacts were tested using an immunologically-based technique called cross-over immunoelectrophoresis (CIEP). This method involves the identification of antigens adhered to archaeological artifacts via blood or tissues. Artifacts analyzed include three GBFS points, a fluted biface tip, eight expedient blade-like scrapers, and a chopper. Four samples yielded preserved protein residue: a GBFS base tested positive for bear (*Ursidae*), a steep-edged scraper tested positive for rabbit (*Lagomorph*), and a unifacial modified flake and a chopper tested positive for bison (*Bison*) (Figure 10).

Discussion

Site Function

The artifact assemblage and location of the site suggest that it served as a short-term hunting locale that was repeatedly occupied throughout the PHT. The site location on top of a steep draw with numerous basalt outcrops may have provided site occupants opportunities for intercept hunting. Protein residue recovered from artifacts provides evidence of hunting both large (bear and bison) and small (rabbit) game. At this time, there is insufficient evidence to determine which, if any, of these animals were actually killed and processed at the site. However, the presence of bison antiserum found on two expedient tools made of local toolstone suggests that at least bison may have been killed and/or processed on site.

Chronology

Among the central issues debated by regional archaeologists are those associated with the temporal relationship between GBSS and GBFS projectile point forms (e.g., Beck and Jones 1997; Jones and Beck 1999; Taylor 2003). Site 42TO3974 contains six chronologically sensitive projectile points: five GBFS and one GBSS point. These projectile point types have been assigned to tool industries dating to the PHT (~13,100-8,300 cal BP) (Beck and Jones 1997; Jones and Beck 1999). Four of the obsidian projectile points (three GBFS and one GBSS) from site 42TO3974 were submitted for obsidian hydration analysis. The use of obsidian hydration dating (OHD) on surface sites in the Great Basin is problematic and should be regarded with caution, as numerous factors effect results of hydration rates (Duke 2011:46). Fortunately, these complicating factors have been somewhat mitigated for this part of the Great Salt Lake Desert (e.g., Duke 2011), and obsidian hydration dating has proven to be a valuable tool to help refine local chronologies (e.g., Beck and Jones 1994, 2000). Although the sample size is too small to draw definitive conclusions, at site 42TO3974 the three GBFS points did return thicker rims (excluding the smaller rim measurement on FS 3) than the GBSS point, suggesting the former may predate the latter.

Lithic Procurement Strategies

In the Great Basin, PHT stone tool industries are generally organized around obsidian and basalt, and to a lesser extent chert (Beck and Jones 1990). Many PHT sites in the Bonneville Basin contain carefully worked and curated formal tools made of obsidian and FGV transported from relatively great distances (e.g., Duke and Young 2007; Jones et al. 2003; Schmitt et al. 2007). Lithic sourcing studies conducted at lowland/wetland PHT sites indicate the majority (80 percent) of the obsidian artifacts are made from material procured from Topaz Mountain and Browns Bench sources, with more than one-half coming from the nearest source-Topaz Mountain (Duke 2008:83). Although chert, cryptocrystalline silicate (CCS), and quartzite sources are available in the surrounding mountains, the PHT sites on the ORB delta are relatively devoid of these local toolstone sources. ORB delta sites have assemblages consisting almost entirely of basalt and obsidian of extra-local origin. Acquisition and transport of high quality obsidian and FGV stone tools over relatively large lithic conveyance zones during the PHT is a well documented pattern in the Great Basin. Generally, this lithic procurement strategy is thought to represent the activities of highly mobile hunter-gatherers during the PHT. The archaeological assemblage at site 42TO3974 is unusual in that it consists mostly of artifacts (including formal and informal tools and debitage) made from chert, with only moderate quantities of obsidian, and a few made from quartzite and chalcedony (Figure 6). Furthermore, of the few obsidian artifacts present at site 42TO3974, only a small percentage originated from the nearest source, Topaz Mountain.

In sum, the artifact assemblage exhibits some of the typical traits of other PHT sites in the area, with the presence of formal tools designed for long use-life (e.g., biface tools and projectile points) made of high quality obsidian transported over relatively great distances. Available evidence indicates that the site occupants were economical with obsidian, acquiring and manufacturing the obsidian tools at distant locations and perhaps using them at many locations. However, the bulk of the assemblage appears to reflect a tool industry centered on locally available, relatively low quality chert. It is interesting to ask if this lithic procurement strategy reflects stop-gap measures to tide over the site occupants until preferred lithic sources could be visited; or conversely, if the heavy reliance on local chert reflects a specific lithic procurement strategy in areas without access to high quality tool stone (e.g., Duke 2008). The discovery of additional sites located in similar ecological settings is necessary to further address this question. Nonetheless, the lithic procurement strategy reflected by the artifact assemblage at site 42TO3974 is notably distinct from the vast majority of PHT sites in this part of the Bonneville Basin.

PHT Settlement/Subsistence Patterns

Among the central issues in Great Basin archaeology are those associated with how to properly classify and reconstruct human lifeways during the PHT, particularly the nature of early period subsistence patterns (e.g., Beck and Jones 2007; Bedwell 1973; Elston 1982; Elston and Zeanah 2002; Madsen 2007; Willig 1989). Specifically, much debate has centered on questions concerning whether PHT foragers were big game hunting specialists practicing subsistence strategies that were markedly different from the broad spectrum foraging patterns practiced by later Holocene populations. As with other areas of North America, during the PHT the Great Basin supported a substantial suite of large game which included several species of now extinct mega-fauna (Grayson 1993). And, like other early period assemblages in North America, PHT tool-kits in the Great Basin appear to be oriented toward big game hunting (e.g., Zeanah and Elston 2002). The co-occurrence of mega-fauna and hunting oriented tool kits has long formed the basis for the view that PHT foragers in the Great Basin and elsewhere were big game hunting specialists (e.g., Basgall 1988; Butler 1973; Heizer and Baumhoff 1970; Kelly and Todd 1988; Mosimann and Martin 1975; Wormington 1957).

Directly addressing questions related to the nature of the PHT diet is complicated by the fact that the vast majority of the early-period archaeology is limited to surface deposits, with preserved faunal and botanical remains generally absent. Further complicating the problem is the fact that the limited subsistence evidence that is available provides conflicting data about the nature of subsistence strategies during the PHT. Particularly notable is the apparent disconnect between PHT tool-kits oriented towards large game hunting (e.g., Zeanah and Elston 2002), and limited subsistence evidence indicating broad-spectrum diets consisting of seeds, fish, and small-and-medium size game (e.g., Beck and Jones 1997; Delacorte 1999; Eiselt 1997; Fry 1976; Napton 1997; Pinson 2007).

Evidence collected from site 42TO3974 provides some insights into the nature of PHT subsistence and settlement patterns. First, the site's location in an upland setting is somewhat unique or underrepresented in this part of the Bonneville Basin and demonstrates that early period foragers utilized resources outside of the wetlands/marshes. Secondly, protein residue analysis yielded evidence of hunting large and small game animals, with artifacts returning positive results for bear, bison, and hare. Unfortunately, at this time it cannot be determined whether the bear and bison residue are from now extinct Pleistocene mega-fauna species (e.g., short-faced bear [*Arctodus simus*], ancient bison [*Bison antiquus*]). Furthermore, it cannot be definitively said which, if any, of these three taxa were procured and processed at the site. Formal tools, particularly projectile points, are often designed for long use-life and are frequently refurbished and used for hunting and processing a wide variety of resources in various settings (e.g., Binford 1979). Nonetheless, artifacts from the site yielded evidence of PHT foragers hunting a broad range of animals, which included very large to small game resources. The data from site 42TO3974 provides some support for recently developed models of Great Basin PHT diets using the investigative framework of Optimal Foraging Theory (OFT).

Models of foraging behavior have been developed using OFT that take into account the likely encounter rate, post-collection processing costs, and net-caloric yield of various resources that were likely available during the PHT (e.g., Byers and Ugan 2005). The foraging models predict that a variety of large-to-small game items as well as numerous broad-spectrum lowland resources, such as hares, waterfowl, muskrats, beaver, voles, roots, tubers, insects, and eggs would have been part of the optimal diet (Byers and Ugan 2005). Large mammals, especially various species of extinct mega-fauna, are also predicted to have been squarely in the PHT optimal diet and targeted whenever feasible (Byers and Ugan 2005). However, large game (particularly mega-fauna) animals are thought to have occurred at relatively low densities on the landscape during the PHT (Byers and Ugan 2005). As a consequence of likely low encounter rates with these animals, it is argued that it would not have been energetically profitable for PHT foragers to exclusively target large game animals (Byers and Ugan 2005). Therefore, the optimal PHT diet would consist of large game whenever encountered and feasible to take, with the majority of diet consisting of small-to-medium size game and various species of plants (Byers and Ugan 2005). Subsistence evidence from Site 42TO3974 consisting of bison, bear, and hare are consistent with this model.

Recent theoretical studies that take into account the differences between men's and women's foraging and reproductive goals postulate that PHT men might have conducted hunting forays over long distances away from lowland settings, while women practiced a more sedentary pattern in lowland settings, utilizing marsh resources (Elston and Zeanah, 2002). However, in the Bonneville Basin there is limited evidence in support of this argument as the vast majority of PHT sites are located in lowland areas. The discovery of site 42TO3974 provides the first evidence of the use of upland settings in the Bonneville Basin. It is interesting to ask whether this site reflects the activities of PHT men conducting logistical forays away from lowland settings, or the more conventional view of PHT populations as highly mobile foragers utilizing diverse ecosystems.

Conclusions

Site 42TO3974 provides unique insights into the nature of human adaptations in the Bonneville Basin during the PHT. The site is exceptional in that it is located in an upland setting, providing evidence that PHT foragers in the Bonneville Basin exploited areas outside of marsh/wetlands in lowland settings. The artifact assemblage contains both GBFS and GBSS points. Though limited, results of obsidian hydration analysis indicate the GBFS points may predate the GBSS points. Furthermore, unlike lowland sites in the area with assemblages dominated by basalt and obsidian artifacts, the PHT occupants of this site utilized relatively low quality, locally available toolstone. Residue analysis of artifacts provides direct evidence that PHT foragers hunted both large and small game, challenging the conventional view that early period foragers focused exclusively on large game. Though unusual, site 42TO3974 is just one of the many hundreds of PHT sites identified over the last few decades in the Bonneville Basin. The discovery of similar sites in similar settings is required to determine whether this site reflects a broader pattern of PHT adaptations in the Bonneville Basin. ■

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Archaeological Signatures of the Trade and Exchange of Locally Produced Utah Pottery: Capitalism and the Push for Self-Sufficiency in the Mormon Domain

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In hopes of establishing a self-sufficient society in what would become modern-day Utah, members of the Church of Jesus Christ of Latter-day Saints created a home industry of earthenware pottery production. Pottery production and consumption situates within a complex web of early Utah consumer choice, and straddles the historic period transitioning from barter and trade economy to a more modern recognizable capitalist, currency market. The author tested earthenware from five archaeological sites in Utah and Nevada using Instrumental Neutron Activation Analysis (INAA), and compared the results against known database of elemental signatures. Results indicate that the movement of earthenware within the Mormon Domain was shaped not only by complex economic factors but also the religious control of goods and people during the nineteenth and early twentieth century.

Introduction

During the nineteenth and early twentieth centuries, members of the Church of Jesus Christ of century Latter-day Saints (LDS) sought to create an independent, self-sufficient society. After several successful attempts at creating utopian, agrarian-focused but heavily capitalistic endeavors in the American Midwest, popular opinion, legal restriction, and outright violence moved Latter-day Saints westward to lands owned by Mexico, now part of modern Utah. Upon arrival in the Great Basin, along the western slopes of the Wasatch Mountains, Latter-day Saints established dozens of colonies each charged with the mission of promoting self-sufficiency through agriculture and other industries. Church leaders hoped that by creating settlements targeting specific facets of an industrial society, such as coal mining, iron foundries, and cotton mills, that self-sufficiency and independence from the United States would be within easy reach. Limited successes at these industrial projects, coupled with precious mineral booms, influx of non-Mormons, arrival of the railroad, anti-Mormon legislation and military action, and an inherent penchant among the Latter-day Saints for imported manufactured goods, all contributed to undermining the self-sufficiency doctrine.

Since the 1830s, the LDS Church held to a doctrine of self-sufficiency for religious and pragmatic rationales. In every community that the Church attempted to establish its presence, the local non-Mormons fought their influence through violence and political means. In the relative isolation of the Great Basin, Mormon leadership could continue its social experimentation without interference. In non-compliance with the Church's stance, faithful members still imported large amounts of goods from the east through necessity or desire. This led to an inspirational and focused speech by President Brigham Young to the Utah Territory Legislative Assembly in 1854 (Deseret News [DN], 14 December 1854:3):

> It would appear, that the expense and trouble of transporting goods over a thousand miles of land carriage, would be sufficiently protective to

> encourage the capitalist to embark in domestic manufacturing. It is manifestly our interest as a people, to more generally produce from our own resources, articles for our own use. It is the spring of wealth to any community—of independence to any State…If our market could be abundantly supplied with articles of domestic industry, and economy, our object would be attained, the money retained in the country, and importers seek elsewhere a market for their goods.

Supporting the claims of Brigham Young regarding high cost of materials from eastern suppliers, goods traveling from St. Louis overland to Salt Lake City before the extension of rail service to Utah Territory in 1869, cost six times more in Utah than in Missouri (Burton 1861:388-389). Fewer goods traveled from San Francisco or Los Angeles, California, with some advertisements purporting, "[g]oods delivered… at Salt Lake City, in lots not less than ten tons, in forty-five days from San Francisco by good Mule Trains…(DN, 26 February 1867:8)." Utah consumers paid dearly for these imported goods and drained the cash reserves of individual members, thereby limiting the amount directed to Church coffers for capital purchases.

A part of the self-sufficiency doctrine was a promotion of locally produced ceramics for use as both storage and serving vessels. Converts from the industrial potteries of England first arrived in the Latter-day Saint settlement of Nauvoo in 1842. For the next 90 years, dozens of Latter-day Saint settlements in Utah, Nevada, Arizona, and Idaho boasted at least a single pottery. An agricultural community needed means of preserving and storing foods through storage crockery, and the distance between the Utah settlements and eastern suppliers led to an incredible opportunity for local potters to dominate the consumer market through a captive audience tied to the self-sufficiency doctrine. Starting with the introduction of mass goods by way of the railroad in the 1860s-1870s, and perpetuated by the loss of the craft industry through family members failing to continue the pottery tradition, all local Utah craft potteries closed by the 1930s.

Stories of Utah's pottery industry faded into the past until potter descendant and historian Kirk Henrichsen (1987; 2000) rekindled the life and histories of these early Latter-day Saints. Archaeologist Timothy Scarlett dedicated his dissertation to the topic, creating the first comprehensive archaeological and historic context for the Utah pottery industry (Scarlett 2002). With no known extant structures or habitations of these early Utah potters, investigation into this topic is now largely archaeological in nature. Merritt (2006) and Montcalm's (2010) theses continued the archaeological investigation of both pottery consumption and production, respectively, in the Great Basin. Scarlett continues to collaborate on further publications regarding the anthropological and historical implications of the pottery industry from both an archaeological and archaeometric perspective (Scarlett 2006, 2010; Scarlett et al. 2007).

A key facet of several of these projects (Scarlett 2002, 2006, 2010, Scarlett et al. 2007; Merritt 2006) was an archaeometric perspective, attempting to create elemental fingerprints for pottery produced in Utah that could lead to tracing the commodities through archaeological deposits around the American West. Merritt (2006), in particular, focused on testing samples from five archaeological sites of pottery consumption, in hopes of reconstructing the spread and distribution of those Utah potters within the current elemental database. Measuring the spread and distribution of this commodity connects the archaeological record to the socio-cultural milieu of nineteenth and early twentieth century Great Basin communities.

Results of Merritt (2006), while limited in sample size, and thus not statistically significant, provides an initial pattern of spread and consumption of Utah-produced pottery within what Meinig (1965) terms the Mormon Domain. As evidenced by the elemental analysis of sample sherds, trade of pottery supports some known

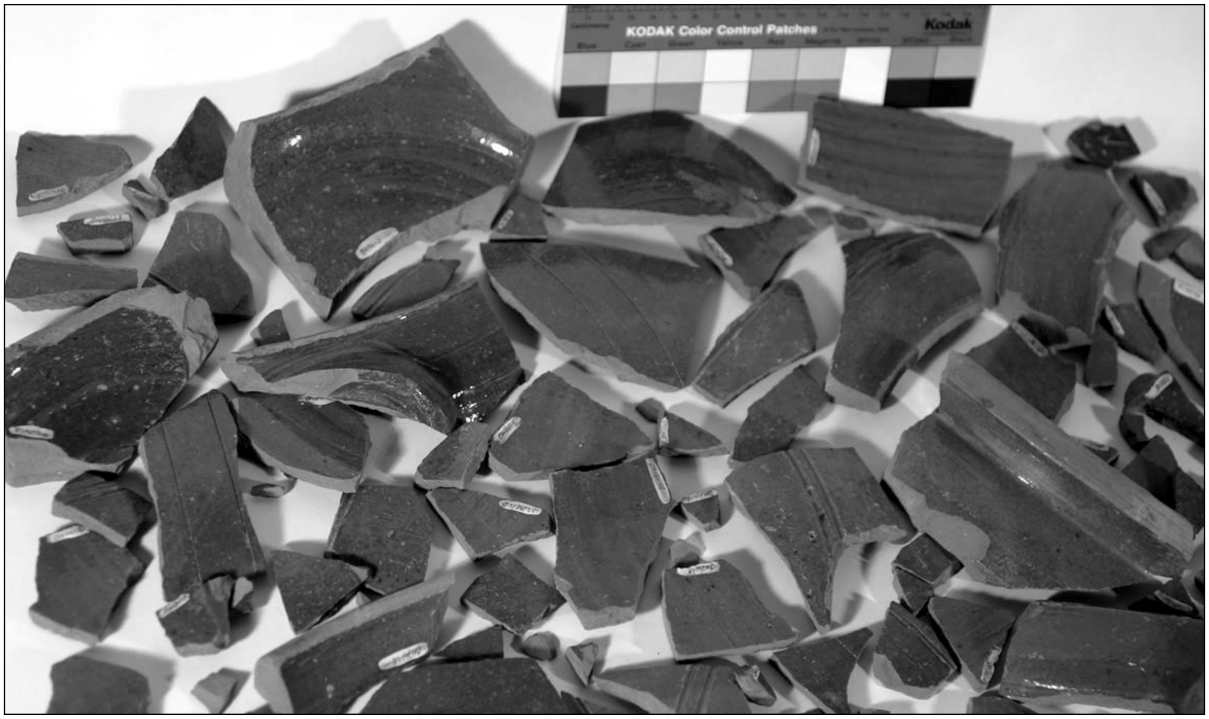

Figure 1. Red-bodied earthenware produced by Frederick Petersen in Salt Lake City, Utah.

trade patterns, but also challenges assumptions of commodity flow. Pottery production and consumption situates within a complex web of early Utah consumer choice, and straddles the historic period transitioning from barter and trade economy to a more modern, recognizable, capitalist currency market. By compiling and presenting the results of Merritt (2006) and situating the commodity interaction within a detailed understanding of consumer choice and the self-sufficiency doctrine, a new facet of Utah history and archaeology emerges. It is hoped that the results presented here spur other researchers to collaborate on further analyses of historic, Utah-produced pottery sherds from archaeological deposits in the Great Basin and perhaps even beyond.

Pottery Production in Utah

Scarlett (2002:8) proposes four periods of the Latter-day Saints' pottery industry, demarcated by identifiable patterns in the social and economic organization. The first period extends from formation of the Church in 1830 to the flight from Nauvoo in 1846, A second period 1847-1868, ranges from arrival of Latter-day Saints in Utah to just before the completion of the transcontinental railroad, includes successive waves of immigrant potters from a diverse ethnic and national background, and formation of cooperative potteries. Between 1869 and 1896, from arrival of the railroad to Utah's statehood, there was a peak of independent potteries in the 1880s with a subsequent decline in the 1890s, and a switch towards heavily capitalized terra cotta industries. Finally, between statehood in 1896 and 1930, many of the independent potters died with no individuals to continue the craft, leading to a domination of the market by factory-made wares. Estimates are that between 1847 and 1930, Utah potters produced nearly 10 million ceramic vessels of nearly every conceivable shape and form with production peaking in the 1880s (Scarlett 2002:259) (Figure 1 and 2).

Figure 2. Terracotta roofing tile produced by Frederick Petersen in Salt Lake City, Utah.

Before reaching the Great Basin, Latter-day Saints established proselytizing missions in the industrialized districts of England and northern Europe. Many of the lower and middle-class workers in these dark and oppressively polluted cities viewed the agrarian and utopian ideals espoused by the Mormon missionaries as incredibly attractive (Arrington 1958:33). Missionary efforts in England, specifically, focused on the industrialized neighborhoods of Staffordshire, a region renowned for its white-improved earthenware ceramics (Scarlett 2002:10).

In 1842, over 200 Mormon converts from Staffordshire crossed the Atlantic Ocean and settled in Nauvoo, Illinois (Henrichsen 1987:2-3). During this period, Nauvoo boasted a population of nearly 25,000 in 1844, making it one of the largest cities in the United States (Arrington 1958:17). Among the first immigrants from Staffordshire, potters began operations in the city of Nauvoo supplying earthenware to the inhabitants (Henrichsen 1987:2-3). Following the murder of Joseph Smith, Latter-day Saints under Brigham Young's leadership removed themselves from Nauvoo and other locales to Winter Quarters in Iowa and eventually moved on to Utah in 1847. Among this forced migration to Utah, the small cadre of potters from Nauvoo reached the Salt Lake Valley between 1847 and 1848, quickly establishing a small pottery workshop (Scarlett 2002:10; Henrichsen 2000).

Around 1848, the Church officially sponsored a pottery under the direction of Staffordshire potters in Salt Lake City. Called the Deseret Pottery, this facility attempted to produce a large number of earthenware vessels to supply the quickly growing Salt Lake Valley population. Under the direction of Ephraim Tomkinson, the potters began assembling the necessary materials for earthenware production including lead for glazing. Problems plagued the Deseret Pottery from the onset, including lack of fuel and insufficient technical skill regarding local clays (Arrington 1958:114). The Deseret Pottery floundered and the arrival of Danish potters signaled its death knell in 1853 (Henrichsen 2000:1).

The initial failure of the Deseret Pottery, along with other industries, troubled the Mormon leadership during the first few hardscrabble years in the Great Basin. A statement to the Utah Territory Legislative Assembly by the Territorial Governor and Church President Brigham Young underscored this preoccupation on self-sufficiency:

> I cannot refrain from again calling your attention to the subject of Home Manufactures. Large quantities of wool, flax, hides, furs, and almost every variety of the best material for the manufacture of…Pottery, and Castings, are found in abundance and easily procured, and yet we find large quantities of such articles annually imported, and purchased by the people, which causes a large and constant drain of our circulating medium. If a few hundred thousand dollars, which are now annually expended, and carried away for imported goods, were instead thereof, invested in Machinery and articles for Domestic Manufactures, it would prove far more advantageous, and rapidly advance the prosperity of our thriving Territory. (DN, 14 December 1854:3)

Brigham Young and other leaders attempted to create and sponsor industrial improvements in the production of all goods listed above. Many of these ventures failed due to mismanagement, insufficient technical skill, or substandard natural resources in quantity and quality. Around 1853, as newly immigrated potters began to fire successful kilns of earthenware, the Church removed funding from the Deseret Pottery and dispersed its leadership (Arrington 1958:114).

Brigham Young and other Church leaders saw the specialized skill of potters as a necessary part of any fledgling community. Around 1850, the Church dramatically increased new settlements throughout the region with potters usually among the specialists sent to establish these new communities. Dozens of skilled immigrant potters from England and Denmark spread across the landscape of the Mormon Domain, setting up shops to service local communities. This dispersed infrastructure of potters supplied their local communities and surrounding regions with the wares necessary for preparing and storing foods, handling sanitary matters, and beautifying homes.

Until the early 1900s, small family-run pottery shops produced the majority of these wares in towns across Utah Territory. As late as 1894, E.C. Henrichsen in Provo, Utah, was producing upwards of 15,000 gallons of pottery for local consumption (Daily Enquirer, 16 February 1894:4). Newspaper editorials promoted consumption of local pottery as the Deseret News hoped one day residents would "sup pudding and milk from stone-china bowls of home manufacture and our tables be adorned with sets of the same, as elegant and far more easily attainable than the costly imported wares" (DN, 22 July 1863:1). Economic changes around the turn of the twentieth century forced many small potters out of business, and coupled with the death of many early immigrant potters, the Utah earthenware industry moved into a new capitalistic era marked by large-scale commercial production facilities.

Consumer Choice in Utah

LDS-produced pottery traveled through the Great Basin trade and exchange system through a unique variety of means that varied over both time and space (Figure 3). Utah, and the surrounding region, possesses a unique pattern of historic-period settlement stemming from the dominance of members of the Church of Jesus Christ of Latter-day Saints as the primary drivers of colonization during the post-1847 period. The ideal of self-sufficiency and home industry within LDS settlements, or colonies, was assisted by the difficulty of overland freighting of goods until the 1869 arrival of the railroad. Imported and domestically produced goods and

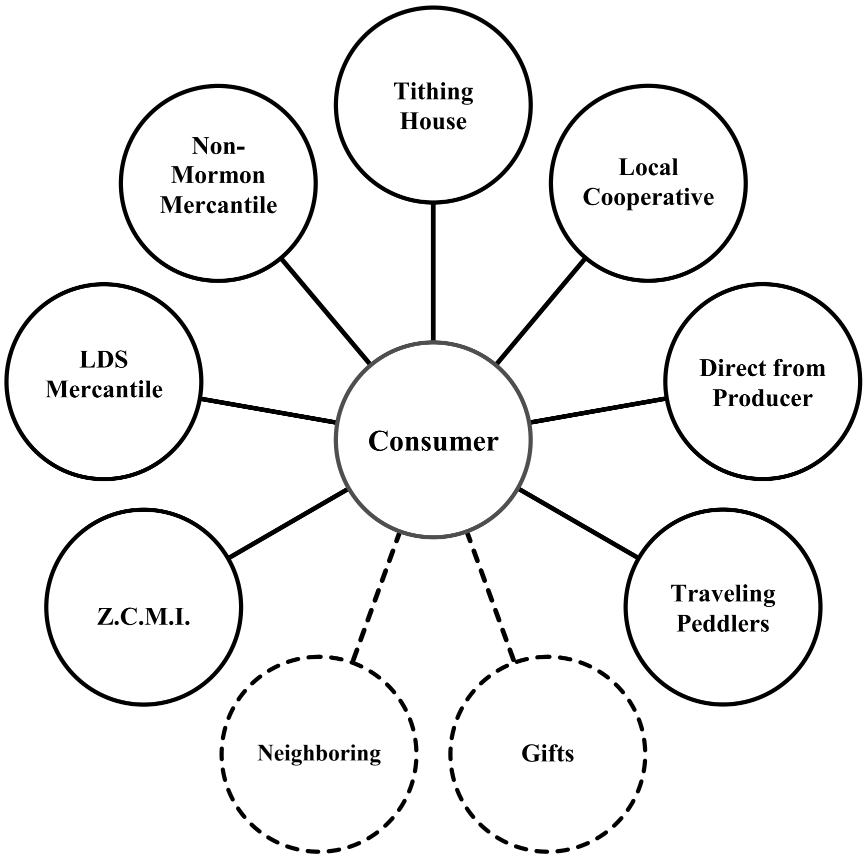

Figure 3. Consumer choice options in a rural or urban Mormon Community, (1847-1929) No Z.C.M.I. before 1868. Dotted lines and circle indicate consumer options removed from a pure commodity transaction phase of consumption.

commodities moved within the Utah economy through reciprocity, redistribution, and market exchange. While these are generally accepted anthropological terms for the movement of goods and commodities within a society, the unique historical setting of Utah and the Mormon Domain offers unique variations of these concepts.

As described by Scarlett (2007:81), "Utah's settlers exchanged ceramics through complex and intertwined social transactions." Economically, ceramics in Utah entered the system not only as objects of purchase and trade, but also in some instances as merely a vessel containing a desired commodity. Commodities flowed within the Mormon Domain through reciprocity from gifts and neighboring, redistribution through tithing to the LDS Church, and market exchange through mercantiles (both LDS and non-LDS operated), local cooperatives, direct from producers, traveling peddlers, and even through catalogs from distant distributors. These commodity flow mechanisms ebbed and flowed in importance and significance over time, tied to the increasing national and international integration of Utah's economy.

Between 1847 and 1868, the region was generally cash-poor, given the distance from eastern and western markets and the focus on self-sufficiency. Much of the available currency stayed under the control of the Church's hierarchy through tithing, allowing the leadership to pursue endeavors like expanding land holdings, sponsoring public works projects and developments, and funding the Perpetual Emigrating Fund (Arrington 1954:43).

Barter, the exchange of goods or services for other goods or services, was the most common means of transaction in the early years of Utah history. Tithing, whereby members of the LDS Church paid 10 percent of their annual production to local and regional tithing houses, was another means of redistributing goods throughout the region. With the constant internal push for creation of new colonies during the initial decades after 1847, tithing house stores provided the bulk of commodities for provisioning new settlements. Large-scale socio-economic disturbances such as the Utah War also destabilized market exchange within at least northern and north-central Utah, with further reliance on tithing stores and communal good sharing for survival.

The population of early 1840s-1860s Utah remained heavily dominated by Latter-day Saints, which allowed better control of markets and exchange by Church and governmental officials. However, the discovery of silver bearing ore in the Wasatch and Oquirrh Mountains in the early 1860s, led to a dramatic demographic and economic change within Utah. The growing non-Mormon mining population demanded a growing array of goods not supplied by the local industry and did not adhere to the dominant self-sufficiency doctrine. During the few years leading up to the arrival of the transcontinental railroad, the mining industry demanded a broad network of supplies to provide equipment and personnel for development of these mineral resources.

The Zions Cooperative Mercantile Institution (ZCMI) started operation in 1868, as a means of allowing the Church to compete with the growing non-LDS business interests (Bradley 1991). After a successful boycott of non-Mormon operated businesses in the mid-1860s, ZCMI was an effort to capture the bulk of the growing market exchange in Utah, but keeping all facets of this exchange within the control of the Church. Witnessing the loss of the local industry's share of the Utah market, ZCMI stocked its shelves with imported goods alongside those produced locally. Garff (1971:84) further notes that the LDS Church hierarchy urged their members to only purchase goods from ZCMI stores, even using rich iconography such as the "all seeing eye" above store lintels. Organization of the ZCMI did not preclude the push towards self-sufficiency through home industry, but was a result of the Church's desire to maintain control of the marketplace through whatever means necessary.

After arrival of the railroad and the continued gentile, non-Mormon, infusion of population, businesses, and mining ventures, Utah moved towards a cash-based economy. This transition led to the reorientation of consumer habits away from barter, and towards a strict market exchange, especially in the growing urban areas of northern Utah such as Salt Lake City and Ogden. LDS Church members shifted their tithing from raw materials, manufactured goods or service towards 10 percent of their cash income. Cash payments rose as tithing offerings towards the end of the nineteenth century. Furthermore, around this period, Umbach (2004) suggests that the consumer revolution in Utah begins in earnest, possibly relating to a youthful demographic surge who did not immigrate to Utah during its hardscrabble infancy.

The Edmunds-Tucker Act of 1887 further limited the role of the Church in influencing the purchasing habits of consumers through the disincorporation of the Church of Jesus Christ of Latter-day Saints and seizing all Church ventures valued over $50,000. Extension of railroad service to more rural areas of Utah in the late nineteenth and early twentieth century, allowed an even greater flow of goods into the state. Specifically to Utah's pottery industry, by 1920, the approximately half-million residents of Utah moved almost exclusively to imported glass canning jars, china, and white-improved earthenware available from a variety of distributors (Henrichsen 1988:389).

Residents of the Mormon Domain had a range of options for acquiring commodities based upon the time period. Consumers in the first decades of LDS control of Utah were provided with a regimented list of available goods, limited by transportation costs and internal religious and political control. Later, with weakening of the political and economic control of the Church through both legislation and a growing non-Mormon population, consumers were exposed to a broader variety of consumer choices. Tithing redistributed goods and commodities within communities, and helped to support settlement of faraway colonies or outposts. As mercantile interests grew within Utah, consumers found a host of mechanisms to acquire goods, all of which affected the movement of material culture throughout the region.

As mentioned earlier, pottery was introduced into the market system as both a commodity and containers for other commodities. Consumers acquired pottery direct from the producers, traveling peddlers, stores owned and operated by members of the LDS Church, neighbors, gifts, and even tithing houses. Each of these consumption spheres is laden with political, religious, and economic meanings. While the act of consumption might have been a choice based upon perceived or actual need, the choice made by the consumer was situated within a complex web of cultural meaning.

There is a paucity of available historical documents on the Utah pottery and much of what is available does not provide a significant base of information to approach understanding the spatial spread of pottery or the mechanism for consumption. Archaeological excavations throughout the Mormon Domain provide concrete evidence for the movement of pottery throughout the region, with technical analyses providing researchers the tools for determining the point of manufacture. Data from archaeological research, tied to an understanding of the consumer choice options available within these individual contexts, and the religious, political, and economic connotations of these consumption activities provides a more holistic view of consumerism in Utah in the nineteenth and early twentieth century.

Instrumental Neutron Activation Analysis

Researchers in the fields of medical science, materials production, biology, geology and numerous others use Instrumental Neutron Activation Analysis (INAA) to answer specific questions regarding elemental composition of cells, organs, or ancient rock (De Soete 1972:1). INAA applies theories of nuclear physics in determining the elemental composition of selected sample materials by bombarding the nucleus with radiation and counting the exiting energy patterns. Activation analysis lends itself specifically to the study of historic pottery as it measures over thirty trace elemental signatures (Tite 1999:197). Due to the geological processes leading to formation of the clay beds exploited by historic potters, analyses must detect dozens of elemental signatures to allow the finely tuned differentiation of various geologic sources. Each clay source exhibits a unique elemental signature though the analytical technique requires capturing the minutest proportions of trace elements (Rice 1988:419).

The basic principle underlying INAA and its application to archaeological materials are succinctly described: "there exist differences in chemical composition between different natural sources that exceed, in some recognizable way, the differences observed within a given source" (Weigand et al 1977:16). Seminal work conducted by Dean Arnold in 1969 and 1970 and detailed in Arnold et al. (1999) formed the theoretical basis for the provenance postulate proposed by Weigand et al. (1977:16). Arnold et al. (1999:81) demonstrated that INAA can accomplish more robust anthropological analysis than simply differentiating pottery groups produced from elementally distinct and recognizable clay sources.

Recently, Mommsen (2004:268) proposed an amendment to the postulate, replacing the term 'source' with 'paste.' Paste in pottery studies comprises the mixture of clay and temper, and is generally unique to the individual potter. This is of particular importance in instances where the INAA study attempts to differentiate individual workshops within a geographically limited area. In a limited area, workshops and potters would likely exploit either the same clay source, or geologically similar beds (e.g. Mommsen 2003; Mommsen et al. 1995:199-200).

Hector Neff (2000) outlined two types of provenance studies, the first attempting to identify and create elemental signatures for known or unknown raw material sources, and the second to test samples against a pre-existing source database (see Schwedt et al. 2003). In Utah, Scarlett (2002) sought to locate source clays of many local potters and establish standards using samples from the pottery shops themselves. As of 2013, eight pottery production sites yielded samples for INAA, providing an elemental fingerprint for seven nineteenth century potteries in Utah and one in Arizona (Scarlett 2002:74). Samples range geographically from J.J. Hansen's shop in Hyrum to St. George's John Eardley in Utah, and the Behrman pottery in Brigham City, Arizona. Merritt's (2006) thesis, however, focused on the second type of provenance study by focusing analysis on sherds recovered from archaeological contexts away from production sites and comparing them against the INAA database created by Scarlett.

Archaeological Samples from Utah

While limited by the number of available and submitted samples, the purpose of this INAA research is to understand the trade and exchange networks within the Mormon Domain during the period 1847-1930. As discussed earlier, consumer choice and trade in Utah during this period, was a unique aggregation of capitalist and agrarian modes of goods movement, coupled with an explicit religious framework creating not only multi-faceted cultural views on consumption habits but also a direct manipulation on the transfer and trade of goods. In order to further illuminate the movement of goods and commodities within the region, suitable archaeological samples for INAA required identification. This identification process faced challenges due to a dual problem in Utah, including the formal lack of any statewide repository for historic-period archaeological artifacts and the relative lack of robust studies on historic-period sites due to inherent biases in the training of the state's archaeologists. While Utah remains a robust and world-renowned laboratory for prehistoric archaeology, historical archaeology within the state remains largely underdeveloped.

At the onset of research in 2005, there was no statewide database on archaeological sites containing locally made pottery suitable for analysis. Using the existing literature and connections with the local archaeological community, the researcher identified several collections with potential for containing locally-manufactured pottery examples. In hopes of casting a wide net for samples, researchers targeted sites in not only Utah (Cove Fort, Fort Douglas, Neilson's Grove in Orem, and Block 49 in Salt Lake City) but also Nevada (Ruby Valley Pony Express Station). All collections resided in different institutions with Cove Fort housed at the LDS Church History Museum, Fort Douglas at the Utah Museum of Natural History, and Block 49 at the Museum of Peoples and Cultures at Brigham Young University. Archaeological materials from Neilson's Grove and Ruby Valley Pony Express Station were never formally reported. The City of Orem provided the samples from Neilson's Grove while Dr. Tim Scarlett provided samples from Ruby Valley Pony Express Station (Figure 4).

Lack of funding and time prevented a further inventory of other pre-existing collections, but it was felt these materials provided a spatial distribution of sites to attempt gleaning some information regarding trade networks and consumer choice. Furthermore, each of the five sample sites provided a different spatial,

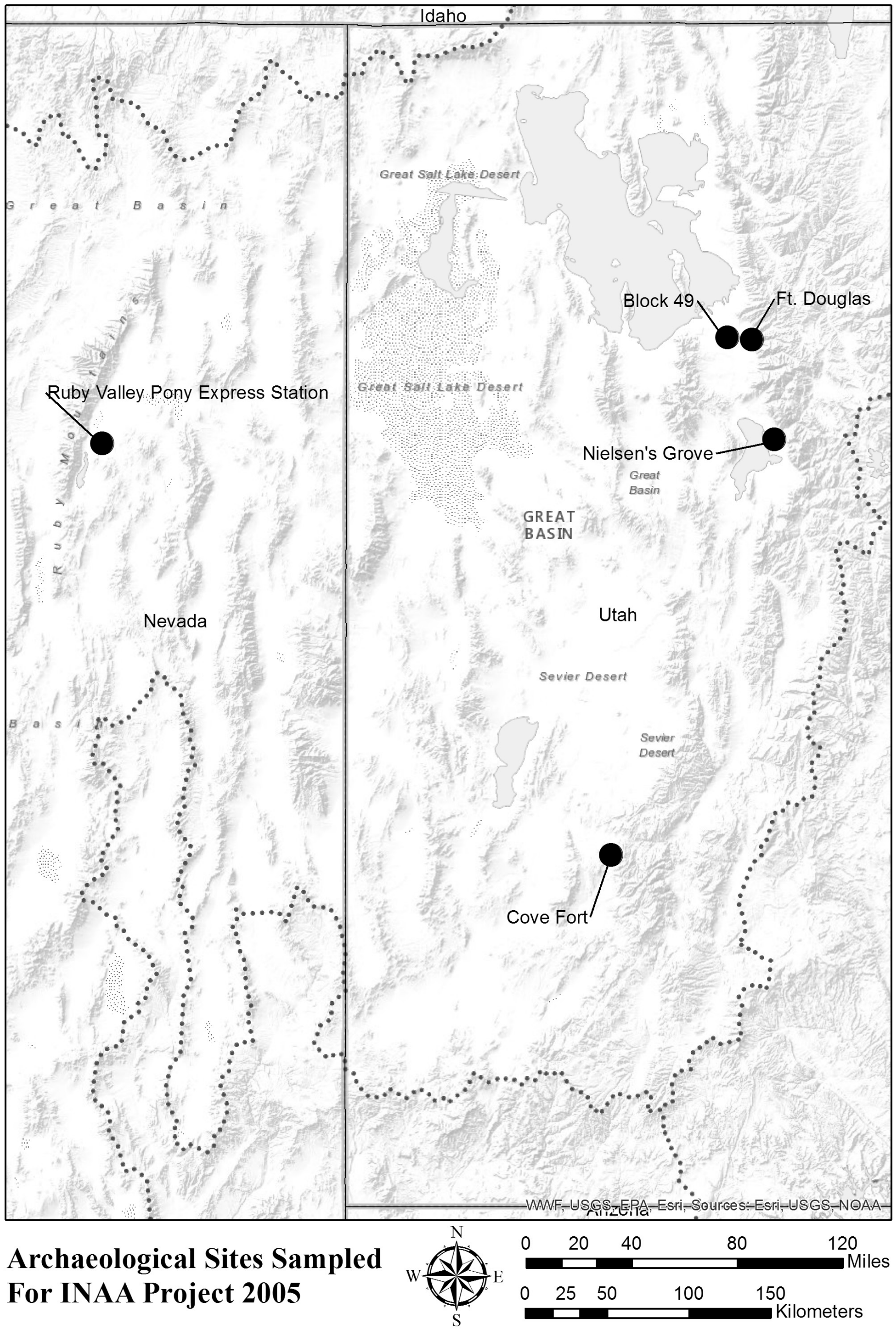

Figure 4. Location of archaeological sites sampled for the 2005 INAA Utah Pottery Project.

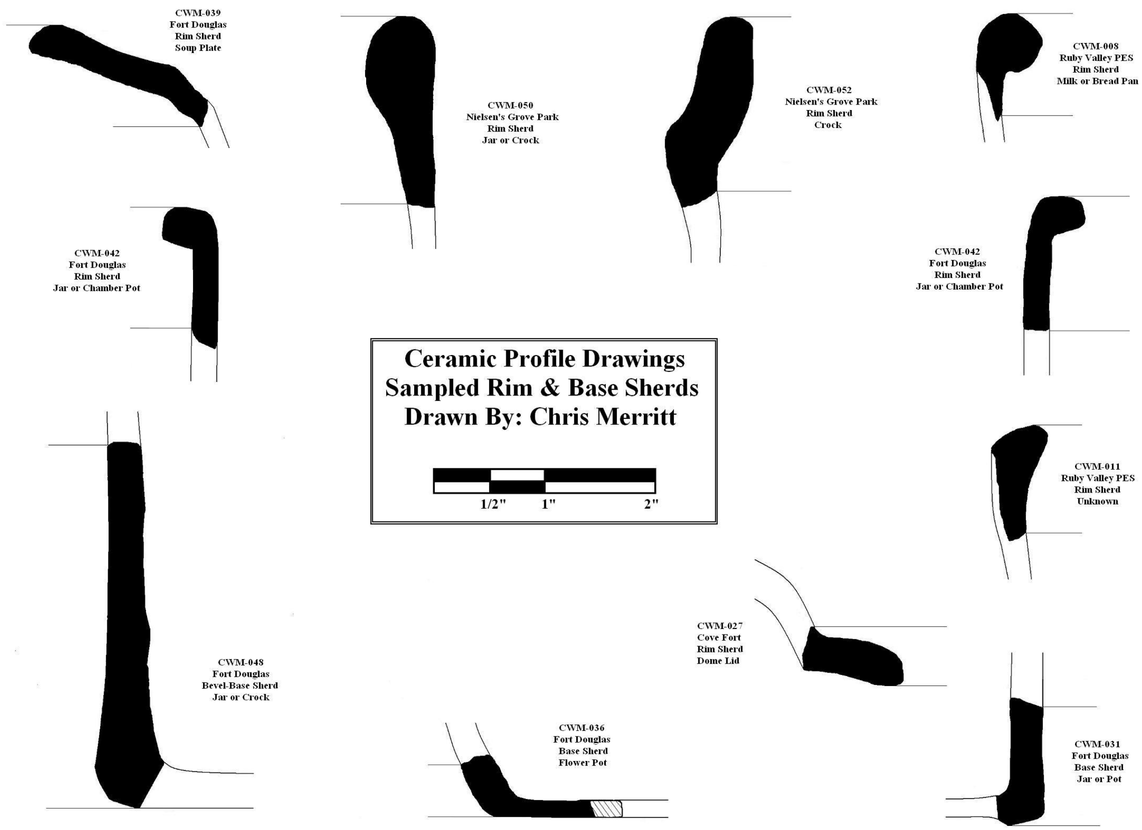

Figure 5. Rim and base profiles for selected sherds submitted for INAA in 2005.

economic, and functional sample. Materials from Block 49 resulted from multiple household dumping events from a largely LDS background, while Neilson's Grove yielded samples from a single individual household. Fort Douglas samples stemmed from the excavation of the officer trash dump, reflecting both non-LDS and U.S. Army in affiliation. Cove Fort's assemblage represented another multi-family deposit from a LDS Church-supported settlement and post. Finally, Ruby Valley Pony Express station, located within Nevada, represented a major trade corridor on the overland stage and express route and near to Fort Ruby.

In total, researchers submitted 52 earthenware samples that appeared locally produced from these five sites for INAA analysis at the MURR Reactor Lab. In all collections, previous archaeologists consistently misidentified these locally produced sherds, either limiting analysis to strictly physical descriptions or suspecting importation. The number of samples from each site includes five from Nielsen's Grove, four from Cove Fort, 10 from Block 49, 15 from Ruby Valley Pony Express Station, and 18 from Fort Douglas. Attributes such as paste, glaze, form, function, decorative features, and provenience information was documented before submission, as INAA is a completely destructive procedure (Figure 5).

Block 49, Salt Lake City, Utah

Located in downtown Salt Lake City, Block 49 was a palimpsest of historical processes, from pioneer cemetery, to homestead, to Bamberger Railroad lot, to the industrialized manufacturing and sales location for Dinwoodey Furniture. Archaeologists from the Office of Public Archaeology conducted extensive excavations in the 1980s after discovery of 32 early, historic-era European American burials during a development project. LDS members used Block 49 as the earliest centralized, but unofficial, cemetery from 1847 to 1856 (Baker et al. 2002; Talbot et al. 2004). After abandonment of the area as a burial ground, Block 49 transitioned from small homesteads in the 1850s to 1870s (Talbot et al. 2004:90), to the heavily industrialized block with Dinwoodey Furniture at its center (Talbot et al. 2004:92-93). Survey of the collection housed at Brigham Young University's Museum of Peoples and Cultures identified ten earthenware sherds that appeared morphologically similar to known Utah pottery examples. Eight of the ten sherds were from the plow zone directly above the historic burials but below the industrialized development (1856-1880s), with the remaining two samples from the mixed zone (1890s-1930s) (Talbot et al. 2004:99).

Nielsen's Grove, Orem, Utah

Nielsen's Grove represents a unique part of Utah history, as it was constructed as a place of recreation and repose for the state's Scandinavian population during the nineteenth century. J.C. Nielsen, who spent his youth tending the royal gardens in Denmark, converted to Mormonism and immigrated to Utah by 1863. After purchasing land on the Provo Bench in 1882, Neilsen started construction of a formal garden space (Calkins 2001). Between 1882 and the garden's abandonment in 1911, Nielsen's Grove hosted numerous events (Utah Enquirer [UE], 20 July 1888:3; UE, 23 July 1895:3). In support of World War I, new occupants plowed over the once-illustrious gardens for the planting of wheat.

The City of Orem purchased Nielsen's Grove in 1995 with hopes of restoring the park to its former stature, but limited funds slowed progress. Passage of a Utah Senate Bill in 2002, provided much needed capital for the project and led to the archaeological investigations (Mikulski 2002:43). Archaeologists tested an ice house constructed in the 1930s, a test unit near Nielsen's original home, and salvage of materials within a massive back-dirt pile from backhoe trenching during restoration (Jenni Prince-Mahoney, personal communication 2005). Unfortunately, the archaeological data has not been formally reported. Pottery samples from Nielsen's Grove came from all three contexts, with two from the backhoe fill, and one each from the Ice House and Nielsen home and date to between 1880 and 1930.

Cove Fort, Millard County, Utah

Charles William Willden Sr. and family, were the first historic occupants of the area along Cove Creek between the settlements of Fillmore and Beaver when they settled down in 1860 (Porter 1966:21). Their adobe home became a popular stopover point for dignitaries and travelers alike, hosting a number of prominent early Church leaders, including Church President Brigham Young, Heber Kimball, Lorenzo Snow, and Ezra T. Benson by 1861. After resolution of the most violent portion of the Blackhawk War in 1867, the Church felt it necessary to establish a series of protective forts along the overland route to California along the Wasatch Front and purchased the now-abandoned Willden property (Lyman and Newell 1999:130). Ira Hinckley was sent to the new fort at Cove Creek, and started construction of the thick-walled, volcanic rock, Cove Fort in 1867 (Porter 1966:67). By 1890, the fort was sold yet again, but this time to a private household.

In 1989, the LDS Church contracted with the Office of Public Archaeology at Brigham Young University to conduct extensive archaeological investigations at Cove Fort to aid in its historical understanding, but also to guide restoration and interpretive efforts (Southworth et al. 1990). Excavations recovered dozens of earthenware sherds, of which the author selected four for analysis based on morphological and qualitative markers for locally produced pottery. Selecting traits were a buff or red paste, thick-bodied, coarse earthenware, salt or lead glazed, and sharing morphological traits with known local pottery types (rims, lug handles, etc.). The four samples came from a variety of contexts including two different outhouses, the barn, and areas within the blacksmith shop. Most samples are within contexts of pre-1900 occupation of the Fort, thus most date from 1867-1900.

Fort Douglas, Salt Lake City, Utah

In order to maintain Utah's loyalty to the Union during the American Civil War and to protect supply and mail routes in the western states, President Lincoln dispatched the 3rd Regiment California Volunteer Infantry from California to Salt Lake City in 1862 under the command of Captain Patrick Edward Connor (Hibbard 1981:18). Captain Connor selected a location on Salt Lake Valley's east bench, three miles from downtown Salt Lake City for construction of a permanent military post (Rogers 1938:56). Over the next several decades, Camp Douglas, as it was originally called, sprawled across the benches, ultimately covering two square miles and housing hundreds of military personnel and their families (Vollum 1875; Hibbard 1981, 1999). The University of Utah and the United States Army currently own and maintain the majority of Fort Douglas.

Archaeologists mitigating infrastructure improvements for the 2002 Winter Olympics identified one sample during the 1912 bandstand reconstruction that likely dates to 1900 to 1960 (Southworth 2003:51). Another 17 samples of pottery submitted for INAA analysis were recovered during construction of a pedestrian overpass, which appears to have encountered the remains of an officer's trash pit dating from 1885 to about 1910 (Southworth 2004:53, 69). Excavators note "[t]he wide diversity of trademarks and manufacture dates suggests that the majority of the ceramics were not part of the military dining service, but probably belonged to the families of the military personnel stationed at the fort (Southworth 2004:73)."

Ruby Valley Pony Express Station, Elko County, Nevada

"Uncle" Billy Rogers established a simple trading post and stage stop on the Overland Route in Ruby Valley, Nevada, in 1859 to service the stream of travelers to California (Patterson and Ulph 1969:135). In 1860, Russell, Majors, and Waddell purchased a cabin at the post to serve as a stop on their Pony Express endeavor (Patterson and Ulph 1969:136). Completion of the transcontinental railroad to the north led to the abandonment of the Ruby Valley post, with the majority of buildings going vacant after that year. In 1960, the Northeast Nevada Historical Society purchased the Pony Express station building and moved it to Elko, Nevada (Gallagher 2000:72-73). While pursuing his doctorate at University of Nevada-Reno in 1993, Dr. Tim Scarlett collected several dozen pottery sherds from the surface of the Ruby Valley Pony Express and Stage Station sites in Ruby Valley, Nevada. All sherds date from the initial settlement of the area in 1859 to the abandonment of the post in 1869 and subsequent periodic use into the 1880s.

Expectations

Given the relatively limited number of samples submitted for INAA from each site, it was clear that the resulting data would not be statistically significant for the purposes of this study. There were, however, expectations in the source point of pottery at each sample site. Archaeologists frame the consumption of commodities within a gravity or fall-off model (Tite 1999, Blalock 1960, Gregory 1963), or a network model. Tite (1999:202) postulates that the density of pottery from a single producer will be denser near the production point and fall off (decline) in ratio as moving away from that source. Hodder (1974:172-174) refines the gravity model with a discussion of gradient, whereby there are different factors within a culture or region that promote differing levels of commodity density. Factors could include an elaborate transportation system within an urban area that will lower the gradient cost of moving a commodity. In contrast, there is a higher gradient for those goods across rural distances, meaning there is a steeper decline in the frequency of commodities across space away from the production center (Hodder 1974:172-174). Another important basis of gravity models is the differential slope of various valued goods, resulting in a larger distributional area for 'prestige' or high value goods, and localized concentrations for low-value or utilitarian wares (Renfrew 1977:76-77).

Other scholars, including Irwin-Williams (1977:147), believe that "[i]nitial indications from the data suggest that exchanged goods do not travel uniformly from space," unlike gravity models predict. Network models view exchange systems as linkages between archaeologically or historically defined settlements, termed vertices (Irwin-Williams 1977:142). Unlike Tite's (1999) or Renfrew's (1977), Irwin-William's model does not attempt to generalize artifact distributions across space as a raster dataset. Instead the aim is to understand the linkages between vertices by measuring a number of variables, including presence or absence of specific objects, proportion of similar types of goods, proportion of dissimilar goods, directional flow of goods, the count of commodity type, and an overall examination of the range of goods exchanged (Irwin-Williams 1977:142-143). On a broad scale, analysis of goods in a network model can reconstruct historic or prehistoric exchange systems as they existed at a set point in time.

Combining these two perspectives it was expected that each site's assemblage sampled for this research will be dominated by pottery from the geographically closest pottery shop. Furthermore, there would be distinct linkages of pottery between different settlements based on a variety of social and economic factors such as tithing redistribution, colony establishment, or other gradient factors in the market exchange. Earthenware in historic Utah was not a prestige good, as seen by the low prices for wares offered by potters (Stenhouse 1888:24), thus it would seem that Renfrew's (1977;142) prestige good variable would not be applicable. In a simple economic model based on fall-off models, researchers expected that samples from Fort Douglas and Block 49 would reflect the domination of the local market by Salt Lake City based pottery shops including Frederick Peterson, Croxall and Cartwright, and the Eardley Brothers. Nielsen's Grove, located in Orem, would likely yield a dominance of pottery from E.C. Henrichsen's shop in Provo. Cove Fort would seemingly rely on locally produced pottery in Parowan or Panguitch, though both were over 30 miles away. Finally, the geographically isolated Ruby Valley Pony Express Station would likely have received the majority of its goods from the movement of people and commodities along the Overland Stage Route.

Results

INAA detected between 32 and 33 elements within each of the 52 submitted sherds. According to Little et al. (2006:3), nickel is below detection limits for the INAA of New World ceramics, thus researchers removed it from statistical analyses. Compensating for the variable concentrations of common and rare earth elements, researchers transformed the raw data to base-10 logarithms. Transformation allowed rigorous statistical testing of elemental signatures and resulted in the formation of normal distribution of concentrations for these samples (Little et al. 2006:3). Principal component analysis (Figures 6 and 7) and the use of Mahalanobis distance measures created a number of centroids relating to specific clay sources utilized by specific historic potters. Little et al. (2006:5) states, "whether a group can be discriminated easily from other groups can be evaluated visually in two dimensions or statistically in multiple dimensions." Using scatter plots relying on Principal Component Analysis and statistical distance measures like Mahalanobis, researchers placed the 52 submitted and 100 existing database sherds into several elementally distinct and discrete compositional

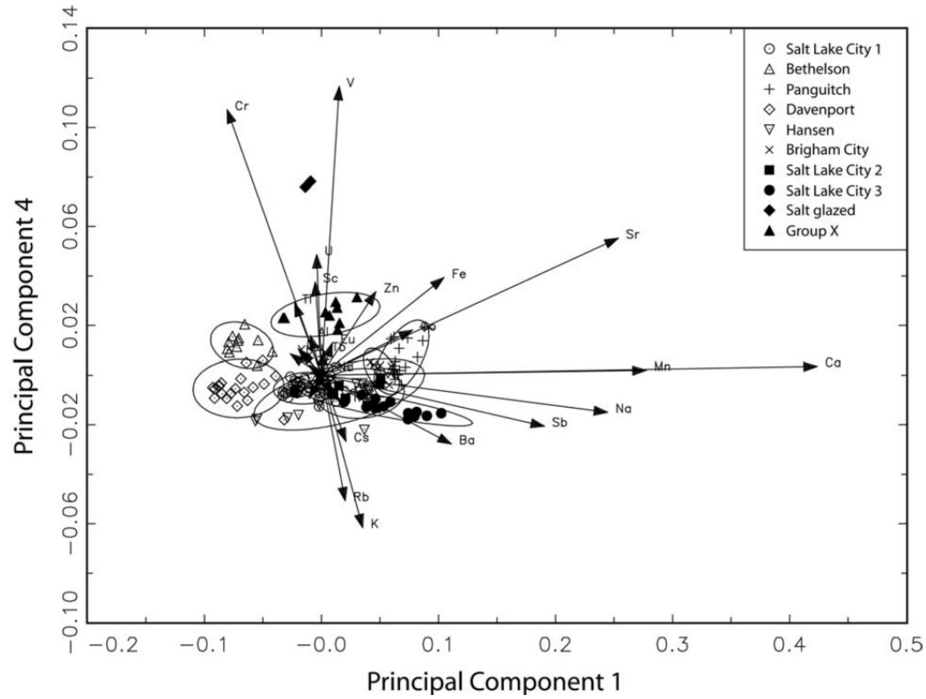

Figure 6. Projection of nine compositional groups by principal components 1 and 4. Ellipses represent 90 percent confidence interval for group membership. (From Little et al. 2006:8)

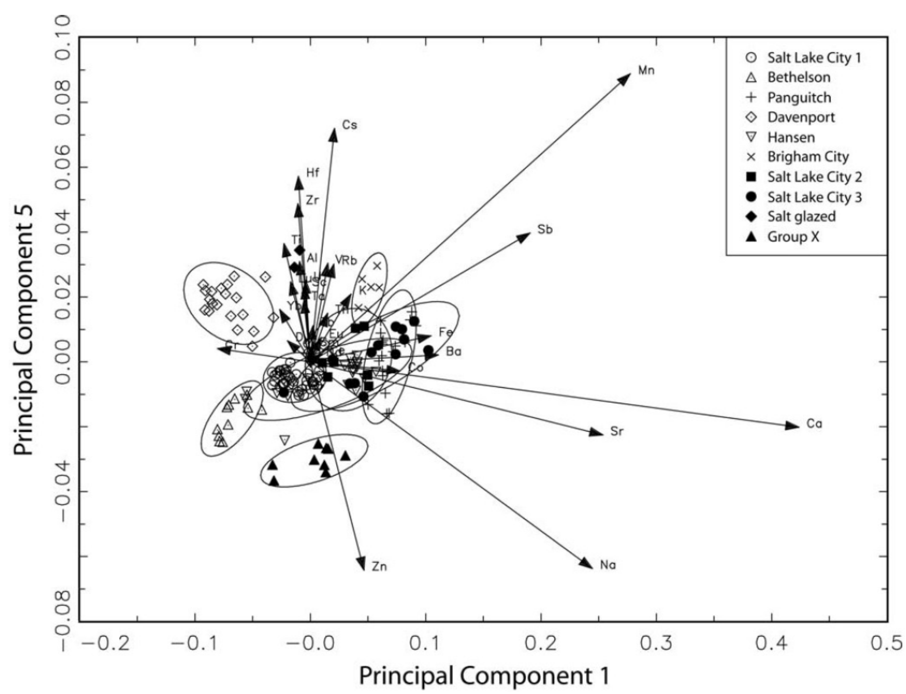

Figure 7. Projection of nine compositional groups by principal components 1 and 5. Ellipses represent 90 percent confidence interval for group membership. (From Little et al. 2006:9)

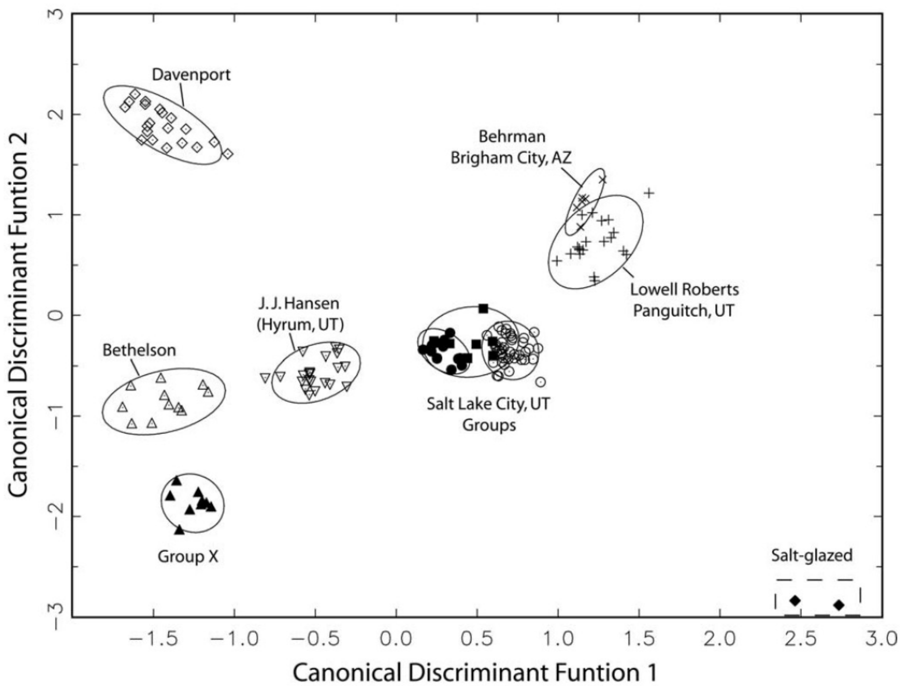

Figure 8. Visual representation of nine compositional groups projected by canonical discriminant functions 1 and 3. Ellipses represent 90 percent confidence interval for group membership. (From Little et al. 2006:10)

groups. These groups directly relate to exploited clay beds, and through strong inference, to the pottery shops of the individuals discussed. Results supported existing pottery clusters and strengthened statistically significant patterns.

By comparing the composition of samples submitted as part of this research to the extant database begun by Scarlett (2002) (see Figures 8 and 9), there is a statistically defensible placement of unknown sherds to known potters. Bivariate projections of the data from INAA resulted in the placement of the majority of submitted samples into four historically known production groups, all relating to the Salt Lake City or Hyrum pottery industry (Table 1). An additional homogenous compositional group does not match any previously defined pottery signature. Some samples failed to fall into any known historical group, or even into a new unique category. One additional pair of samples related strongly to each other, though due to the small number of samples the definition of a robust compositional group is not possible. None of the samples submitted as part of this research appear to relate to the pottery operations of the Bethelson Pottery in Fountain Green, the Lowell-Roberts pottery in Panguitch, or the Davenport Pottery in Parowan, as defined by Scarlett (2002).

Most sampled sherds related to one of three defined Salt Lake City groups that likely relate to individual clay sources and the likely potters that exploited those sources. Elemental analysis shows that the three Salt Lake City Groups are more similar to each other than other defined pottery groups. Within these groups Principal Component Analysis of trace elements (manganese and scandium) shows that each group is distinctive (Figure 10). Salt Lake City Group 1 and Salt Lake City Group 2 relate to wares produced by the Bedson Eardley and Frederick Petersen potteries. Bedson Eardley wares exclusively comprise Salt Lake City Group

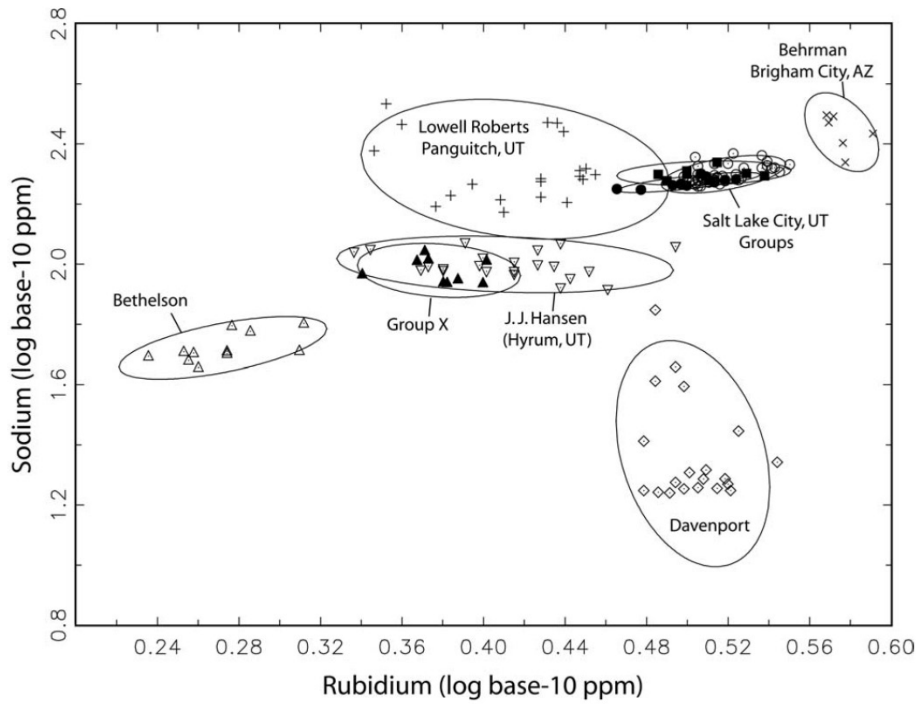

Figure 9. PBivariate plot of rubidium and sodium base-10 logged concentrations projecting current samples against compositional groups previously defined by Scarlett (2002). Ellipses represent 90 percent confidence interval for group membership. (From Little et al. 2006:11)

Table 1. Site and Pottery Distributions.

	Compositional Group and Sample Site Distribution 2005 Project						
Sample Site	SLC 1	SLC 2	SLC 3	Hansen	Salt	Group X	Unassigned
Block 49	6	3	–	–	–	1	–
Fort Douglas	10	1	1	1	–	2	3
Nielsen’s Grove	–	–	–	1	–	4	–
Ruby Valley PES	13	–	–	–	2	–	–
Cove Fort	1	–	1	–	–	2	–
Total	30	4	2	2	2	9	3

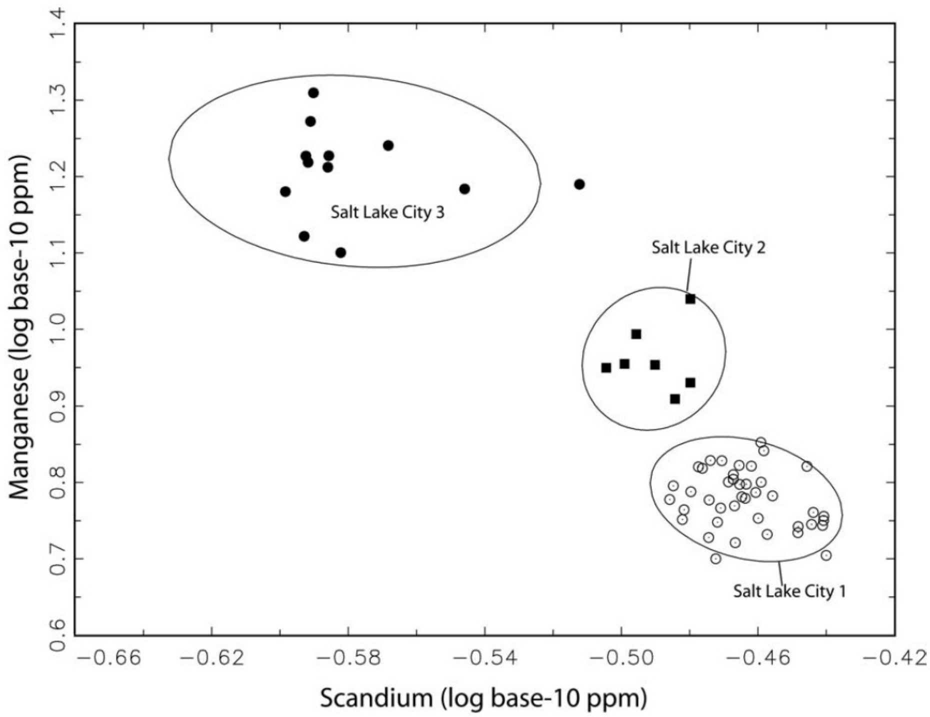

Figure 10. Bivariate plot of scandium and manganese base-10 logged concentrations showing the definition of compositional groups within the Salt Lake City production area. Ellipses represent 90 percent confidence interval for group membership. (From Little et al. 2006:12)

3. Only two sampled sherds relate to Salt Lake City Group 3, with 31 associated with Salt Lake City Group 1, and four relating to Salt Lake City Group 2. In total, 37 of the 52 sampled sherds fall into compositional groups relating to Salt Lake City based potteries, including the Bedson Eardley and Frederick Petersen operations.

The remaining 15 sherds fall into one of four remaining groupings. Two sherds belong to the J.J. Hansen compositional group. J.J. Hansen operated a pottery out of Hyrum, Utah, approximately 60 miles north of Salt Lake City. A group of 9 sherds form another statistically supported compositional group (termed Group X), though there is no historically defined potter associated with this grouping (Figure 11). Two sherds from Ruby Valley fall into another group called Salt, as tests by researchers at the MURR indicate that the glaze on these sherds is possibly salt-based. This grouping does not rely on the elemental fingerprint of the paste, but rather on the elemental ratios in the glaze. The final three sherds relate to no known pottery group, or to each other, and thus fall into an unassigned group, along with five sherds from Scarlett's earlier study.

Discussion of Self-sufficiency and Ties to Consumer Choice

It is important to note that the current study only focuses on locally produced earthenwares with all sampled sites, including assemblages of imported earthenwares, stonewares, and porcelains. A larger study could build off this existing database and analyze the proportions and use of local earthenwares compared to imported vessels, but is outside the scope of this paper and research. While the two sites within the greater Salt Lake City area, Fort Douglas, and Block 49 do show a high proportion of earthenware from Salt Lake City producers (72.2 percent and 90

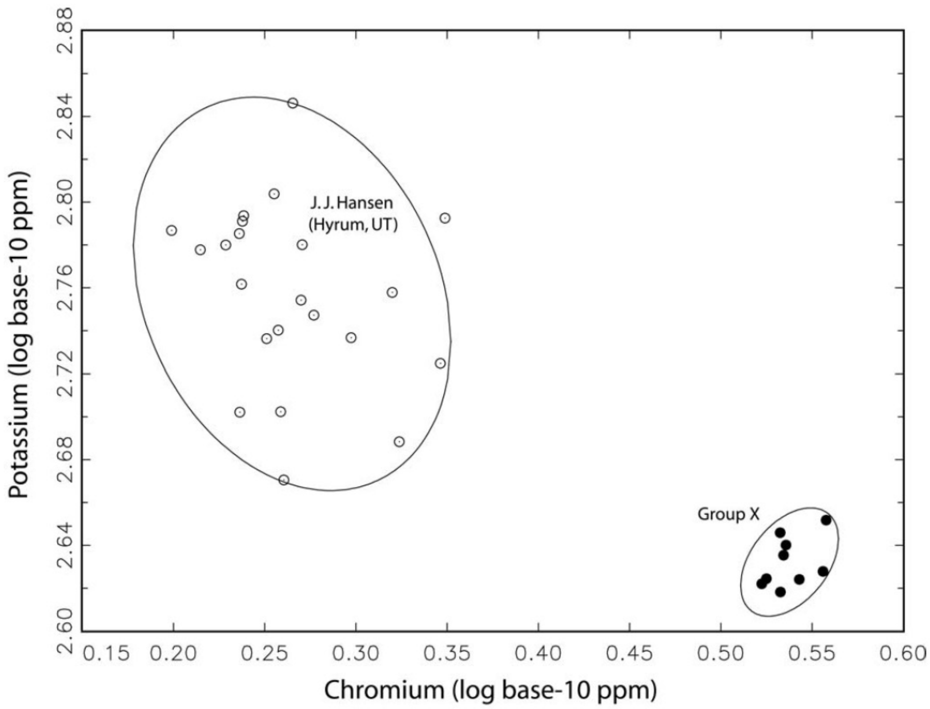

Figure 11. Bivariate plot of chromium and potassium base-10 logged concentrations showing the definition of J. J. Hansen (Hyrum, UT) and Group X compositional groups. Ellipses represent 90 percent confidence interval for group membership. (From Little et al. 2006:13)

percent respectively), more distant sample sites show a similar pattern. Ruby Valley Pony Express Station, nearly 200 miles west of Salt Lake City, has the same high proportion of Salt Lake City earthenware at 86.6 percent. Extremely isolated by geography, and thus limited in the connection to markets, Ruby Valley relied on the local procurement of some grain from nearby farmers, and the purchase of large quantities of goods from the Russell, Majors, and Waddell firm that owned and operated the Pony Express. Uncle Billy was decidedly non-Mormon, and thus the formal tithing, mercantile, and cooperative interests of the LDS Church did not extend into this rural locale directly. Yet the artifact assemblage at Ruby Valley Pony Express Station is a reflection of the economic, social, and religious forces at work in the historic Mormon Domain. The only large supply point near to the region was the LDS-dominated Salt Lake City market.

In this case, it appears that the majority of goods supplying the Ruby Valley Station, and potentially others in eastern Nevada and western Utah came from Salt Lake City. More specifically, it appears that Russell, Majors, and Waddell purchased earthenware (either for the pottery themselves, or the goods they contained) from a single producer or retail outlet. This is evidenced by the exclusivity of earthenware from the Salt Lake City Group 1, relating to the Bedson Eardley and Frederick Petersen potteries. Tite's (1999:202) theory of commodity fall-off does not work when looking at the Ruby Valley Pony Express Station. Geographical distance did not affect the distribution of pottery, as much as the lack of competition from other potters. No other potteries existed closer to the Ruby Valley location than those located along the Wasatch Front in Utah. With lack of competition, there is a lower threshold against commodity dispersal.

Further evidence against the simple linear fall-off discussions are the INAA results from Cove Fort. First, the relative paucity of earthenware meeting the researcher's criteria at Cove Fort indicates that pottery was not a major part of the archaeological assemblage and thus only a small part of the economics of the site. Of course this assumption is based upon the level of archaeological investigation at Cove Fort and other sample biases. Half of the earthenware sampled came from producers in Salt Lake City while the other 50% came from Group X, which might relate to the nearby E.C. Henrichsen's Provo Pottery, though that claim is unsubstantiated until completion of further work. Cove Fort is roughly 200 miles south of Salt Lake City. There were three historical potteries within 100 miles at Parowan, Ephraim, and St. George, and additional ones in Provo, roughly 150 miles away. The reliance chiefly on Salt Lake City pottery, with so many other consumer choices, seems to indicate a non-market movement of goods.

Cove Fort was a LDS Church endeavor to protect travelers on the road to and from Los Angeles. In an isolated and economically unviable location, the Fort received most of its supplies and support directly from the Church. The INAA results seem to support this historical interpretation as the majority of pottery would have come directly from central Church of Jesus Christ hierarchy located in Salt Lake City. Goods of local traders visiting Cove Fort from Parowan or Panguitch apparently did not include earthenware, as there were no INAA matches in the samples. The lack of a ZCMI cooperative, or even a gentile-owned store within at least 35 miles, suggests that the residents of Cove Fort relied heavily on imported supplies versus a trip to market. This hypothesis suggests that Cove Fort relied on long-distance peddlers or tithing for their supply of earthenware. Given a fall-off model, it is also unlikely that a traveling peddler would transport Salt Lake City produced earthenware such a long distance to Cove Fort.

Nielsen's Grove offers yet another view of the economic, social, and religious factors shaping the dispersal of historic earthenware in Utah. Interestingly, the Nielsen's Grove assemblage lacked any sherds identified as coming from the three defined Salt Lake City compositional groups. Instead, one sherd came from J.J. Hansen's pottery in Hyrum, and four from Group X. It is possible that the compositional Group X reflects E.C. Henrichsen's Provo Pottery. The close physical location of Nielsen's Grove to Provo, coupled with the lack of any sherds from Salt Lake City, possibly suggests a reliance on locally produced earthenware. During the time of the Grove's operation and inhabitance, there were two main pottery operations: E.C. Henrichsen and the Roberts family. The sherds from Nielsen's Grove all date from 1885 to 1950. Only the E.C. Henrichsen pottery operated during this time in the Provo area.

Two sherds in particular provide an interesting glimpse into the movement of earthenware and other goods within the Mormon Domain. J.J. Hansen's pottery in Hyrum, Utah, produced one of the sherds discovered at Fort Douglas and one at Nielsen's Grove. Both Salt Lake City and Provo had powerful earthenware industries, suggesting that these wares would dominate the assemblage. If the markets around Fort Douglas and Nielsen's Grove were saturated with locally produced wares, why would residents purchase pottery from Hyrum? The answer to this question stems from what was in the pottery, not from the ware itself, and relates to why gravity models may not accurately represent earthenware exchange and distributions.

According to newspaper accounts, J.J. Hansen started his pottery in 1869, producing brown and yellow-bodied ware (UJ, 18 September 1889:3). By 1889, Hansen had to

> Construct a large two-story building and increase the size of his kilns to meet the increased demands to his trade. Mr. Hansen has invented several pieces of machinery to aid him in his work. (UJ, 18 September 1889:3).

Interestingly, the Utah Journal states that stores in Cache, Malad, and Bear Lake Valley purchased the majority of Hansen's wares, and all are to the north or northeast of Hyrum. During Hansen's production between 1869 and the mid-1890s, the town of Hyrum became renowned for its locally-grown sorghum sugar cane and the molasses produced from the crop. As reported in the October 3, 1883 Utah Journal:

> The molasses mills are in full blast and the [sorghum] cane is turning out a splendid quantity of molasses…Our locality is well adapted for the production of cane, and molasses has always a ready sale, generally from ninety cents to one dollar a gallon.

Owing to the suitability of the climate to sorghum sugar cane production, a single farmer processed over 140 gallons of molasses in 1886 alone (UJ, 10 November 1886:3). As there is no specific documentation of the use of Hansen's pottery in the storage and sale of molasses from Hyrum, it remains plausible that the fame of Hyrum's chief money crop helped the spread of pottery beyond the local region.

As pottery was one of the means of storing and transporting molasses before the widespread acceptance of glass canning jars in Utah in the 1890s, it is reasonable to assume that locally-procured pottery helped the product to reach market. However, one cannot discount Hansen's role in moving pottery himself as "Mr. Hansen [of Hyrum] sold his merchandise locally and also made several trips a year, during the summer months, with team and covered wagon as far south as Utah's Dixie, selling his wares along the way (Christensen 1969:92)."

It is hard to determine the exact economic mechanism that spread Hansen's earthenware from Hyrum to Fort Douglas and Nielsen's Grove. While the residents of the Mormon Domain used molasses for beer brewing, pudding, and nearly any other recipe requiring sugar, it is not certain that the Hansen's sherds found at the two sites contained molasses at one time or another. The spread of a relatively small operation's wares across a substantial physical distance and against market economics suggests either that the pottery was of higher quality, which is unlikely, or that it contained goods not easily found in these two markets. The larger operations of the Eardley Brothers and Croxall and Cartwright in Salt Lake City suggest that the appearance of Hansen's wares relate to the latter scenario of unique goods.

The sherds submitted for INAA from these five distinct sites help to illuminate a pattern of economic exchange of pottery within the Mormon Domain. This pattern, however, does not follow the fall-off trends espoused by Tite (1999:202) and others (Blalock 1960; Gregory 1963). It appears that the processes at work are of a higher complexity than simple linear regression modeling and data tabulations as discussed by Hodder (1974). There are multiple gradient factors at work in the Mormon Domain, affecting the spread of goods positively and negatively.

A modification of gravity models to accommodate the concept of competition, market isolation, and governmental control is necessary. For the Ruby Valley Pony Express Station, there was a market isolation, which forced those running the operation to purchase from the central economic hub in the Mormon Domain, Salt Lake City. This historical factor excluded large pottery operations in Provo from gaining access to the market of these overland stations in both directions from Salt Lake City. Cove Fort also had no market access, as the closest retail center was nearly 35 miles away, a hefty distance for those in wagons. In the case of Cove Fort, the LDS Church tithing operations superseded market economics, or capitalistic ventures, and had nearly a monopoly on the Fort's source of consumer goods.

Alternately, the strong earthenware industry located in Provo appears to have kept the Salt Lake City wares from reaching the Nielsen family's home. The exclusion of Salt Lake City wares from the Nielsen Grove assemblage has numerous explanations, including the possibility that the pattern reflects the small sample size in both excavations and INAA submissions. Salt Lake City pottery frequencies appear to reach only as far as there is little or no competition in the consumption community.

The workings of Utah's history are incredibly complicated and hard to model due to the unique mixture of religious institutions and doctrines, economic developments and structures, and active agents. So how *did* the economic and social factors at play in the Mormon Domain affect the distribution of a single potter's ware? It appears that even with substantial political, geographic, and economic tensions, few barriers existed for the movement of goods within the Mormon Domain. Salt Lake City's role as economic, political, and religious hub facilitated the distribution of goods produced in the city to some of the most remote regions of the Mormon Domain.

From the interpretation of the INAA data, the single most important factor affecting the distribution of earthenware in the historic Mormon Domain appears to be competition. In markets saturated by local goods, such as Provo and Orem, Salt Lake City pottery did not appear in any numbers. Patterns within the Salt Lake City market itself, namely the materials found at Block 49 and Fort Douglas, suggest domination of the Salt Lake City Group 1. Deposits at these two archaeological sites dated to a wide range from 1847 to the early 1900s. In each instance potters exploiting the clay deposit related to Salt Lake City Group 1 dominated the assemblage. Due to the overlap in potters' wares relating to this compositional group, it is unclear if one production center was more successful than others. Further INAA work is necessary to refine these Salt Lake City compositional groups.

At non-Mormon sites, namely Fort Douglas and the Ruby Valley Pony Express Station, goods exchanged hands through a capitalist and currency based transaction. Residents of Cove Fort acquired pottery through a structured exchange system based on the LDS Church's system of tithing with supplementation of other goods from cash and barter exchanges with local communities. Finally, Block 49 and Nielsen's Grove residents acquired their ceramics by a number of different mechanisms. Tithing redistribution of pottery seems to be of less importance at Nielsen's Grove, as the owner and residents appeared financially self-sustainable through their businesses. Large-scale transitions in the economic make-up of Block 49 make it hard to pinpoint one or even multiple types of exchanges. Salt Lake City had a number of large Mormon and non-Mormon private merchants, ZCMI outlets, and even direct-to-consumer trading with the potters themselves.

Consumption of goods and commodities lived within a complex web of cultural mores, religious values, and active use of objects to support and resist the dominant and subordinate populations in Utah. The 1866 and 1868 boycotts of non-Mormon business establishments, with social pressure applied to those actions of LDS members violating these prohibitions (Garff 1971:84-85), provides a clear linkage for the use of the material to advance political and economic goals. Thus, objects such as pottery are imbued with multiple layers of meaning and even played central roles in the shaping of Utah history and statehood.

Glass canning jars, indoor plumbing, and the availability of high quality imported ceramics doomed the potting industry. This followed a pattern affecting many of the small local industries including the cooperative furniture market discussed in Main (2001). Consumption habits changed dramatically by the end of the nineteenth century as, "Mormons initially resisted external influence by manufacturing and promoting local [products], but ultimately failed in their [producers] efforts to convince people to demonstrate loyalty to their church through their consumption habits (Main 2001:212)." Greg Umbach (2004) goes into detail regarding the consumer revolution in Utah from 1847 to 1910, also suggesting that from the first years in Utah, Mormons fought a battle within themselves, on one side purporting a self-sufficiency doctrine, while on the other side envying the material goods of the fashionable east. The revolutionary change in consumption behavior ended many local manufacturing businesses in Utah. Local newspapers continued to espouse local consumption in support of local industry, even when E.C. Henrichsen was producing thousands of gallons of pottery, as the Utah Daily Enquirer hoped that "his business will continue to grow till all importation of such ware as he makes shall cease" (DE, 16 February 1894:4).

Ultimately, the attempts at self-sufficiency failed to hold back the importation and adoption of non-Mormon produced goods including pottery. The use of pottery as a symbolic representation of home industry and its religious connotations to the members of the LDS Church is an important object-based interpretation of archaeological materials. Church hierarchy used pottery as a tool to highlight the importance of locally produced goods in consumer choice amongst its membership. Pottery, in essence, became a center hub of social tensions over consuming local versus global.

Understanding the realm of consumer choices within the Mormon Domain's economy, and then studying the choices on an individual level, as represented by material objects, can provide the physical linkage of artifacts to theory (Bourdieu 1977; Giddens 1984; Garfinkel 1984). Use of objects in social contexts struggling over local consumption of local production is a key concept in agency theory and can be seen as a resistance activity to outside forces. Started in archaeology by Ian Hodder (1982), agency theory literature increasingly expanded in volume and influence through the 1990s and 2000s (Barrett 2000; Dobres and Robb 2000; Shanks and Tilley 1987; Wobst 2000). Historic research, archaeological investigations, and archaeometric analyses seem to bring forth a picture of an active consumer in Utah that has theoretical implications beyond the region.

Conclusion

Even with a decidedly small and non-statistical sample size, it is clear that locally produced pottery in the Mormon Domain was socially situated in a complex web of production, consumption, political, and even a theocratic milieu. Tensions between the local communities in the Mormon Domain and the surrounding American interests created a situation where pottery production and consumption symbolized resistance to these overpowering influences. Even with this strong support of local industry, and the admonishment of those who failed to consume locally, the LDS domestic pottery industry disappeared by the early twentieth century.

There were extensive trade networks existing in the Mormon Domain even before the arrival of the transcontinental railroad. Goods traveled through an increasingly complex network with reciprocity, redistribution, and market exchange invariably expressed at local, state, and regional levels. Pottery also moved against significant distance gradients, through mechanisms only cursorily known at this time. Further research and more robust sampling of archaeological pottery samples from historic sites in Utah and surrounding states will hopefully yield a more fine-grained analysis of these complex networks.

There are few studies of historic material culture in the Mormon Domain from an archaeological perspective, especially those attempting to understand anthropological patterns of consumption. Further, the INAA results presented here and those by Scarlett (2002, 2006) suffer from a lack of data due to a limited pool of identified samples and formally excavated sites. It is hoped that future scholars will continue to grow the INAA database established by Scarlett (2002) and Merritt (2006). There are clear indicators that mapping exchange and consumption trends in historic-era Utah will help to refine our understanding of larger human patterns. The unique social, religious, and economic underpinnings of the Mormon Domain provide a fertile ground to investigate and test human behaviors and cultural traits. ■

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Steward's Lost Tipis Petroglyphs Found

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Missing rock art is nearly impossible to track down and is rarely recovered, but in the case of one boulder covered in petroglyphs that was removed from Connor Springs in the early 1940s and placed on display miles away in Tremonton, Utah, a community has preserved it. Anthropologist Julian Steward photographed it in the 1930s and speculated that some of the glyphs were "tipis".

On a rocky hill above Connor Springs at the southern end of the Blue Spring Hills in Box Elder County, Utah, are numerous boulders and rock walls covered in petroglyphs incised and pecked by Promontory/Fremont people (Simms 2008; Steward 1937). The site is on private ATK land with restricted public access. In April 2009, the authors, along with Mark Stuart and an ATK employee, hiked the hill on a USAS chapter field trip with permission granted from ATK to photograph the rock art.

In 2010, Nina Bowen, a rock art investigator with URARA, contacted the authors with a tip about a petroglyph-covered boulder at an LDS church meetinghouse in Tremonton, Utah. We drove there to find and photograph it (Figure 1). Mountain West Digital Library's collection of black and white photographs in the Frank A. Beckwith Collection, titled "Kanosh, Black Rock, Pumice and Connor Spring, scrapbook [25]", includes a photograph taken by anthropologist Julian Steward at Connor Springs in the 1930s (Figure 2). It is titled "Tipis" and appears to be the exact same panel as the one located in Tremonton. This photo was also included as Plate 9 in Steward's book about his excavations at Promontory Caves (Steward 1937). It appears with a photo of a petroglyphs panel adjacent to the Tipis boulder. In Steward's view, "the row of triangles…conceivably represents a camp circle of tipis." His photo is nearly a perfect match to the petroglyphs boulder that one of the authors photographed in Tremonton, and it confirmed a report of a 'missing tipi panel' (Mark Stuart, personal communication, 2010).

Figure 1. Tipis petroglyph boulder at Tremonton LDS church building.

History

The Blue Spring Hills are situated north of the northern Promontory Mountain Range above dunes and salt marshes, which includes Salt Creek Waterfowl Management Area north of Little Mountain. Several springs flow across private land there. In August 1841 the First Overland Emigrants-Bidwell-Bartleson Party camped overnight on their trail westward at these

Figure 2. Tipis petroglyph boulder before it was removed from original location. Photo courtesy of Mountain West Digital Library, Frank A. Beckwith Collection.

springs, which were later named Connor Springs (Hamilton 2008). The nearest town is Penrose where early ranchers made use of the springs and grasslands that the Shoshone Indians had long used (Huchel 1999). Locals named the springs in honor of General Patrick Edward Connor, a respected Indian fighter who led his troops in the bloody Bear River Massacre of Shoshones on January 29, 1863 near Preston, Idaho (Wagner 2010).

The springs were an important water source for nomadic Promontory/Fremont people and perhaps a neutral ground between neighboring kin-groups. While none had exclusive water rights, the Fremont may possibly have managed the springs, salt marshes, and the surrounding hunting land. Copious amounts of rock art on the hill overlooking Connor Springs attest to the marshland's significance.

Description

The Tipis boulder originally sat on the same hilltop above Connor Springs where several hundred petroglyphs were incised and pecked onto dark patina surfaces of calcareous sandstone. Its removal occurred between 1937-1941, according to one of the authors' aunts, nearly a decade prior to when ATK (Thiokol) built their Promontory Complex in 1957, then surrounded the property with security fencing. Fremont anthropomorphs are the predominant petroglyph figures at the site. Several petroglyphs appear to be superimposed on Archaic period glyphs. Some petroglyphs are similar to the Fremont-influenced Great Basin curvilinear style. The upper edge of the Tipis boulder panel was bordered with an abstract 'sawtooth' element (Schaafsma 1971) like a row of tipis.

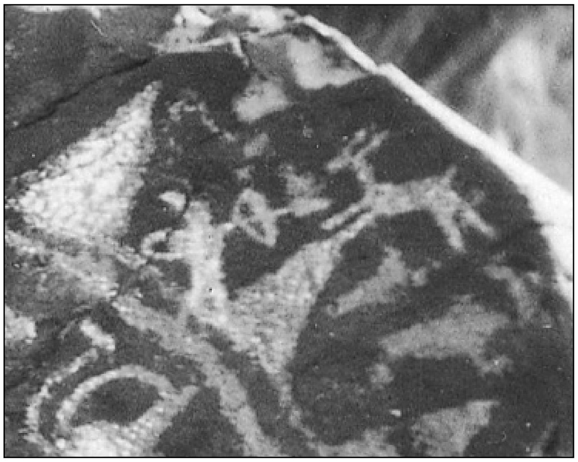

Figure 3. Hunter aiming at deer on Tipis boulder.

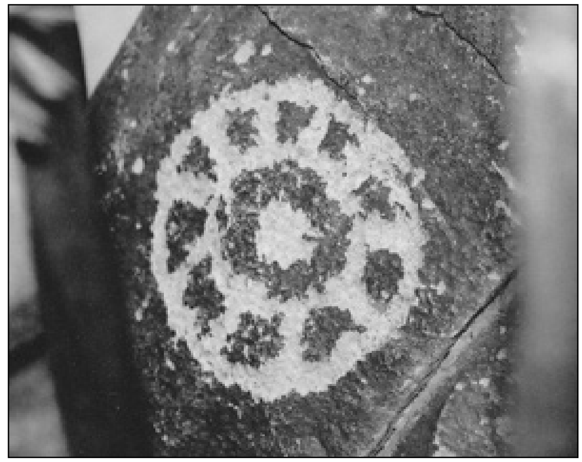

Figure 4. Spoked sun disc on Tipis boulder.

It is the interpretation of one of the authors that it might instead possibly be a panoramic depiction of the Wellsville Mountains located east of Connor Springs, similar to mountain-like glyphs on the upper edge of a petroglyphs panel boulder discovered by the authors in Willard (Stuart 2009). The symbolism of sawtooth glyphs as "tipis" or "mountains" remains open to other interpretations. Ten or more anthropomorphic figures represented on the Tipis boulder include a hunter aiming a bow and arrow at a deer (Figure 3) in or near the tipis/mountains. A spoked sun (Figure 4) can be seen on the far right end of the panel high above the tipis/mountains. Four of the sawtooth triangles were broken off on the top far left, but are visible in Steward's photo. The far right of the adjacent panel was also broken off during the removal of the Tipis boulder, and is still missing.

Conclusion

In its current location on the north side of the Tremonton LDS church meetinghouse at 200 North and Tremont Street, the Tipis boulder is displayed next to a brick wall and a window enclosed behind an iron fence with an unlocked gate. There is no signage, nor anything that answers the questions of when, how, who, or why the boulder came to be there, nor a word of caution, like "Please don't touch the rock art." For decades hundreds of people have touched the boulder through the fence, unwittingly causing minor erosion of the petroglyphs. A sign placed by the fence could certainly help educate people about preserving the rock art.

Across the street is a public park, and most of the community knows about the boulder's presence at the meetinghouse. The boulder, the authors were informed, will remain where it is. An obvious concern to LDS church leaders and several USAS members is that moving and returning it might damage the petroglyphs. Over eighty years ago, Steward took a good photograph of it. If one hundred years from now his photo is still preserved in a digital collection or in his book, it may stand a good chance of outlasting the Tipis rock art itself, which is vulnerable to human-caused deterioration over time. ■

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A Painted Fremont Pithouse

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Painted walls have been found in kivas in the Ancestral Puebloan region of the Southwest, but this phenomenon is unknown among the Fremont. This paper reports the first discovery of painted walls on a Fremont pithouse located in Monroe, Utah, in the Sevier River valley. The geometric designs are reminiscent of those found on rock art in the same region.

The purpose of this paper is twofold. The first is to describe a lost opportunity for scientific research, and the second is to document a very rare painted Fremont pithouse. This is the only occurrence of a painted Fremont pithouse that I am aware of, making it a possible first in Fremont archaeology.

A number of years ago, my friend Jeff Roberts showed me a Fremont habitation site in the Sevier River Valley near the town of Monroe, Utah. The site, which is on private land, is in the middle of an old cattle feedlot constructed on an elevated rise of high ground at the mouth of Monroe Canyon. Before the water was taken for modern irrigation, Monroe Creek flowed near the site. The area surrounding the site was known locally as a good place to look for Indian arrowheads.

The top of the high ground on which the site was built was leveled many years ago to construct the feed lot. This feed lot was used for a number of years before it was abandoned. After the abandonment, the land owner allowed some individuals to use a backhoe to trench the old feedlot to search for Indian artifacts. At the time of our visit, several long backhoe trenches around three feet deep had been dug across the site. Once prehistoric features had been located, the trenches were dug with shovels to search for artifacts. It appeared that all decorated pottery sherds, stone tools, and other diagnostics had been collected. Numerous plain gray sherds were thrown into an old water trough. The ceramics I examined would likely be classified as Sevier Gray with abundant black igneous temper.

Unfortunately, the backhoe trenches had cut through the floors of at least two pithouses and a probable adobe surface granary, which had been largely destroyed by shovel excavation. It is the second, more intact pithouse that was the object of my attention.

This pithouse was around fifteen feet in diameter and was square with rounded corners (sub-rectangular). This type of construction likely places the structure in the late Fremont period, dating after 1150 AD. The excavations had destroyed the south half and west wall of the structure. The floor was hard-packed clay. At the center of the house was a clay-rimmed hearth two and a half feet in diameter (Figure 1). On the partly intact north wall of the structure was an extraordinary panel painted in red geometric designs. The panel was four feet long, two and a half feet wide, and approximately one foot above the floor of the structure. The design was painted on a background of whitish/cream plaster. The geometric designs were painted in red paint (probably red ochre) and skillfully executed with great care (Figure 2). A drawing of the design is shown in Figure 3. There may have been another painted panel to the left of the mostly intact

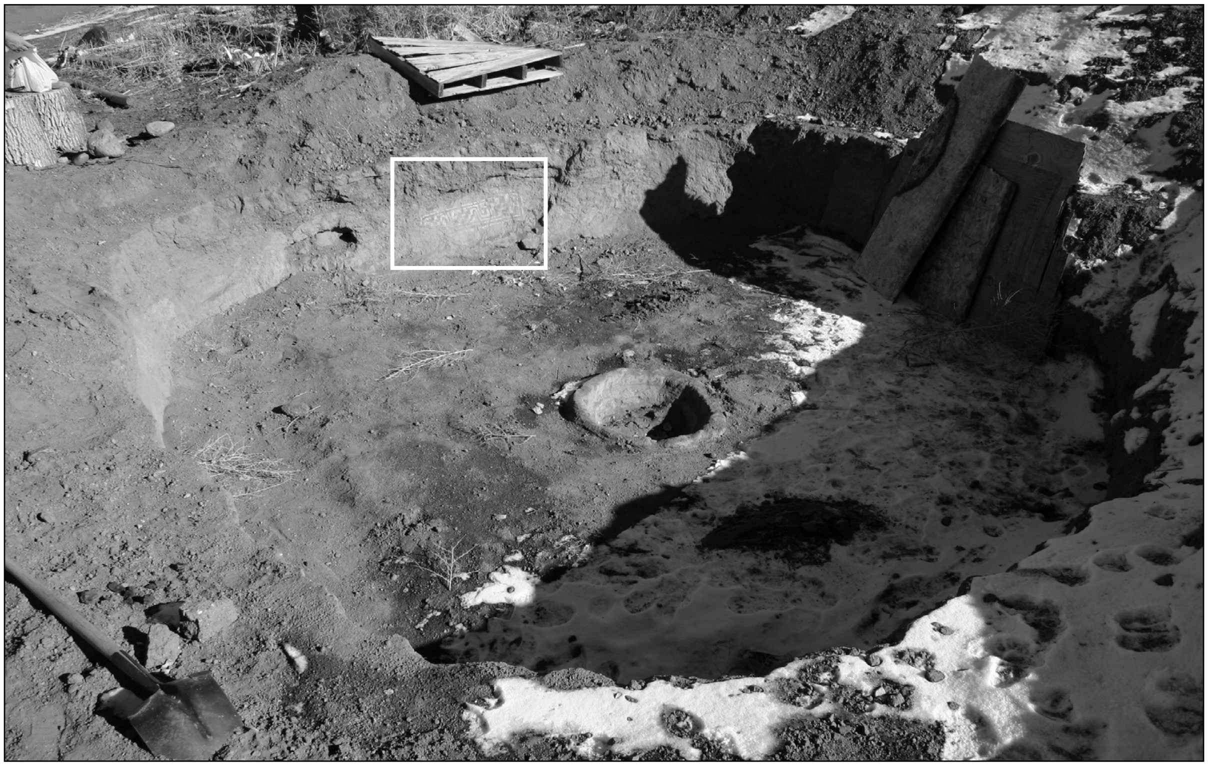

Figure 1. Overview of the Painted Pithouse showing the clay-rimmed hearth (center) and the red painted panel above on the north wall (highlighted by box). Photo courtesy of Utah State History.

panel, but the shovel excavations appear to have destroyed most of it. I had not, in my experience, seen anything like this painted pithouse.

A literature search of published scientific excavations of Fremont sites did not turn up any painted pithouses nor did my conservations with several other archaeologists reveal knowledge of such a thing. The closest parallel I could find was the occasional painted Anasazi kivas in the Mesa Verde region of southeastern Utah and southwestern Colorado (e.g., painted kivas at Lowry Ruin and Comb Wash). If so, this may be a first in Fremont archaeology and another indication of Ancestral Puebloan influence or ties to the Fremont. Whether the red painted design was ceremonial or merely decorative cannot be determined and requires further research.

An interesting parallel can be found in the famous red blanket pictograph in nearby Clear Creek Canyon (Figure 4). Jeff Roberts (personal communication, 2014) also knows of four other red blanket pictographs in the Richfield area. This style appears to be restricted to the Sevier Valley of central Utah.

Upon recognizing the significance of the site, Jeff Roberts contacted archaeologist Renee Barlow (then at the Eastern Utah Prehistoric Museum in Price, Utah) who visited the site. Assistant Utah State Archaeologist Ron Rood was also notified. These professional archaeologists

Figure 2. Red painted panel on north wall of the Painted Pithouse. Photo courtesy of Utah State History.

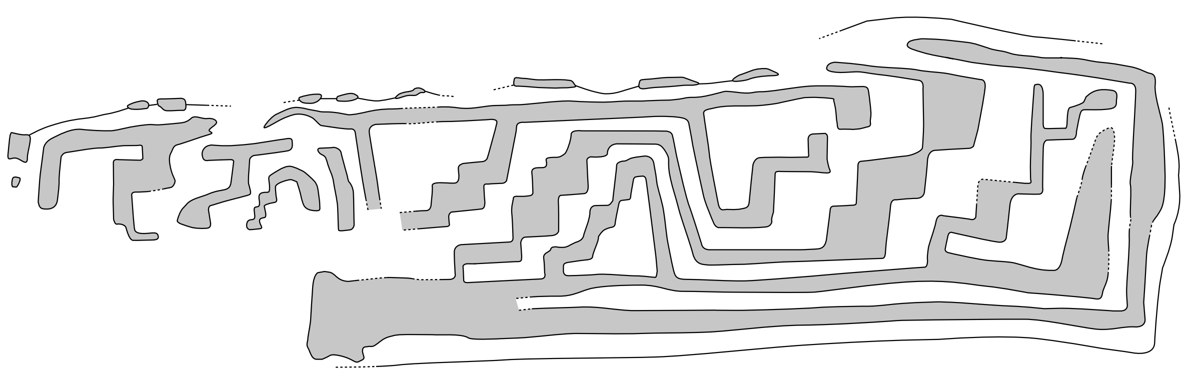

Figure 3. Reconstructed drawing of the Painted Pithouse design.

Figure 4. Red blanket pictograph in Clear Creek Canyon.

contacted the land owner and asked that the non-professional excavations be stopped and scientific research undertaken. The land owner was not cooperative at that time and all access to the site denied. The status of this important site at this writing is unknown. It is hoped that this brief report adds another page to the ongoing study of the Fremont complex. ■

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Book Review

"From Mountain Top to Valley Bottom: Understanding Past Land Use in the Northern Rio Grande Valley, New Mexico" edited by Bradley J. Vierra. University of Utah Press, Salt Lake City, 2013. ISBN-13:978-1-60781-266-1

Review by Byron Loosle, Division Chief - Division of Cultural, Paleontological Resources and Tribal Consultation, Bureau of Land Management.

Syntheses like this volume fulfill important roles as the archaeological discipline strives to develop a landscape approach. Although much of the detail and in-depth discussion contained in the volume is primarily beneficial to the regional, or in the case of the obsidian and climatic reconstruction chapters, topical specialists, the student of Utah archaeology can gain something from this valuable effort. A great deal of cross fertilization can occur when we understand the trends, issues, theories, and patterns observed in other regions of similar environmental and cultural complexity. This is especially the case for this volume with its emphasis on understanding the lowland and upland regional use by hunter-gatherers and farmers. The volume is divided into three sections called Landscape, Movement, and Technology. The sections on Movement and Technology cover most of the relevant cultural developments or artifact classes for the region. Although the Landscape section does not provide a complete overview of the local environment, it has important chapters with significant conclusions for paleo climatic reconstruction, obsidian sourcing, and local geoarchaeology.

At first glance, it seems that one of the shortcomings of this volume is the difficulty of constructing regional trends and patterns because of missing data. This was particularly apparent in the concluding chapters discussing flora and fauna used for subsistence. Although good data was available for some site types and particular localities, the authors found broad regional overviews and trends difficult to create. However, that is precisely one of the most important values of developing a regional synthesis which can identify data gaps and questions that need further exploration. Another example can be found in Vierra's very provocative ending discussion. At one point, he questions the conclusion an author made in one of the book's chapters, "whether it is really credible to claim that low temperatures prevented the dispersal of farmers north of La Bajada at the same time as Fremont farmers were spreading all the way to northern Utah." Perhaps, he suggests, the number of frost free days, moisture, or other factors were just as important. More accurate and complete data is needed to address this issue and he lists some of the types of data that could be collected or helpful to the discussion, effectively pointing in the direction of relevant future research.

Another benefit of a regional overview is that localized trends and patterns often make more sense in a wider context. In the geoarchaeology chapter (Chapter 2) aeolian events could be explained more adequately than could be with localized data. The climatic reconstruction chapter (Chapter 3) noted that the severe drought at the end of the 1200s in the San Juan region never occurred in the Northern Rio Grande and probably explains why large numbers of refugees appear to have moved into the area. This chapter also notes that while climatic patterns were similar in three environmental areas within the region, there were dramatic year-to-year differences between the zones. The net effect was that nearly residents in at least one zone always would have been able to produce a surplus when other zones experienced drought in any particular year. Appropriate social connections would have enabled residents to transfer supplies and helped buffer them from environmental fluctuations.

A regional perspective can also help define larger cultural patterns. Although the Northern Rio Grande region was occupied through much of prehistory, for example, agriculture and village life came much later than most other areas of the southwest. Initially the farmers occupied the lowlands and river valleys and then moved into the uplands, as some of the authors theorize, when new strains of maize or new techniques (mulch gardens) were developed.

Chapters 5 on the Archaic period and Chapter 6 on the Transitional Period are particularly interesting to the Utah archaeologist. Some of the same trends and patterns occur in the Northern Rio Grande as in Utah. This is especially the case in the Transitional Period when foragers and famers were interacting, as has been argued for the Fremont of Utah. Other chapters are of more localized value. For instance, in some cases early Rio Grande farmers appear to have been bi-seasonal with a mixed economy. They raised domesticates for part of the year, while exploiting the uplands or other environments in other seasons as may have occurred in the Uintas, Range Creek, and Nine Mile Canyon. There is considerable discussion and debate about the role migration and movement of populations played into various aspects of the regional prehistory. Although most authors see major movement of San Juan populations after collapse in the Mesa Verde region, at least one author sees a long record of continuous occupation by a local group. Migration theories and patterns are useful to understand for groups occupying southeastern Utah, west of the San Juan area, but also generally for the student of Fremont archaeology. The Gallina culture, discussed in Chapter 7, is a unique high elevation culture that only occupied areas above 7,000 feet during a favorable climatic period. Their brief occupation, use of towers, and relatively small pueblos bear some similarities to the Ancestral Puebloan occupation in Beef Basin northwest of the Abajo Mountains.

One of the clearest examples of transhumance movement between the lowlands and uplands was discussed in Chapter 8 for the historic period Jicarilla Apache. They lived in secure areas on Spanish land grants seeking protection from the Ute and Comanche. They essentially developed a symbiotic relationship with the local Hispanic or Anglo communities farming or providing labor during some seasons. They traveled to the uplands for hunting and to secure trade goods (clay, meat, leather, medicinal herbs) for other lowlands residents. As with so many other instances, it appears the particular arrangement only worked for a short period of time. Then political, social, and environmental changes disrupted the system. Although the Utah Ute practiced similar seasonal movement, they were never as integrated into the local Anglo economy as the example in this chapter.

The Technology section presented several ideas of interest to Utah researchers. The Chapter 9 discussion of trends in Archaic projectile points mirrors those in Utah. The author argues they are a result of functional changes and perhaps related to advances in technology, or performance in killing animals. However, Vierra in his concluding discussion, wonders if social factors were also at play. The chapter 10 discussion of maintainable versus reliable systems of pottery is reminiscent of Simms and Ugan's mobility theory that has become common in Fremont pottery analysis. Incorporating a broader array of characteristics and aspects of the production sequence could make the Simms application even more robust.

This volume is worthwhile for the Utah archaeologist to review, to stimulate ideas, and generate discussion of our local theories and approaches. It is especially helpful as an example of a regional overview that synthesizes available data, addresses important research questions, identifies data gaps, and helps develop hypotheses for future research in Utah. The collaboration, discussion, and participation of multiple authors involved in a wide spectrum of research and locations clearly benefited this volume.