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Utah and the Latter-day Saints

Pottery in the Mormon Economy: An Historical, Archaeological, and Archaeometric Study

ABSTRACT

Pottery production was important to Latter-day Saint communities and distinguished these towns from their non-Mormon neighbors. The potters and workers left scant records that reveal how their wares fit into Utah's theocratically organized economy. Potters and potteries of 19th-century Utah and the Mormon Domain were part of an archaeological survey conducted between 1999 and 2000. The research project yielded examples of kiln wasters that could be subjected to instrumental neutron activation analysis (INAA). The results demonstrate the utility of integrating primary records and archaeometric tools in the study of historical era economic processes. Data also indicate the applicability of the approach for potteries in close geographic proximity and to determine patterns of variation within site assemblages. The authors propose an anthropological research program to explore the economics of religion in Mormon Utah, combining the analytical power of archaeometry with the contextualized questioning possible in historical archaeology.

Introduction

Researchers with the Utah Pottery Project have studied the region's immigrant pottery makers since 1999. They began by cataloging those individuals who immigrated to Utah during the 19th century and went to work in pottery shops. Researchers have identified the locations of the shops and factories and selected a subset of those sites for archaeological testing. Archaeological excavations and archaeometric analysis, interpreted within a detailed historic context, have shown great promise as tools to reconstruct the potters' experiences. By integrating all types of data available to historical archaeologists, researchers will be able to measure economic and social interactions within Latter-day Saint communities.

In 1846, Brigham Young led his followers into the "First Mormon Diaspora" as they evacuated from Illinois (Goodsell 2000:357). The Latter-Day Saints had experienced a repeating pattern of settlement, stress, conflict, and retreat as community conflicts drove them from New York progressively further into the west to Kirtland, Ohio; Independence, Missouri; and then Nauvoo, Illinois. Finally driven from Nauvoo in 1846 with the murder of the prophet Joseph Smith, the new leader, Brigham Young, led his followers into Spanish-held territory of the Intermountain West. Ten thousand people followed the first settlers in 1847. Continual immigration brought approximately 60,000 more over the next 20 years (Wahlquist 1978:115; May 1992 for a critical reassessment of these population estimates).

Young and his advisors directed settlers to establish more than 350 communities throughout modern Utah, Idaho, Wyoming, Colorado, New Mexico, Arizona, Nevada, California, and parts of Canada and Mexico. They began with an inner cordon of towns along the front of the Wasatch Mountains and then expanded their settlements along the "Mormon Corridor" from the Great Salt Lake in Utah to San Bernardino, California (Arrington 1958:84–86; May 1992:125). By 1900, the number of Latter-day Saint communities had surpassed 500 (Rosenvall 1978:52).

The settlement process was highly organized. Church leaders substituted centralized planning for the external capital that drove other colonizing settlements in the region. The Mormon settlers built transportation systems, immigration networks, cooperative merchandizing institutions, utopian settlements, and innovative hydraulic management systems—all of which included new legal and social relations. Ecclesiastical leaders called upon the faithful to serve as missionaries. Many of those would travel the world to teach the Mormon gospel, but "others were called to mine gold, manufacture iron, raise silk, settle a disagreeable country, and teach Indians the arts

of agriculture” in order to build up their desert Eden so it could become God’s Kingdom on Earth (Arrington 1958:33).

Religious ideals merged with social and economic practices in daily life. The unique settlements created by Latter-day Saints were so distinct from their neighbors’ towns that scholars eventually recognized them as a “folk hearth” of one unique culture area within the United States. The new culture and pattern have been described in significant works by sociologist Lowry Nelson (1952), economic historian Leonard Arrington (1958), the geographers Daniel W. Meinig (1965) and Richard Francaviglia (1970, 1978), and the anthropologist Mark Leone (1978, 1979).

Since 1999, the Utah Pottery Project has chronicled the experiences of the immigrant potters that experienced the Latter-day Saint colonization of the West. Insights gained from historical, archaeological, and archaeometric research into the potters’ experiences demonstrate the utility of a research design that creatively incorporates both historic and scientific data. Instrumental neutron activation analysis (INAA) was used to examine artifacts recovered from archaeological survey and excavation. INAA proved to be a viable tool to measure the pottery business in Utah’s rapidly globalizing 19th-century economy. Along with an assessment of the long-term research enabled by this study, the authors propose a program of research for historical archaeologists in the Mormon Domain that includes large-scale analysis of regional social and economic trade networks concurrent with microscale ecobiographic studies of individual potteries.

Utah and the Latter-day Saint Potters

Between 1848 and 1929, European and European American immigrants founded more than 45 potteries in at least 26 towns and cities surrounding the Great Basin region of North America (Figure 1) (Table 1). Leaving behind their native environments and economies, these potters re-created their craft in new and different ecosystems within a new matrix of social relations. Transferring their knowledge created more than just technological and ecological problems because they moved to new or established communities with entirely new economic and

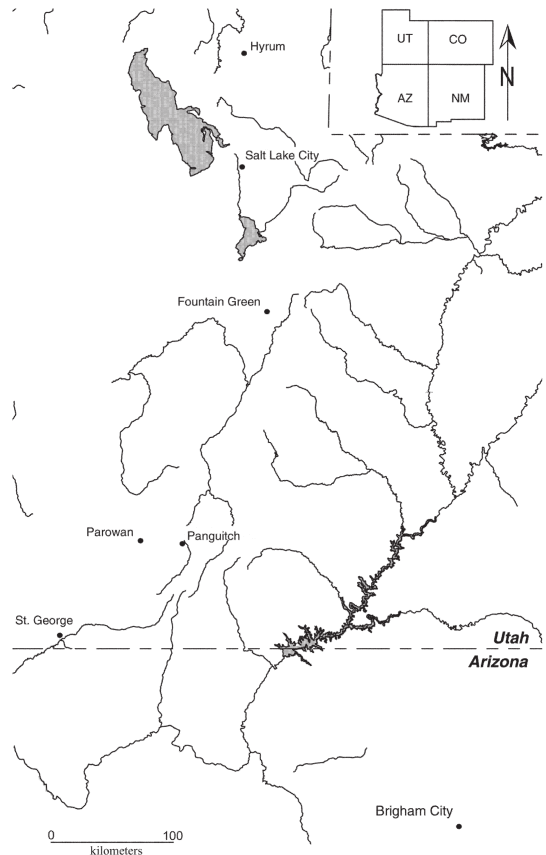


FIGURE 1. Utah and northern Arizona showing major physiographic features and site locations discussed in the text. (Map by Robert J. Speakman, 2004.)

ideological systems (Meinig 1965:193,213–217; Francaviglia 1970, 1978).

Centered in Utah, the industry included shops distributed from Logan to St. George, Panguitch to Vernal, but also in Idaho, Arizona, and Nevada. Considered as a whole, potters made improved and unimproved earthenwares with red-, cream-, and buff-colored fabrics. Some individuals eventually manufactured stoneware. Their products ranged from storage jars to piggy banks, from flowerpots to teapots, from umbrella stands to chimney liners, crucibles, brick, and tile. Pots and other products were bartered, traded, and sold in pottery shops and retail stores, from family wagons, and by independent peddlers. They were even shipped by railroad to distant markets. People used pots in reciprocal gift giving and in the church’s tithe-based poverty relief system.

TABLE 1
INSTRUMENTAL NEUTRON ACTIVATION ANALYSIS SAMPLE SUMMARY

Site Name	City	Operational Dates	National Origin	Quant	Sample Numbers	Context/Collection Strategy
Bedson Eardley Pottery	Salt Lake City, UT	1860/68–1896	England	18	TJS001–TJS018	primary deposition, highly disturbed salvage.
John Eardley Pottery	St. George, UT	1867–1903	England	3	TJS019–TJS021	secondary deposition, highly disturbed surface survey.
Peterson Pottery	Salt Lake City, UT	1860–1898	Denmark	8	TJS022–TJS029	primary deposition, salvage context.
Bethelson Pottery	Fountain Green, UT	1878–1888	Denmark	11	TJS030–TJS040	secondary deposition (plow-zone), surface survey.
Lowell-Roberts Pottery	Panguitch, UT	1875–1882	United States	20	TJS041–TJS060	primary deposition, shovel test probe and wide area excavation, plow-zone surface survey.
Davenport Pottery	Parowan, UT	1853–1888	England	20	TJS061–TJS080	primary deposition, shovel test probe and wide area excavation, plow-zone surface survey.
J. J. Hansen Pottery	Hyrum, UT	1860–1914	Denmark	20	TJS081–TJS100	primary deposition, shovel test probe survey, plow-zone surface survey.
Behrman Pottery	Brigham City, AZ	~1875–1881	Germany	7	PDL403, PDL 423–PDL428	primary deposition, wide-area excavation.

Local potteries flourished following the construction of the transcontinental railroad. Only the death of the artisans halted production. The potting business, meanwhile, was transformed during these potters' lives, and the craft was reborn as both a capitalized industry and an art form. The archaeological study of these potters provides an under-recognized source of insight regarding the interconnected nature of economic production, exchange, and consumption within a culture region.

The lives of Utah's potters provide stories that are both compelling and important. Their lives do not reflect the typical experiences of Latter-day Saint settlers throughout the Mormon culture area because these artisans lived widely varied lives. They struggled with the industrialization of ceramic production and the steady growth of a heavily capitalized economy of scale in the cores of the ceramic industry. They mediated the increasing obsolescence of their technical skills within a globalizing economy through a

myriad of localized strategies. Their profession and shops were important economic and social symbols of permanence.

Some of the potters worked through and after the complex process of Americanization of Utah around the turn of the century, when the Mormon kingdom lost its distinct identity and became much like (although not identical to) the rest of the nation (Sorenson 1997:84–85). The United States government and the economic leaders from outside the region attempted to break the Latter-day Saints' control, particularly their economic and political independence. Anti-Mormon efforts, which culminated in the 1882 Edmunds Act, the 1887 Edmunds-Tucker Act, and the United States Supreme Court's 1890 upholding of Edmunds-Tucker, broke more than the institutional practice of polygamous marriage. The acts also forced divestiture of church control over local businesses and real estate and scaled back ecclesiastical involvement in economic planning and the courts (Arrington 1958:358–362).

Potteries in Latter-day Saint Communities

During the first 30 years of settlement, the economic development of Utah was generally a highly planned process, of which the creation and evolution of the pottery shops were one part. Timothy Scarlett (2002:appendix A) has completed a catalog of operative potters and, when possible, identified the sites where they worked. Archaeological surveys between 1999 and 2000 produced a collection of earthenware samples from seven potteries in six different cities and towns. An eighth pottery had already been examined at the Archaeometry Laboratory at the University of Missouri Research Reactor Center (MURR) (Lyons 2001).

Existing historical information permitted the listing of each site with its principal partners or master potters (Henrichsen 1988; Scarlett 2002). Of the potteries mentioned in this study, three were founded and operated by immigrants from England, three from Denmark, one German, and one European American from the eastern United States. All of the potters joined the Church of Latter-day Saints before immigrating and came to Utah under some degree of direction from the church authorities. The potters in this study presumably intended to set up shops upon their arrival. Although many pottery workers came to Utah from Europe, only a small fraction either founded or worked in local potteries. Most presumably took the opportunity to establish themselves as farmers or laborers in other businesses.

One should not generalize from the chronological framework and imagine these potters as isolated inventors working alone in town-defined vacuums. The master potters and workers knew each other over several decades, and their relationships were at different times secular and religious, consanguine and affinal, and pedagogical and wage-based. Productive decisions in each pottery were made by several people, including the master potters, spouses, workers, apprentices, and laborers. The pottery artifacts must be understood as the products of all these individuals working together.

The church leaders were involved in the pottery industry initially during settlement. Ecclesiastical officials had called a group of Staffordshire immigrants to establish a pottery factory in Nauvoo, Illinois, and they called

another to build a factory in Salt Lake City soon after settlement in 1847. The immigrants' positions within the factory system of Staffordshire remain to be determined, but presumably, they were skilled in different segments of production. This first immigrant group established the Deseret Pottery Company, which commenced work in 1848 and sporadically produced small quantities of earthenware. The leadership continually struggled to implement industrial processes, and despite a change in leadership at the factory, the workers remained frustrated in their attempts to make lead glazed, slip-cast refined earthenware. The enterprise eventually consumed approximately \$17,000 of the church leaders' cash and commodities reserves (Scarlett 2002:119–120).

While these English immigrants struggled to resolve sustainable manufacturing processes, two other sets of immigrants became successful producers without direct and ongoing financial support from church leaders. American Horace Roberts immigrated to Utah, and the church authorities sent him to establish a pottery at Provo. He built a family-operated craft shop and began successful runs of earthenware production in 1852. A small group of Danes also arrived that year, their travel financed by a church-directed fund. One of these Danish immigrants, Niels Jensen, had operated a small pot shop in Denmark. Jensen and his young apprentices quickly adapted their techniques to the Great Basin's resources, operating their pottery steadily after 1853. Roberts's and Jensen's successes prompted church leaders to withdraw direct financial support of the English factory workers. The church authorities disbanded the Deseret Pottery Company and assigned the former factory managers other tasks. Some took up missionary duties in Staffordshire, while others set up small pot shops in various newly established settlements throughout the territory (Henrichsen 1988:362–363; Scarlett 2002: 165–170).

These events might lead one to argue that the traditional skills of family-based, craft production gave the preindustrial potters an advantage transferring their technological system, since those potters had often mastered the entire production process. Factory workers, on the other hand, had different skill sets specialized for that mode of production. A thrower probably lacked

most knowledge of clay preparation, and a kiln fireman understood nothing about matching fabric chemistry to glaze properties.

This preadaptation explanation may be naive because another set of English immigrants established a pottery shop in 1861. Led by the three Eardley brothers, these English immigrants successfully operated a smaller shop using the same productive techniques attempted by the first Deseret Pottery Company. This transfer of a technological system, or the potters' failure to adapt, will remain a complex problem requiring more study before explanations can be resolved (Scarlett 2002:71).

Archaeological samples from eight different potteries were examined. Those potteries, summarized in Table 1, represent several different productive strategies. Even though the technology of production always included hand-thrown vessels made upon wheels using local clays, some potters (like Bedson Eardley) supplemented this with slip-cast vessels and even jolly-pressed flatware (Scarlett 2002:71). Given changes in production technology, each potter also resolved traditional forms and fashionable decorative styles within new, multiethnic markets (Behrman pottery). Different pottery shops would be grossly stereotyped if generalized into a single immigrant potter experience.

Differences in production ran deeper than merely technology or style. Many potters established their shops because of direct influence from the church leadership (Behrman, Davenport, Lowell, John Eardley), while others seem to have decided where to locate their shops independently (Bethelson, Petersen, Bedson Eardley). Most of the potteries in the study were entirely owner operated, independent of direct ecclesiastical supervision. Bedson Eardley ran his pottery for a time as a cooperative business with several other Staffordshire immigrants. While they operated their co-op independent of the church leadership, their common religious identity facilitated the shop's operation (Scarlett 2002:169–177).

The Brigham City Cooperative Pottery, operated by Ferdinand F. Hansen, operated under direct ecclesiastical direction. The local church bishop, Erasmus Snow, also served as the director of the Cooperative Mercantile Association. The pottery was one division of the association. Thomas Davenport donated his shop to the

United Order, one of the utopian organizations designed by Brigham Young to help local producers circumscribe outside competition following the completion of the transcontinental railroad. He and his family continued to work the shop, while a local leader advised them on production decisions in consultation with the church leadership in Salt Lake City (Scarlett 2002:170).

Some of the potteries operated on family labor (Lowell, Roberts, Davenport, Bethelson), while others mixed family, apprentices, and paid laborers (Bedson Eardley, Petersen, Hansen). The Roberts family was a craft dynasty in Utah where several generations practiced the craft over 60 years. Other producers appeared only briefly in the region (Bethelson, Lowell). Church leaders often facilitated wage labor agreements and apprenticeships for newcomers, so they were put to work in a pottery shop until they could be settled onto their own property (Petersen, Behrman) (Scarlett 2002:175–176).

The potteries of Mormon Utah were diverse and while each potter worked within a context infused with religious meaning, each potter's situation was different from the next. More detail about each individual site and potter can be found in Scarlett (2002), Kirk Henrichsen (1988), and Emma Nielson (1963). Table 1 summarizes the relevant information about each pottery covered in this study, including the date of first founding, date of final operation, and the master potter's birth country. Some potteries listed here had several years of intermittent operation, produced wares under various official names, and periodically changed staff.

The Social Business of Potting

Rather than attempt to describe a single generalized experience, research focuses upon the experiences of different potters as they negotiated the new conditions of their lives. Potting, like any economic activity, is a social act. Potters made productive decisions based upon their perception of consumers' interests, and the patterns of distribution reflect the routes of exchange created via social institutions and relationships. Both the individual relationships and the institutionalized economic system they constituted ranged over wide geographic and chronological scales (Scarlett et al. 2005).

Historical research provided some glimpses of the social webs in which people found themselves enmeshed.

Potters left only scant primary records of their businesses. Newspapers carried occasional advertisements or editorials that mentioned potteries. Additional information is available from a few eyewitness accounts and basic descriptions recorded in oral history collections published by the Daughters of the Utah Pioneers. Many sources tangentially mention the importance of the nuclear or extended family as the basic unit or organization in production. Family members worked at various jobs, including digging clay, throwing pots, and peddling finished wares. Many wives traveled on peddling expeditions, selling pottery wares and other domestically produced commodities. These travelers included Mrs. Hansen of Brigham City (Forsgren 1937: 84; Nielson 1963:100–101) and Anna and young Fred Peterson (Carter 1940:295).

Young adults also often undertook peddling trips. Thomas Davenport's sons, particularly John (Thomas Davenport Family Organization 1981:42), and Ephraim Roberts's sons, Montie and Frank (Roberts [1950]), sometimes traveled up to 500 miles. The scope of the peddling trade included trips from Parowan to Beaver (Thomas Davenport Family Organization 1981: 42), from Hyrum south to Provo and as far as Beaver (Nielson 1963:37,42), from Provo north into Idaho (Henrichsen and Henrichsen 1984:10), more than 250 miles from Vernal through Wyoming (Roberts [1950]), and also to St. George and surrounding areas (known as Dixie) from Hyrum and Panguitch (Chidester et al. 1949:60–61; Christensen 1969:92).

Potteries used other avenues to distribute crockery, including agreements with third-party peddlers and other retailers. The *Salt Lake Daily Herald* (1880) ran a representative announcement noting, "the old City Pottery is doing quite a rushing business and is shipping to the surrounding territories crocks, jars, and flower pots in abundance." E. C. Henrichsen's Provo Pottery ran from 1873 until 1929, and consumers purchased Provo Pottery wares from many sources, including from the pottery itself, the Henrichsen Mercantile retail store, and an array of retailers in Utah, Idaho, California, and other western states. Lynn Henrichsen and Kirk Henrichsen (1984:9–10) recounted

some illustrative details they recorded while completing a family oral history:

The good ones [pots] were packed in wild (timothy) hay to prevent breakage when they were shipped to customers. ... E. C. [Henrichsen] himself delivered many of the pots to mercantile establishments, florists, and individuals. At first, this was done by a horse-drawn wagon, and E. C.'s delivery trips lasted for weeks. As he traveled, Scandinavian friends often put him up throughout Utah. Later, as business grew, pots were shipped by train also.

Utah's Latter-day Saint potters paid a tithe to the church whose poverty relief system provided another institutional route to distribute their wares. Observant Latter-day Saint potters tithed 10% of their income, 10% of the product of their labor, and 10% of their time. For example, while little information remains from Matthew Dalton's Northern Pottery in Ogden, Nielson (1963:91) reported seeing a \$6.44 receipt on labor tithing dated 21 May 1853. E. C. Henrichsen also paid his tithing in pots (Henrichsen and Henrichsen 1984:3). The wares potters turned over to the church tithing office became part of the highly planned, centralized redistribution system. Church authorities sent the earthenware to communities lacking a pottery shop, particularly newly colonized mission settlements. This system permitted the coordinated settlement of arid regions with no external capital from the East, and was locally flexible to accommodate specific needs in each community (Hartley 1987: 97–108; Kimball 1988:103–107).

This redistributive system included venues of trade and exchange as well as outright economic aid in the form of poor relief. Bedson Eardley paid more than \$700 in tithes in pots from the Deseret Pottery between 1884 and 1886. In addition to his relationship with the general tithing office, Eardley maintained considerable accounts with the general tithing store, as well as the main ZCMI Cooperative, the 6th and 7th Ward co-ops, the General Bishop's Store, and the 5th Ward Family Store (Scarlett 2002:276). These stores were part of the church authorities' attempts to control the penetration of global products and mitigate competition with local producers (Scarlett et al. 2005; Scarlett [2008]).

Shopping for Latter-day Saint customers was supposed to be an act of religious devotion. The church taught that supporting home industry

contributed to “building up” the kingdom of God on Earth and helped reinforce the Latter-day Saints’ independence from Babylon. Many potteries specifically advertised their wares as home manufactures to capitalize on this social pressure. In addition, church-run stores like the Brigham City Cooperative Company Store sold local wares at a relatively lower price while offering imported goods at a considerable markup. Since a church representative kept the account books, the authorities knew who purchased which goods at the Co-op Store and which community members shopped among the non-Mormon “gentiles” (Scarlett 2002: 189–202).

Deseret and Brigham City Potteries

Business records from only two potteries are known to survive and provide comparative material: Bedson Eardley’s last account book and the ledger from the Brigham City Cooperative Company Store. These two sources provide glimpses into the social economy of potting in Utah’s 19th century. Sheri Slaughter has Bedson Eardley’s last account book and daybook, and she filed copies of these two volumes with the J. Willard Marriott Library Special Collections Department at the University of Utah. The Church of Jesus Christ of Latter-day Saints Historical Department archived the records of the Brigham City Co-Operative Company. Although the Co-op Pottery Division records have been lost, the Co-op Store account books captured transactions with the company’s pottery division.

Eardley’s final accounts represent only the last few years of several decades of extensive production and wide ranging sales. Earlier in Bedson’s career, he had worked with many other potters including his three brothers and a nephew. Whereas these accounts record Eardley’s sales from 1882 until the early 1890s, the most complete accounts are from the mid-1880s when he operated his shop independently as the sole proprietor. Before those years, when he worked as a partner with his brothers and nephew, other potters, and even briefly constituting his shop as a cooperative, his accounts were balanced in other volumes that are now lost. His daybook also includes Bedson’s record of the contents of nine kilns fired sequentially during 1881 (Scarlett 2002:281–295).

These documents record transactions from years of trouble for Bedson. The Territorial Court interrupted Eardley’s business, for example, by sentencing him to two separate terms in prison for unlawful cohabitation. Eardley served his prison terms in 1887 and 1889–1890. These months away from production had a negative impact upon his customer relations, which showed loss of regular accounts after each period (Slaughter 2001:117–118).

The account books of the Brigham City Cooperative Company Store recorded details about production at the pottery division shop. This entire town had organized as a utopian joint-stock company under direct church leadership. The company owned the pottery and paid Frederick F. Hansen and his assistant hourly wages to operate the shop. Each time a kiln was burned, the successfully fired products were transferred to the Co-op Store, and the store managers provided an economic evaluation of the wares produced by Hansen and staff. That total value was entered into an account against which the pottery division could purchase goods needed for production and for making payments to Hansen and staff. In 1875, the store’s account summary also provided an itemized list of the different types of wares brought to the store. Following the entries during this year, the accountant included only summary totals of production.

The records of Bedson Eardley and the Co-op Pottery provide detailed insight into social aspects of the pottery market, but direct comparison remains difficult. The potters made production decisions in very different social contexts that distinguished Salt Lake City from Brigham City. Both sets of records are chronologically incomplete and often contain only indirect details about production. Eardley operated his business in the largest city in the territory, and he dealt primarily with retail stores and their urban consumers. In contrast, Hansen sold his wares in a comparatively small community and its rural hinterland. While he also dealt directly with a resale store, the co-op company’s directors had a very different business model based upon an ecclesiastical utopianism. These contexts likely produced distinct use and exchange values for the same ceramic objects. For this reason, it is difficult to make any direct comparisons of market prices.

Given the limitations, Figures 2 through 5 present some comparisons between the two

**Percent of Total Sales by Functional Category
Brigham City and Eardley Potteries**

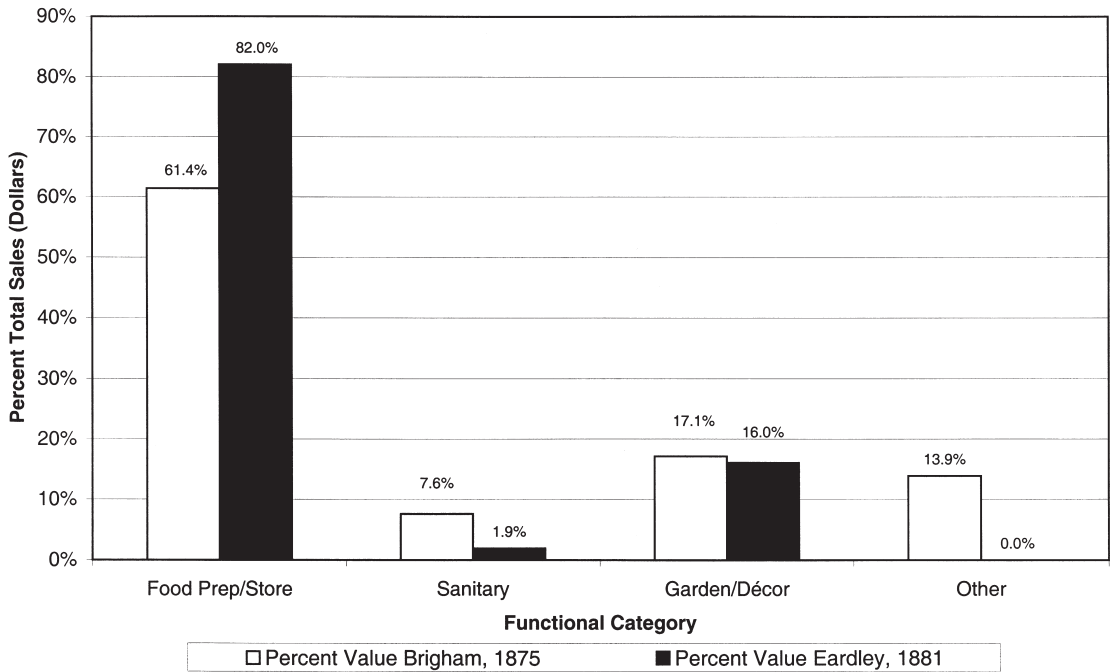


FIGURE 2. One year of sales at Bedson Eardley and Brigham City cooperative potteries. The graph is organized by functional category expressed as a percentage of the dollar value of total sales. (Graph by Timothy James Scarlett, 2006.)

potteries based upon the percentage of ware types divided by functional categories. While an extended discussion of these accounts appeared in Scarlett (2002:281–295), the interpretation is summarized below. Figure 2 shows that food preparation and storage remained the single dominant ware type made at both Bedson Eardley’s urban shop and Frederick Hansen’s pottery. Both potteries also produced nearly identical percentages of flowerpots and decorative wares. This should call into question assumptions about the difference between 19th-century consumers in urban and agricultural settlements in Utah. Hansen sold a much higher percentage of chamber pots and sanitary ware, however, suggesting a difference in demand among local consumers.

Figures 3 and 4 show the seasonal pattern of production for each pottery during those periods with reliable records. Both graphs indicate that sales peaked in the fall, around September and

October. This pattern matches those observed above, that both city and town consumers in Utah still needed crockery to put up preserves during the fall harvest. The storage crock remained the most important product for local potters, despite health risks presented by pickling foods in lead-glazed vessels. Church authorities had published warnings against lead glaze beginning in the 1870s, but as late as 1885 these vessels were still the local dominant product.

Eardley’s detailed records permitted some further comparison of the types of ware produced during a yearly seasonal cycle. Figure 5 illustrates how Bedson scheduled production in light of seasonal demand for different types of ware. Through the spring, summer, and early fall, Bedson continually manufactured jars, building his inventory for the fall season’s peak consumer demand. He rushed the production of flowerpots, by comparison, during the winter months, since he knew that demand for jars would be lowest

Eardley's Total Sales by Month, 1882-1883

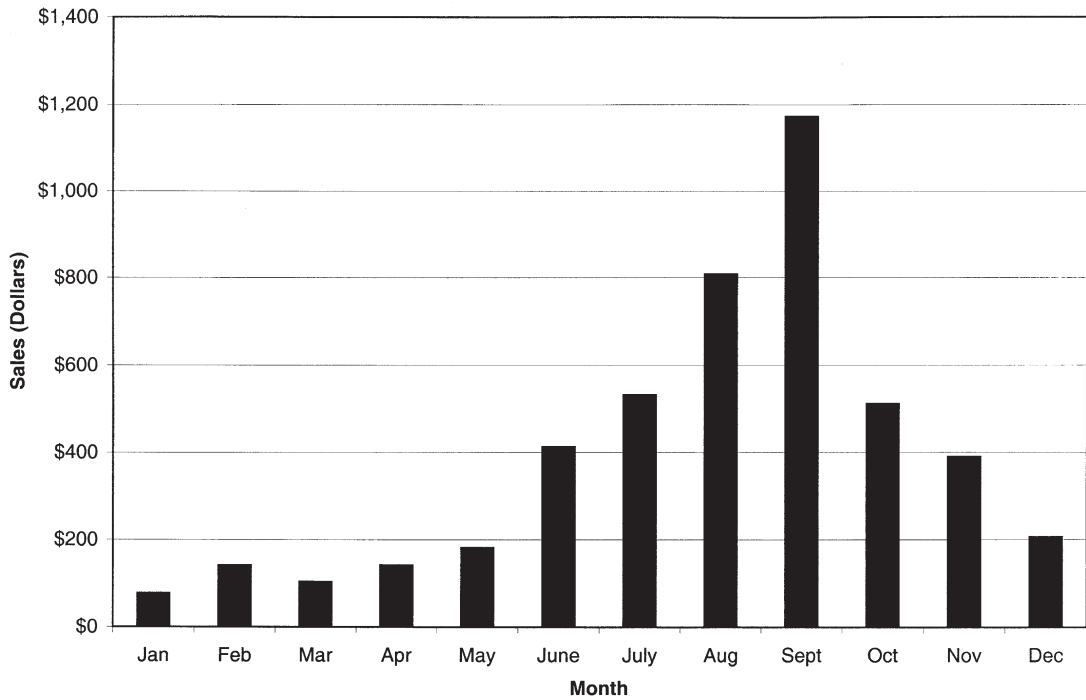


FIGURE 3. Bedson Eardley's monthly sales, 1882–1883. (Graph by Timothy James Scarlett, 2006.)

Total Monthly Production at the Brigham City Co-op Pottery

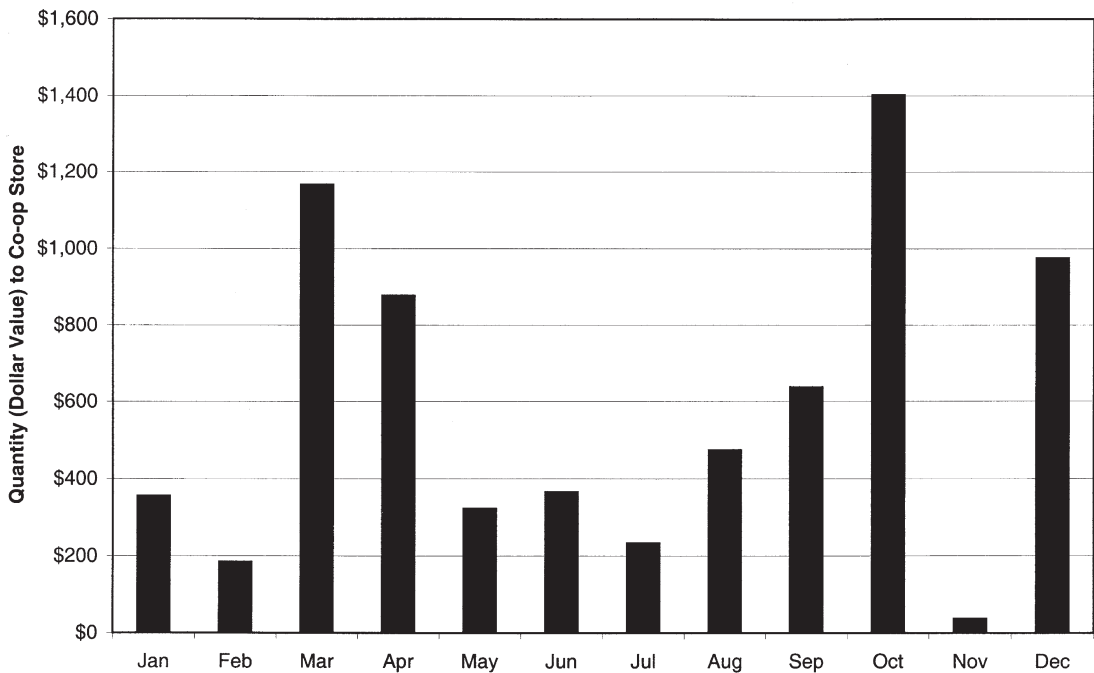


FIGURE 4. Monthly "home-manufacture" pottery sales at the Brigham City Co-Op Store, 1875–1880 (Fredrick F. Hansen, potter). (Graph by Timothy James Scarlett, 2006.)

Eardley's 1881 Production by Artifact Type

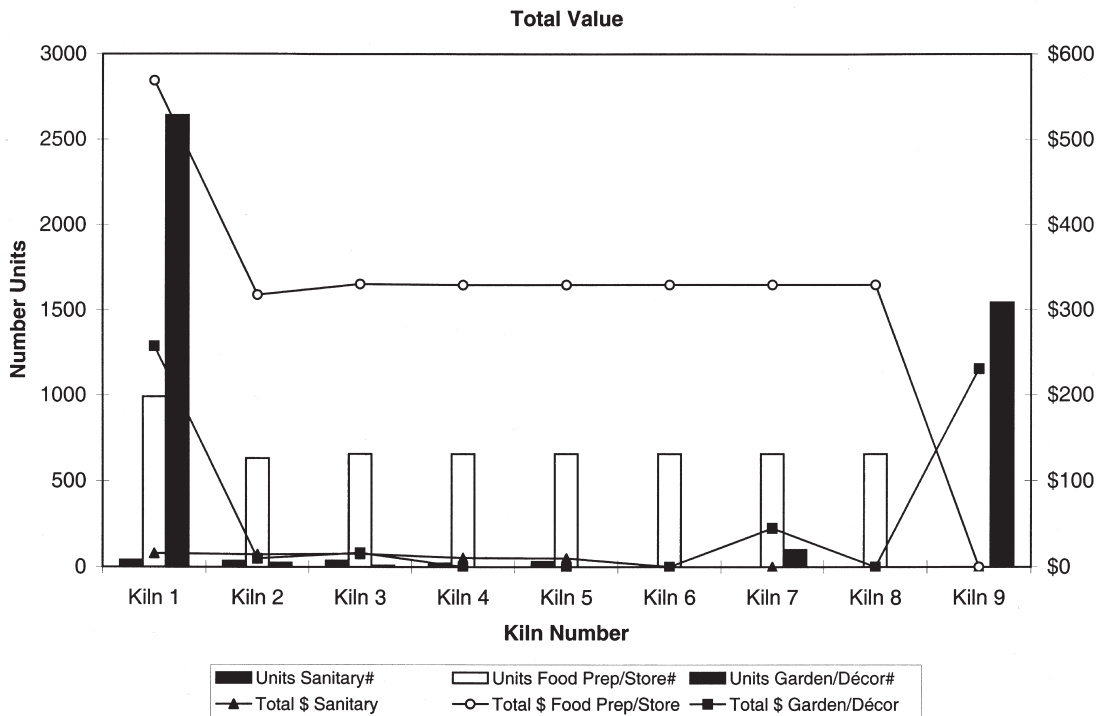


FIGURE 5. Bedson Eardley's 1881 production for nine kiln firings in 1881, grouped by functional type. Kiln firings presumably run from January through December. (Graph by Timothy James Scarlett, 2006.)

then and in the early spring. Perhaps such a compressed schedule permitted him to respond to changing aesthetic interests among consumers for their decorative flowerpots. Figure 6 shows that flowerpots provided less profit per unit than storage jars and crocks.

Production and exchange were social activities. Ceramic exchange clearly indicated much more than terminal, cash-based market commodity exchange. Utah's settlers exchanged ceramics through complex and intertwined social transactions. The exchanges placed each ceramic vessel within several commodity phases, ranging from family gift and religious tithe to market sale; from uniquely singular commissioned art to machine-assisted, mass-produced artifact; from community-centered "neighboring" systems of barter on account to barter among professional peddlers. Unlike some commodities, ceramic distribution and consumption patterns are further complicated by their use as containers (Scarlett et al. 2005; Scarlett 2006).

Historical research revealed glimpses of the rich and complex social context of exchange in domestic pottery. Those surviving records provide exciting information about a few individual potters at certain places and specific points in time. The same records also indicate that researchers should not extrapolate from this dataset to generalize about the entire industry. The analysis above provides a framework for questions. Archaeology will provide more-extensive knowledge of the full extent of the trade and fill in details on those potters who left no record at all. North American historical archaeologists have asked similar questions about pottery in the economy throughout the discipline's history (Adams 1977). In the past, researchers rapidly exhausted the potential in analyses of domestically produced, common utilitarian earthenware. This study turned to the potential of physical characterization to enrich traditional research strategies in historical archaeology and push the discipline toward a broad regional perspective on economic landscapes.

Eardley Production by Kiln, 1881

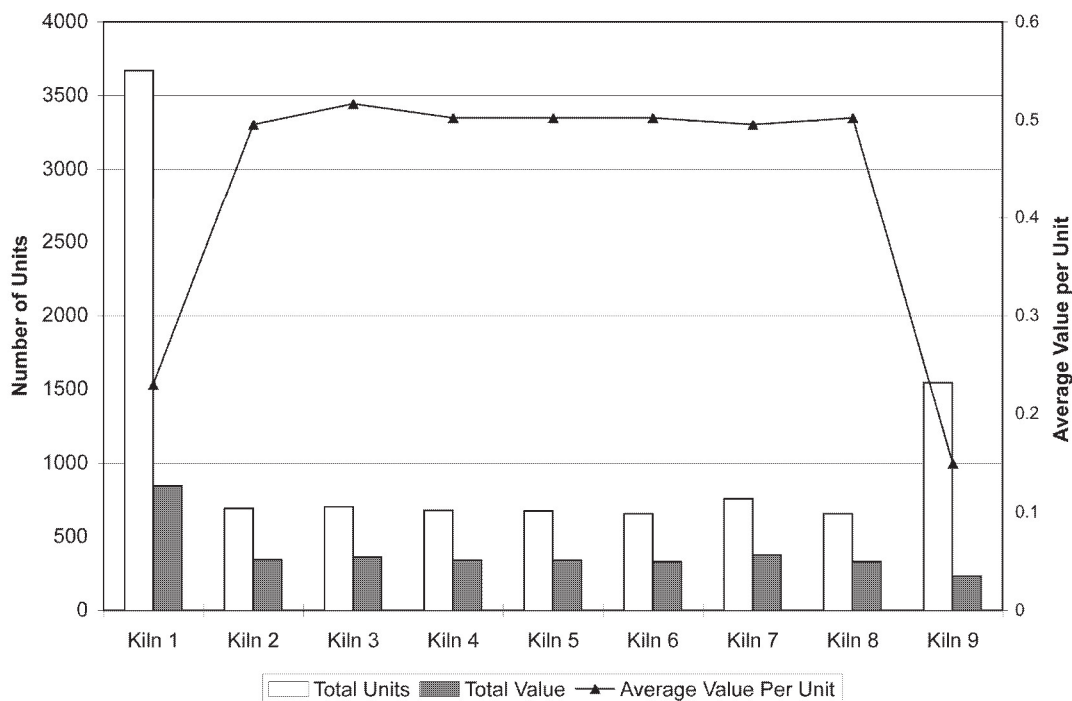


FIGURE 6. Bedson Eardley's production for 1881, organized by total number of units, total value of units, and average value per kiln firing. (Graph by Timothy James Scarlett, 2006.)

Archaeometry and the Study of Exchange

One potential aspect of archaeometry—provenance studies based on chemical characterization—is to examine ceramic exchange within a large geographic and cultural region. Chemical characterization of these fragments, especially using INAA, provides an analytical framework for examination of different routes of exchange and distribution of ceramic commodities throughout the Mormon domain. No North American historical archaeologist has yet undertaken to comprehensively study domestic production, exchange, and consumption by first creating a research design that joined an elaborate historic context, systematic survey and testing of ceramic production sites, and materials science characterization of a single class of artifact.

Historical archaeologists rely upon ceramic commodities to provide basic chronological information, but sherds often also serve as the “meat and potatoes” in examinations of ethnicity, gender, economy, class, religion, and socioeco-

nomics status. In past decades, North American historical archaeologists have asked increasingly sophisticated questions about ceramic consumption. Domestically produced earthenwares typically informed these studies only minimally, leaving researchers with a simplified set of assumptions about local production and consumption.

The complexity of research questions about people quickly surpassed the analytical resolution of typologies based solely upon morphological and stylistic traits (Drakich 1982:95–96; Turnbaugh 1983; Pendery 1985:72; Steen 1999: 62–63). This problem often arose in sidebar discussions following papers at annual meetings, when, for example, researchers from the Caribbean noted that some of “their” sugar plantation’s red-bodied earthenwares looked identical to the images of Philadelphia’s lead-glazed redware just shown in a presentation. New England archaeologists sometimes recognized pot fragments recovered in Nova Scotia.

Utah’s rich heritage region provides researchers with a database from which archaeologists can

develop an integrative approach to domestic pottery and truly explore the interpretive potential inherent in the field's multidisciplinary nature. Despite the geographic vastness of the Mormon domain, the number of pot shops is small when compared to other North American regions like the redware potters of New England and the Mid-Atlantic, the colonoware makers throughout the plantations of the southeast and circum-Caribbean, or the majolica manufacturing system that linked the Spanish colonial borderlands with Mexico and Europe's Iberian Peninsula.

Besides the comparatively small number of potters, the Utah Pottery Project survey revealed that many of the potteries remain as well-preserved archaeological sites. A high percentage of the potteries can still be studied, a nearly unique opportunity for archaeological research. While researchers have extensively studied potting traditions in America's folk-cultural hearth regions, development during the postwar, mid-century construction boom destroyed the archaeological integrity of most the pottery production sites (see Watkins 1950).

Study thus far has revealed some fabric, decorative, or glaze characteristics that may be unique to specific potters in specific locations in the Mormon domain. Thomas Davenport added coarse black sand to some of his ware in Parowan, which appears to be a unique practice. The Bethelsens used a glaze that seems uniquely thin and bright, yet relying upon macroscopic traits to identify the products of a particular potter already presents problems. The majority of Thomas Davenport's pottery sherds lack the distinctive black inclusions. The Bethelsens worked at other potteries in Salt Lake City before setting up in Fountain Green, Utah, and their glaze may appear on wares made in more than one locale at different times. Many potters actually worked in multiple locations, as in the case of John Eardley. He concurrently ran potteries in St. George, Panguitch, and Beaver, and he had worked in Salt Lake City earlier in his career. His distinctive decorative motifs (whatever they turn out to be should his sites be excavated) may appear on ware made at any of these sites.

A handful of Bedson Eardley's sherds exhibit a complete rainbow of refined paste colors, including deep red, pale red/orange, buff, yellow, and cream. These sherds, salvaged from the kiln

site during construction in the 1970s, include both wasters and finished objects. The different fabrics do not seem to correlate with different functional forms or ware types. These diagnostic problems will only get worse as archaeologists excavate new sites and more intensively test known sites.

Despite the limited number of potters, simply examining the macroscopic traits of pottery fabrics or decorative styles will never provide enough analytical resolution to differentiate among all the pottery production sites. The formal analysis of the potters' products must be accompanied by some archaeometric technique. Historical archaeologists have increasingly turned to materials science to recover information about the manufacture, trade, and exchange of ceramic commodities (Thomas et al. 1992; Gilbert et al. 1993; Chrestien and Dufournier 1995; Cowell and Gaimster 1995; Gaimster and Hook 1995; Hughes 1995; Owen and Hansen 1996; Owen 1997, 2001, 2003; Vaz et al. 1997; Owen et al. 2000; Gible and Janowitz 2002; Owen and Hillis 2003; Bishop et al. 2004; Skowronek 2004). While historical archaeologists have pointed to the utility of archaeometric techniques over the last 30 years, no one has taken full advantage of these resources.

Archaeologists periodically discover historic features relating to significant ceramic production sites during surveys but only add materials science analyses as an afterthought to the mitigation strategy. The resulting studies derive from different archaeometric techniques and produce data that are not directly comparable. Studies, for example, published by Barbara Heath (1988) and the contributors in Sarah Turnbaugh (1985) with more recent papers by M. J. Hughes (1995) and Michael Young (2002) remain individually interesting and provocative but largely fall short of historical archaeology's full analytical potential because they cannot aggregate data.

INAA provides archaeologists with an excellent tool with which they can create a single database that can include many hundreds of samples. It is a destructive technique that requires consultation with experts at a laboratory that operates an analytical nuclear reactor. While the technique is expensive, ranging upwards of \$100 per sample, INAA can measure a wide range of major, minor, and trace elements with

relatively good precision. Laboratory staff uses a computer detector to measure the presence of 33 different elements in parts-per-million or parts-per-billion concentrations. Once the computer's instruments have measured the quantity of different elements, an analyst makes multivariate statistical comparisons among the samples using the ratios of different proportions among the elements. The computer then sorts the samples according to their similarities, creating clusters of sherds with similar elemental "fingerprints." Given the instrumental precision and number of different elements included in the analysis, the technique often yields very fine differentiation in the statistical analysis. Michael Glascock (1992) and Hector Neff (1992) detailed the technical and procedural specifics of INAA at MURR.

Of the 45 potteries identified between 1999 and 2000, archaeological sherds from eight different sites were included in this analysis. Survey and testing at five of those sites produced new samples that were combined with specimens from two previously salvaged sites and one site on which INAA had already been completed. Table 1 summarizes these contexts and collection strategies. Nancy Richards salvaged Bedson Eardley's pottery site in 1977, and the artifacts she collected are now held at This Is The Place Heritage Park and Deseret Village Museum in Salt Lake City. In the early 1990s, Kirk Henrichsen picked up samples from a disturbed area at Frederick Petersen's 2nd Ward Pottery in Salt Lake City.

In addition to those samples selected for analysis during the survey, some samples of historic pottery from the Mormon culture area had already been analyzed using INAA. During the early 1990s, Alan Ferg (1993) directed a crew of volunteers to excavate Behrman's kiln in Brigham City, Arizona. That volunteer crew completed both surface survey and excavations that recovered earthenware fragments, kiln wasters and furniture, and unfired clay vessel fragments. Volunteers continue this analysis, and the final excavation report is in preparation (Ferg 2005). Patrick Lyons (2001) examined samples of Behrman's sherds at MURR with INAA as a comparison with the local aboriginal pottery traditions.

The authors analyzed 100 new pottery samples at MURR, adding to Lyons's data. The sherds were not randomly selected for analysis but

represent the maximum variation at each site. Whenever possible, 20 sherds from each kiln site were included, including some warped, over-vitrified, or slumped wasters and some fragments of well-fired pots. In most cases, at least five sherds represented different paste types (by color and inclusions), stratigraphic context units, and morphological or functional categories (refined-paste tablewares such as teapots or plates, coarse-paste crocks and pans, and unrefined paste artifacts like roof tile). Samples from the Behrman Pottery included both fired kiln wasters and fragments of unfired wheel-thrown clay vessels. Between 2000 and 2003, researchers using INAA examined 107 samples (Table 2). The results strongly suggest that studies of 19th-century ceramics using elemental chemistry hold great promise to enrich understanding of pottery production, exchange, and distribution among Latter-day Saint communities in North America's arid West.

Sample Preparation and Analysis

Researchers prepared ceramic samples using standard MURR procedures (Glascock 1992). A piece of each sherd was ground clean with a silicon carbide burr to remove glazed or slipped surfaces and adhering soil. Researchers then washed each burred sample with deionized water and ground it to a fine powder in an agate mortar. The powdered samples dried in an oven at 100° C for 24 hours. Portions of each sample were weighed and sealed in a vial—about 150 mg in small polyvials used for short irradiations and 200 mg in high-purity quartz vials used for long irradiations. Along with the unknown samples, MURR staff prepared reference standards of SRM-1633a (coal fly ash) and SRM-688 (basalt rock) and quality control samples (standards treated as unknowns) of SRM-278 (obsidian rock) and Ohio Red Clay. The standards and quality control measures provide the keys by which the resulting data can be normalized for comparison as different studies compile statistical data over multiple years. The same standards permit data to be normalized and compared between different reactor labs.

At MURR, INAA of pottery and clays consists of two irradiations (one short and one long) and three gamma counts (technical details,

TABLE 2
MURR INAA SAMPLE LIST WITH ASSIGNED STATISTICAL GROUPS

ANID	Group	Pottery Name	Location	Description
TJS001	Bed-1	Bedson Eardley	Salt Lake City, UT	body frag., hard, buff paste with red and white inclusions, glaze overfired.
TJS003	Bed-1	Bedson Eardley	Salt Lake City, UT	base frag., orange paste, glaze burned to powdery red dust.
TJS004	Bed-1	Bedson Eardley	Salt Lake City, UT	base frag., very pale brown and soft paste.
TJS006	Bed-1	Bedson Eardley	Salt Lake City, UT	rim frag., everted (similar to 33EE) paste is soft strong brown, with voids.
TJS007	Bed-1	Bedson Eardley	Salt Lake City, UT	rim frag., jar, pale brown and soft paste.
TJS008	Bed-1	Bedson Eardley	Salt Lake City, UT	lid rim frag., buff paste.
TJS009	Bed-1	Bedson Eardley	Salt Lake City, UT	bowl rim frag., reddish orange paste, (profile in notes).
TJS010	Bed-1	Bedson Eardley	Salt Lake City, UT	bowl or jar rim frag., everted with pale brown paste.
TJS011	Bed-1	Bedson Eardley	Salt Lake City, UT	rim frag., salmon colored paste with red, black and white inclusions (profile in notes).
TJS012	Bed-1	Bedson Eardley	Salt Lake City, UT	body frag., very similar color to stamped vessels, apple green glaze, buff paste.
TJS013	Bed-1	Bedson Eardley	Salt Lake City, UT	body frag. from reconstructable vessel, strong brown paste, dark brown, overfired glaze.
TJS015	Bed-1	Bedson Eardley	Salt Lake City, UT	rim frag., jar, very pale brown paste, clear glaze with brown mottled spots.
TJS017	Bed-1	Bedson Eardley	Salt Lake City, UT	body frag., crock? very pale brown paste, yellow-green glaze with brown flecks, ext. overfired.
TJS002	Bed-2	Bedson Eardley	Salt Lake City, UT	body frag., hard red paste with white inclusions, int. glaze overfired, similar glaze to stamped vessels.
TJS014	Bed-2	Bedson Eardley	Salt Lake City, UT	body frag. red paste, white inclusions, pale yellow glaze (lead over slip?).
TJS018	Bed-2	Bedson Eardley	Salt Lake City, UT	jar rim frag., strong brown paste, brown glaze.
TJS030	Beth	Bethelson	Fountain Green, UT	spall with orange paste, possible salt glaze.
TJS031	Beth	Bethelson	Fountain Green, UT	rim sherd with orange paste and very thin glaze, possible salt, no inclusions.
TJS032	Beth	Bethelson	Fountain Green, UT	rim sherd, orange very soft paste, poorly sorted, white inclusions, thick overfired burned opaque glaze.
TJS033	Beth	Bethelson	Fountain Green, UT	thick body sherd, pale orange paste with white and gray inclusions, over-burned thick glaze.
TJS034	Beth	Bethelson	Fountain Green, UT	body frag., pale orange paste, clear glaze.
TJS035	Beth	Bethelson	Fountain Green, UT	body frag., pale orange paste, glaze thick int./thin ext.
TJS036	Beth	Bethelson	Fountain Green, UT	body frag., pale red paste, thin glaze ext., thick glaze int.
TJS037	Beth	Bethelson	Fountain Green, UT	body frag., pale orange paste, clear glaze.
TJS038	Beth	Bethelson	Fountain Green, UT	body spall, pale red paste, very thin glaze on ext., entire sample consumed.
TJS039	Beth	Bethelson	Fountain Green, UT	body frag., soft orange paste, thin light glaze, possible salt?
TJS040	Beth	Bethelson	Fountain Green, UT	base frag., soft orange paste, thin clear glaze, possible salt?
PDL423	Brig	Behrman	Brigham City, AZ	G set tile.
PDL424	Brig	Behrman	Brigham City, AZ	CT set tile.

TABLE 2 (CONTINUED)
MURR INAA SAMPLE LIST WITH ASSIGNED STATISTICAL GROUPS

ANID	Group	Pottery Name	Location	Description
PDL425	Brig	Behrman	Brigham City, AZ	HB set.
PDL426	Brig	Behrman	Brigham City, AZ	milk set B.
PDL427	Brig	Behrman	Brigham City, AZ	crook rim, unfired.
PDL428	Brig	Behrman	Brigham City, AZ	pitcher handle, unfired.
TJS061	Dave1	Davenport	Parowan, UT	handle frag., soft, light reddish brown paste, unglazed.
TJS063	Dave1	Davenport	Parowan, UT	rim frag., soft, light reddish brown paste like TJS-061, unglazed.
TJS064	Dave1	Davenport	Parowan, UT	bowl, rim frag., soft light reddish brown paste like TJS-061, unglazed.
TJS065	Dave1	Davenport	Parowan, UT	body frag., light brown paste, glazed int., overfired glaze, green color.
TJS066	Dave1	Davenport	Parowan, UT	body frag., soft light reddish brown paste like TJS-061, glazed int., green overfired glaze.
TJS067	Dave1	Davenport	Parowan, UT	body frag., soft light reddish brown paste like TJS-061, glazed int., green overfired glaze.
TJS068	Dave1	Davenport	Parowan, UT	body frag., soft light reddish brown paste like TJS-061, brown glazed int., overfired glaze.
TJS069	Dave1	Davenport	Parowan, UT	body frag., soft light reddish brown paste like TJS-061, brown glazed int., overfired glaze.
TJS070	Dave1	Davenport	Parowan, UT	body frag., soft light reddish brown paste like TJS-061, brown glazed int., overfired glaze.
TJS071	Dave1	Davenport	Parowan, UT	base frag., soft light reddish brown paste like TJS-061, green int. glaze.
TJS072	Dave1	Davenport	Parowan, UT	base frag., soft light reddish brown paste like TJS-061, brown glaze int., overfired.
TJS073	Dave1	Davenport	Parowan, UT	rim frag., soft light reddish brown paste like TJS-061, brown glaze int., overfired.
TJS078	Dave1	Davenport	Parowan, UT	body frag., soft light reddish brown paste like TJS-061, brown glaze int., overfired.
TJS074	Dave2	Davenport	Parowan, UT	body frag., soft light reddish brown paste like TJS-061, ceramic and grog inclusions, unglazed.
TJS075	Dave2	Davenport	Parowan, UT	body frag., soft light reddish brown paste like TJS-061, but w/large dark black inclusions, overfired.
TJS076	Dave2	Davenport	Parowan, UT	body frag., light reddish brown paste with large black inclusions, like TJS-074, brown glaze int.
TJS077	Dave2	Davenport	Parowan, UT	body frag., paste light reddish brown paste with large black inclusions, like TJS-074, brown glaze int.
TJS062	Dave3	Davenport	Parowan, UT	body frag., soft light reddish brown paste, unglazed.
TJS079	Dave3	Davenport	Parowan, UT	highly reduced overfired and slumped vessel, with no inclusions.
TJS080	Dave3	Davenport	Parowan, UT	pitcher frag., punctate decoration, paste hard, purplish red.
TJS090	JJ1	J. J. Hansen	Hyrum, UT	body frag., light reddish brown paste with no inclusions, unglazed.
TJS094	JJ1	J. J. Hansen	Hyrum, UT	body frag., light reddish brown paste with no inclusions, unglazed.
TJS095	JJ1	J. J. Hansen	Hyrum, UT	base frag., light reddish brown paste with no inclusions, unglazed.
TJS096	JJ1	J. J. Hansen	Hyrum, UT	body frag., light reddish brown paste with no inclusions, unglazed.

TABLE 2 (CONTINUED)
MURR INAA SAMPLE LIST WITH ASSIGNED STATISTICAL GROUPS

ANID	Group	Pottery Name	Location	Description
TJS097	JJ1	J. J. Hansen	Hyrum, UT	body frag., light reddish brown paste with no inclusions, unglazed.
TJS098	JJ1	J. J. Hansen	Hyrum, UT	body frag., light reddish brown paste with no inclusions, unglazed.
TJS099	JJ1	J. J. Hansen	Hyrum, UT	body frag., paste light reddish brown with no inclusions, int. and ext. glazed, reduced, and overfired.
TJS100	JJ1	J. J. Hansen	Hyrum, UT	base frag., like 86, int. ext. glazed, glaze overfired, brown color.
TJS082	JJ2	J. J. Hansen	Hyrum, UT	rim, light reddish brown paste with no inclusions, int. glaze, green color.
TJS083	JJ2	J. J. Hansen	Hyrum, UT	body sherd, paste reduced to blue gray, paste overfired and slumped, very highly vitrified.
TJS087	JJ2	J. J. Hansen	Hyrum, UT	rim frag., jar? light reddish brown paste with no inclusions, unglazed.
TJS092	JJ2	J. J. Hansen	Hyrum, UT	everted rim frag. from incised jar, brick red to brownish red paste, no inclusions, unglazed, reduced.
TJS093	JJ2	J. J. Hansen	Hyrum, UT	body frag., light reddish brown paste with no inclusions, unglazed
TJS081	JJ3	J. J. Hansen	Hyrum, UT	everted rim, light reddish brown paste with no inclusions, unglazed.
TJS084	JJ3	J. J. Hansen	Hyrum, UT	body sherd, paste reduced to blue gray, paste overfired and slumped, highly vitrified.
TJS085	JJ3	J. J. Hansen	Hyrum, UT	rim frag., reduced paste gray to brick red with massive voids, paste highly vitrified, ext. glazed?
TJS086	JJ3	J. J. Hansen	Hyrum, UT	rim sherd, lid, very pale brown fine paste, without inclusions, unglazed.
TJS089	JJ3	J. J. Hansen	Hyrum, UT	body frag., light reddish brown paste with no inclusions, unglazed.
TJS091	JJ3	J. J. Hansen	Hyrum, UT	everted rim frag., light reddish brown paste with no inclusions, unglazed.
TJS088	JJ4	J. J. Hansen	Hyrum, UT	body frag., light reddish brown paste with no inclusions, unglazed.
TJS019	Jon	John Eardley	Salt Lake City, UT	thick rim sherd, red brown, soft paste, unglazed.
TJS020	Jon	John Eardley	Salt Lake City, UT	body frag., red paste, white inclusions, overfired speckled brown glaze.
TJS021	Jon	John Eardley	Salt Lake City, UT	body frag., red paste, white inclusions, overfired dark glaze ext., light or clear int.
TJS041	Pan1	Lowell-Roberts	Panguitch, UT	flowerpot saucer? very hard paste, warped, unglazed.
TJS042	Pan1	Lowell-Roberts	Panguitch, UT	mug rim, lt. brown paste, green glaze overfired.
TJS043	Pan1	Lowell-Roberts	Panguitch, UT	chamber pot body, warped paste, glaze overfired.
TJS044	Pan1	Lowell-Roberts	Panguitch, UT	flowerpot saucer? rim, paste light and speckled.
TJS045	Pan1	Lowell-Roberts	Panguitch, UT	flowerpot saucer? rim, paste light and speckled, like TJS044.
TJS057	Pan1	Lowell-Roberts	Panguitch, UT	lid, teapot? red paste, unglazed.
TJS046	Pan2	Lowell-Roberts	Panguitch, UT	body sherd, unglazed, buff paste.
TJS047	Pan2	Lowell-Roberts	Panguitch, UT	body sherd, unglazed, buff paste.
TJS048	Pan2	Lowell-Roberts	Panguitch, UT	body sherd, red paste, covered with powder of red lead.

TABLE 2 (CONTINUED)
MURR INAA SAMPLE LIST WITH ASSIGNED STATISTICAL GROUPS

ANID	Group	Pottery Name	Location	Description
TJS049	Pan2	Lowell-Roberts	Panguitch, UT	body sherd, red paste, covered with powder of red lead.
TJS050	Pan2	Lowell-Roberts	Panguitch, UT	body sherd, red paste, covered with powder of red lead.
TJS051	Pan3	Lowell-Roberts	Panguitch, UT	body sherd, medium brown paste, unglazed.
TJS052	Pan3	Lowell-Roberts	Panguitch, UT	body sherd, light brown paste, unglazed.
TJS053	Pan3	Lowell-Roberts	Panguitch, UT	body sherd, lit. brown paste, powdered glaze.
TJS055	Pan3	Lowell-Roberts	Panguitch, UT	rim sherd, light brown paste, ext glaze has crawled.
TJS059	Pan3	Lowell-Roberts	Panguitch, UT	kiln fum.? very overfired clay blob.
TJS060	Pan3	Lowell-Roberts	Panguitch, UT	kiln fum., very refined paste, hard pale yellow paste, unglazed
TJS054	Pan4	Lowell-Roberts	Panguitch, UT	base sherd, light brown paste, unglazed.
TJS056	Pan4	Lowell-Roberts	Panguitch, UT	kiln fum., very refined paste, hard, pale yellow paste unglazed.
TJS058	Pan4	Lowell-Roberts	Panguitch, UT	kiln fum., fist roll, unburred due to decayed condition.
TJS022	Pete	Peterson	Salt Lake City, UT	crook rim frag., soft red paste, int./ext. yellow glaze, overfired with bubbles.
TJS023	Pete	Peterson	Salt Lake City, UT	base sherd, soft red paste, int. ext. yellow glaze, overfired with bubbles.
TJS024	Pete	Peterson	Salt Lake City, UT	base of a roof tile.
TJS025	Pete	Peterson	Salt Lake City, UT	base of a roof tile.
TJS026	Pete	Peterson	Salt Lake City, UT	roof tile frag.
TJS027	Pete	Peterson	Salt Lake City, UT	roof tile frag.
TJS028	Pete	Peterson	Salt Lake City, UT	roof tile frag.
TJS029	Pete	Peterson	Salt Lake City, UT	roof tile frag.
TJS005	Unass.	Bedson Eardley	Salt Lake City, UT	rim frag., 2.5?yr. 4/6 red paste, very poorly wedged clay with irregular and large voids, very dark burned glaze.
PDL403	Unass.	Behrman	Brigham City, AZ	clay sample.
TJS016	Unass.	Bedson Eardley	Salt Lake City, UT	bowl? rim frag., very dark reddish brown blaze, red paste with white inclusions.

including flux rates, are found in Glascock 1992; Neff 2000). Short irradiations require that samples enter the reactor core where they are bombarded by neutrons for 5 seconds. The samples decay for 25 minutes and are then counted using a high-resolution germanium detector for 720 seconds. This count yields data for the short-lived elements: Al, Ba, Ca, Dy, K, Mn, Na, Ti, and V.

For the long irradiation, MURR researchers expose duplicate samples to gamma radiation for 24 hours. After decaying for seven days, the detector counts for 2,000 seconds (the “middle count”). The middle count yields determinations of seven medium half-life elements: As, La, Lu, Nd, Sm, U, and Yb. After an additional two-week period of decay, the samples are counted again for 10,000 seconds each. This measurement permits quantification of 17 long-lived

elements: Ce, Co, Cr, Cs, Eu, Fe, Hf, Ni, Rb, Sb, Sc, Sr, Ta, Tb, Th, Zn, and Zr.

Results and Discussion

Pottery from each manufacturing locale formed a statistically viable group when the 32 elemental variables were subjected to principal components analysis (Table 2) (Figure 7). While most clearly expressed as plots of two variables, such as in Figure 7, the groups are actually based upon statistical clusters of all 32 different dimensions where each element forms an axis in the scatter plot. The groupings in this analysis are calculated using only 32 of the 33 potential elements. Nickel was below detection limits, as is the norm in most New World ceramic studies, and it was removed from consideration during data analysis.

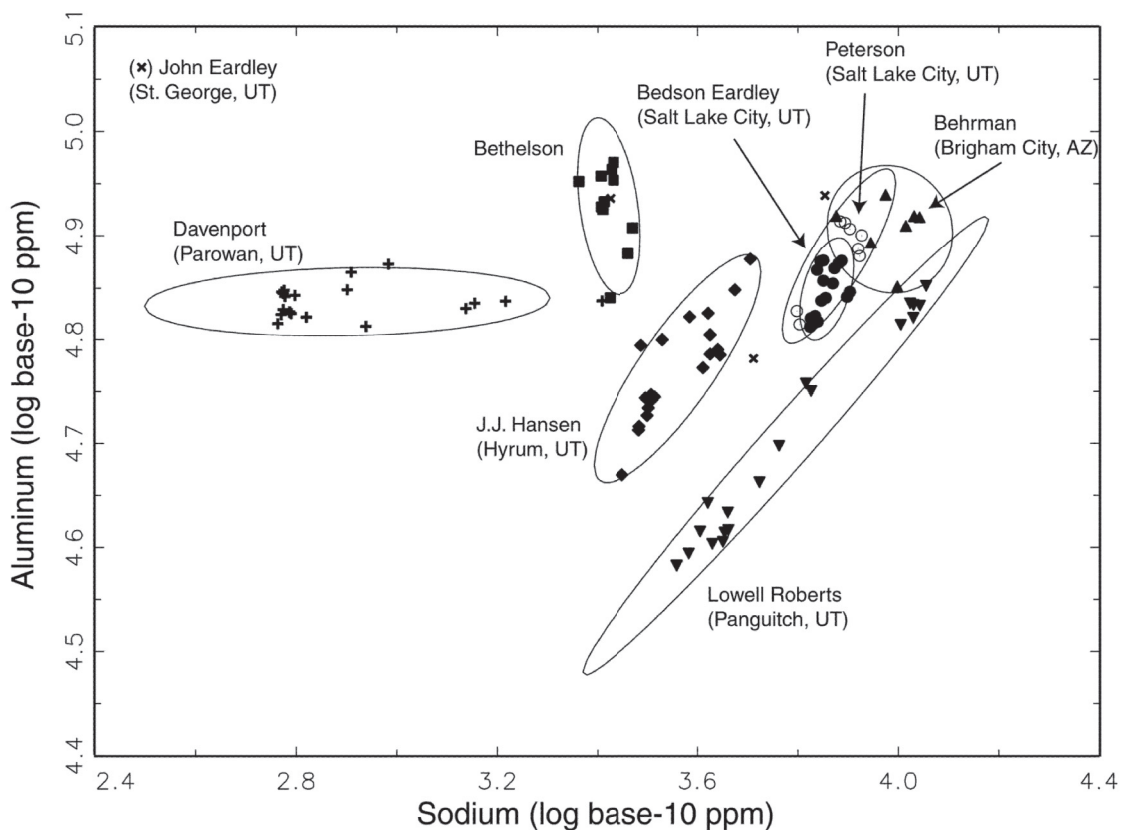


FIGURE 7. Bivariate plot of sodium and aluminum base-10 logged concentrations showing differentiation of ceramics from the various potteries analyzed in this study. Ellipses are drawn at the 90% confidence interval. An ellipse for John Eardley's St. George pottery is not shown due to the small sample size for this site. (Graph by Robert J. Speakman, 2006.)

These results clearly demonstrate the feasibility of using INAA to study the exchange and distribution of ceramics manufactured in the Intermountain region during the 19th century. Although the products of a single shop might vary widely in color and texture, such as the 20 samples from Bedson Eardley, immigrant potting technologies produced highly homogeneous fabric chemistry. When the products of one pottery are compared to another, the combination of animal- or water-powered clay milling, hydrated mixing, slaking, wheel throwing, and slip casting produced clearly differentiated clay fabrics. Each pottery's fabric is so distinct that even two different shops in the same city, such as the Bedson Eardley and the Fredrick Petersen potteries of Salt Lake City, produced samples that fell into distinct categories (Figure 8). Each pot shop used unique formulas to mix raw materials, and the results are clearly distinct even when the raw clays may be similar. In future analyses, the

high resolution created through INAA will permit bypassing a "Salt Lake City type" and focus examination to the level of specific kiln sites.

Researchers excluded John Eardley's St. George Pottery samples from this statistical analysis due to the small sample size (3) and the disturbed nature of their provenience. Three other samples were classified as unassigned, including a raw clay sample from Behrman's pottery in Arizona and two sherds from Bedson Eardley's pottery in Salt Lake City. This classification is discussed in detail below, but the overall results show that continued study will allow historical archaeologists to undertake sophisticated analyses of ceramic distribution and exchange. Using a GIS-base, for example, scholars can design research to examine general patterns of distribution in archaeological samples. The artifactual and documentary patterns could then be contrasted with chronological change in a wide array of data shells, including the following:

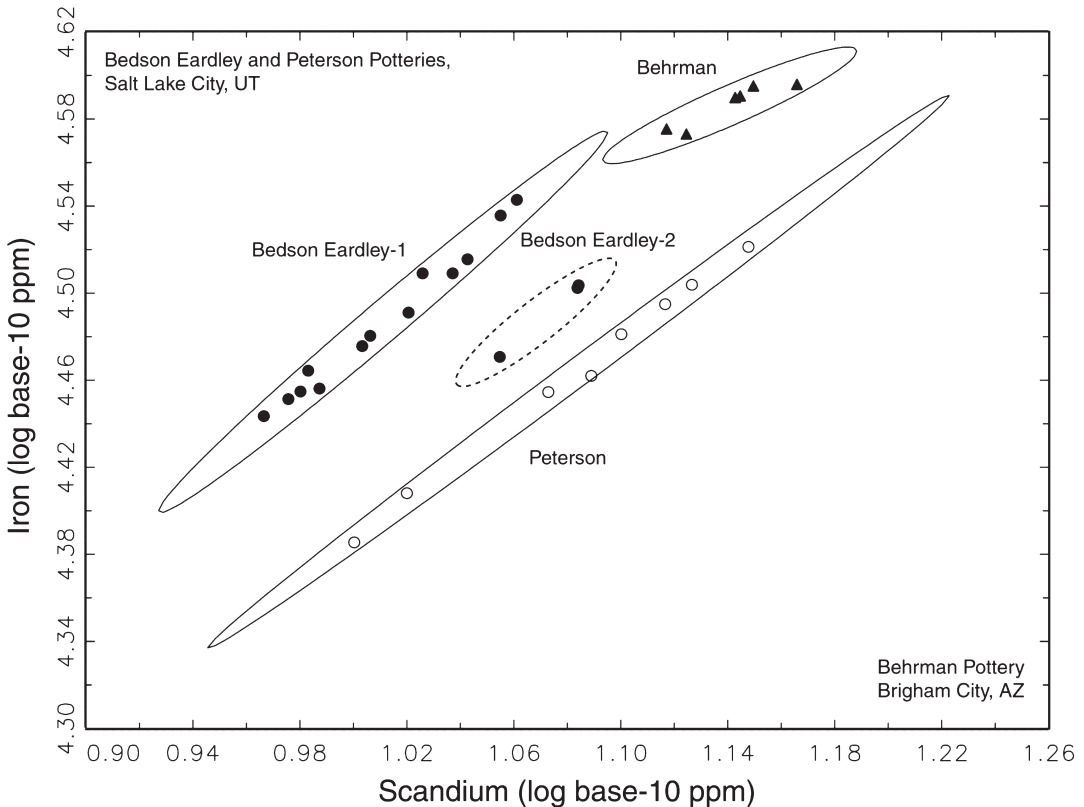


FIGURE 8. Bivariate plot of scandium and iron base-10 logged concentrations for both Salt Lake City potteries and Behrman's Arizona ceramics. Ellipses are drawn at the 90% confidence interval. (Graph by Robert J. Speakman, 2006.)

- Transportation routes (such as railroads and wagon roads) and freight costs (bills of lading, advertised shipping costs) as well as topography.
- The location and diversity of retail stores (cooperatives vs. non-Mormon retailers) and their price evaluations, inventories, and account data.
- Community histories (settlement patterns, mission formation, village fission, population streams, settlement growth).
- Distributions of functional types of earthenware, including architectural/industrial (brick, pipe, tile, and refractory products), food preparation/storage (jars and jugs), and decorative terracotta (flower pots).
- Ethnic and familial relationships within geography, reciprocal exchange, and distribution networks (measuring gift exchange).

- Competing products, including glass canning jars, tin wares, indoor plumbing, and imported ceramic wares.

Archaeologists will be able to examine complex questions about the relationship between community history and economic interdependence, the significance of transportation to the growth or decline of economic interaction between communities, and the geography of sales as influenced by centralized redistribution and market actions.

These GIS-based studies will allow archaeologists to perform sophisticated historical and economic analyses, examining each potter's life in detail and fitting it into the community and region as a producer. Such a regional study will surpass the limitations of studies based in consumption, bringing more accurate interpretations of expressions of identity wrapped in ethnicity,

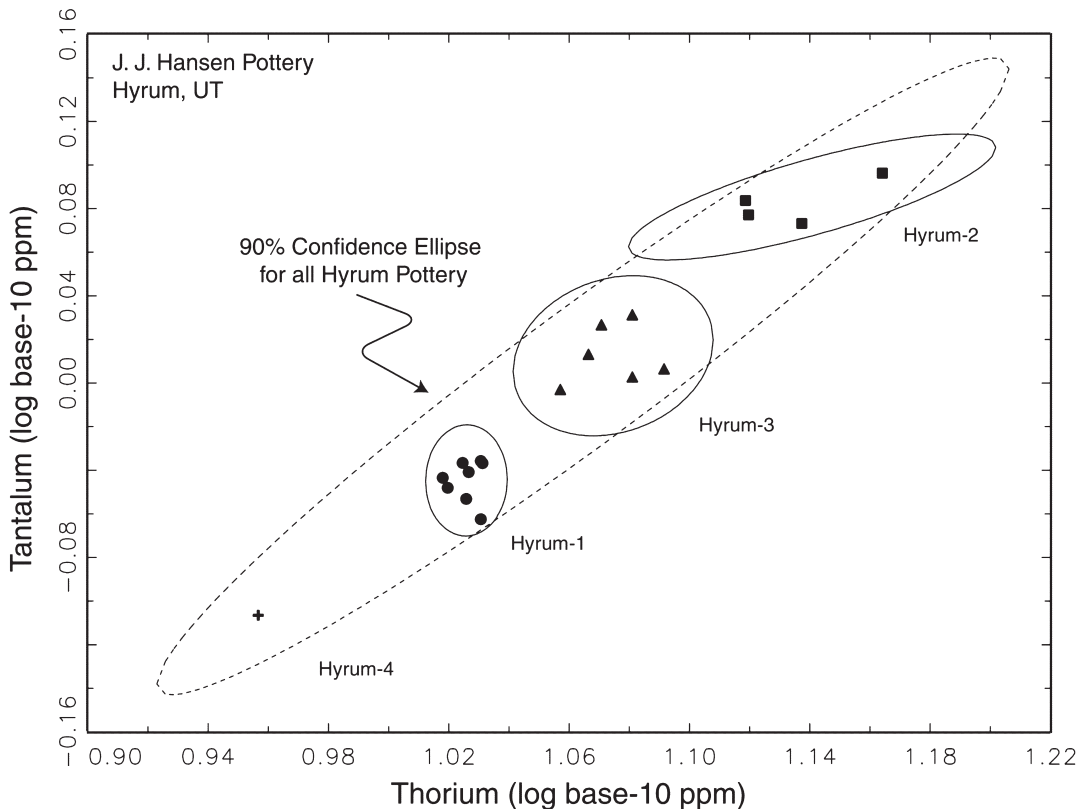


FIGURE 9. Bivariate plot of thorium and tantalum base-10 logged concentrations showing the overall confidence ellipse for J. J. Hansen's Hyrum pottery as well as three distinct subgroups. Ellipses are drawn at the 90% confidence interval. (Graph by Robert J. Speakman, 2006.)

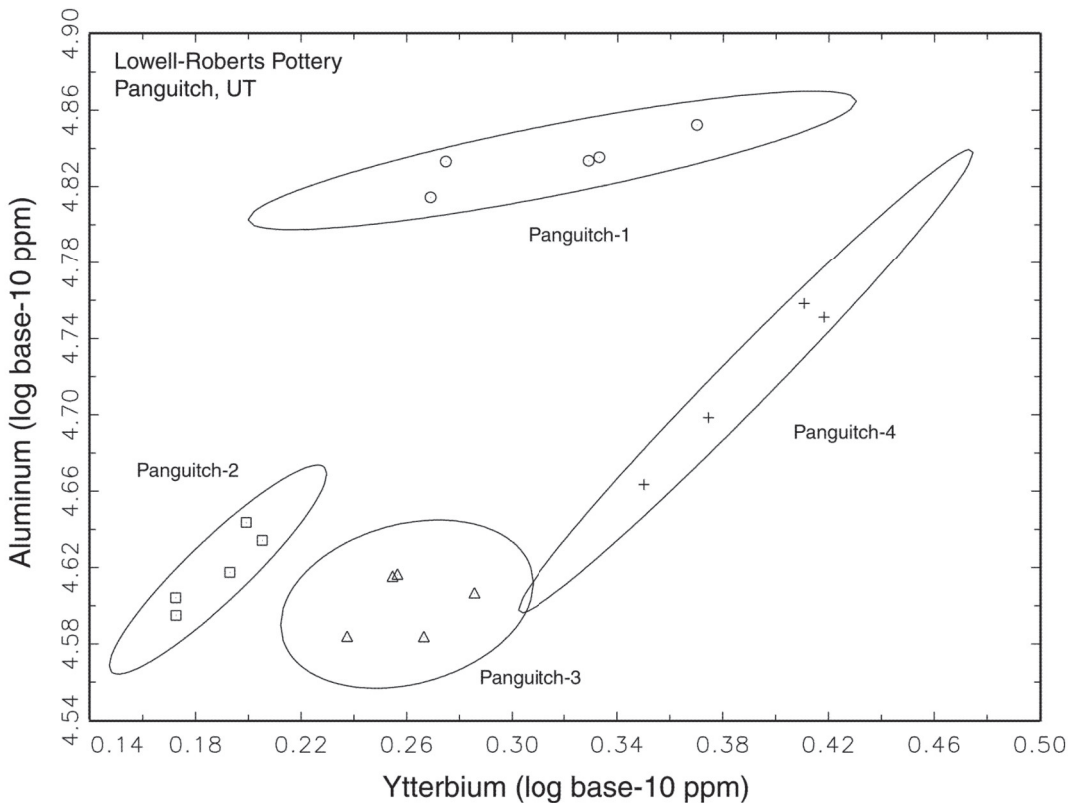


FIGURE 10. Bivariate plot of ytterbium and aluminum base-10 logged concentrations showing the four distinct subgroups identified in the sample from the Lowell-Roberts Pottery in Panguitch. Ellipses are drawn at the 90% confidence interval. (Graph by Robert J. Speakman, 2006.)

gender, class, religion, and other areas of social symbolism. Rather than simply looking for “the Latter-day Saint consumption pattern,” archaeologists will begin asking, “What are the specific strategies of Latter-day Saint exchange?” Researchers could design field and lab research to measure familial gift giving or test the traditional assumptions of locality in the distribution of utilitarian commodities.

In addition to the overall clustering, the samples from several potteries in this study showed internal patterning and subgroup clustering. While each ware’s fabric appears elementally quite distinct from the products of other potteries, the internal variation also seems to cluster. Rigorous statistical testing of the subgroup structure was not possible due to the number of groups identified and the small number of specimens assigned to each subgroup. Despite this limitation, pottery from each site was determined to be chemically distinct, and in several

cases more than one chemical “fingerprint” was identified at a production site—an indication of changes that occurred in recipes through time and for manufacture of different ware types. This was true at Bedson Eardley’s Deseret Pottery in Salt Lake City (Figure 8), J. J. Hansen’s Hyrum Pottery (Figure 9), the Lowell-Roberts pottery in Panguitch (Figure 10), and Thomas Davenport’s Parowan Pottery (Figure 11).

Eardley’s pottery was partially salvaged in 1977 when Nancy Richards and a group of University of Utah students pulled samples from back-dirt piles on a construction site. The artifacts lack any stratigraphic relationship whatsoever. The wasters and most vessel fragments clustered quite clearly and can be firmly associated with the production site. On the other hand, the finished vessels may not link as firmly, as evidenced by the pair of unassigned sherds. Shovel test probes on the properties surrounding J. J. Hansen’s Hyrum

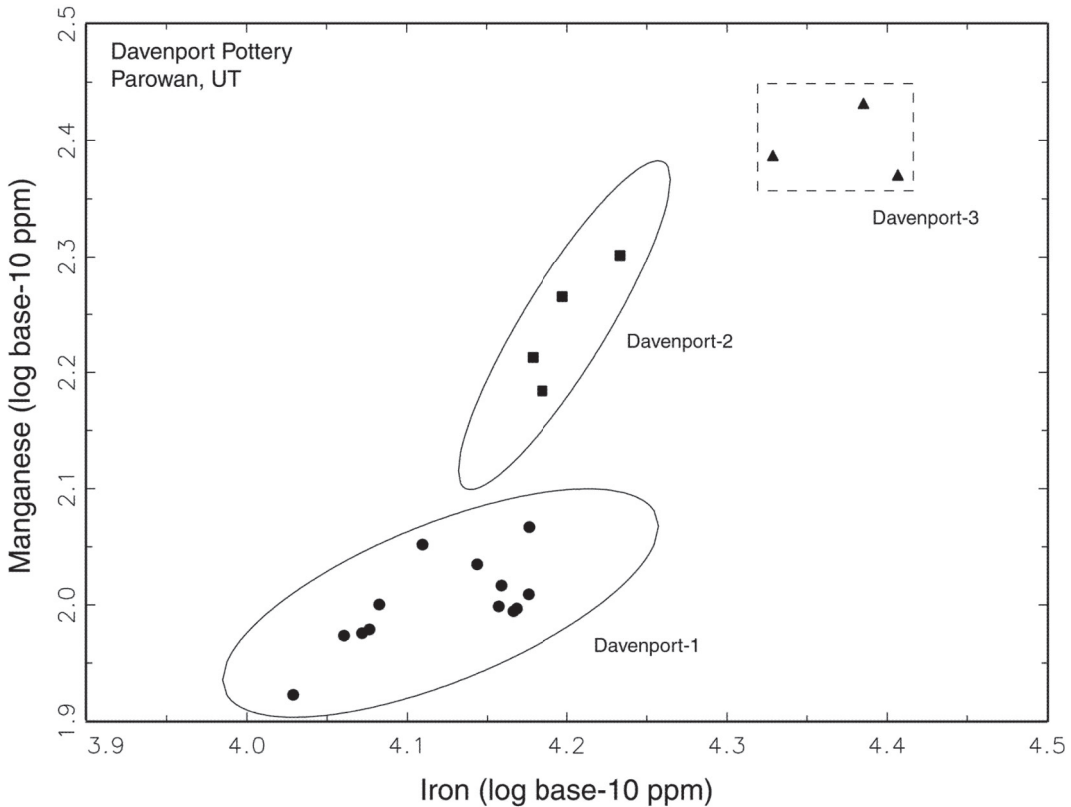


FIGURE 11. Bivariate plot of iron and manganese base-10 logged concentrations showing three subgroups identified in the sample from Thomas Davenport's Parowan Pottery. Ellipses are drawn at the 90% confidence interval. (Graph by Robert J. Speakman, 2006.)

pottery produced sherds that sort into four subgroups (Figure 9). The samples did not exhibit a meaningful pattern that archaeologists can define in relation to horizontal or vertical stratigraphy at this time. Unlike the situation at Eardley's pottery in Salt Lake City, future fieldwork will provide much more data for analysis at Hansen's Hyrum Pottery.

The subgroups from the Lowell-Roberts pottery in Panguitch offered interesting patterns because stratigraphic association closely matched chemical association (Figure 10). Subgroup 1 included only wasters from a single excavation unit (1 x 1 m). Subgroups 2 and 3 represented the bottom and top levels of a vertically stratified feature of pottery wasters. The final set, Subgroup 4, included one sherd from the surface collection along with two kiln furniture fragments visually identical to fragments in Subgroup 3. By comparison, the samples from Thomas Davenport's Parowan pottery sorted

into three major subgroups (Figure 11). These kiln wasters and ceramic fragments sorted out roughly by stratigraphic context but separated most clearly according to macroscopic fabric traits. Davenport subgroups 1 and 3 included massive fabric paste of a light reddish brown color. Subgroup 2 at this site included a similar paste fabric, but these sherds also included coarse sand-sized, black inclusions.

As future work provides a larger sample size for sites exhibiting stratigraphically and typologically defined subgroups, archaeologists should be able to detect production decisions made by individuals or single families/production groups. This research program will provide a rare opportunity to examine in fine detail how craftspeople flourished or failed within new environments. By mixing archaeological excavation and contextual research with aggressive experimental and materials science laboratory work, the study of Utah's 19th-century potters

presents a rare opportunity to enhance archaeological models of colonization, landscape learning, and technology transfer. Those potteries with substantial intact archaeological deposits, such as Panguitch, Parowan, and Hyrum, provide an opportunity to write ecobiographic narratives that recount detailed stories of how people built lives within the dynamically changing ecological and cultural landscape in each place (Hardesty and Fowler 2001; Scarlett et al. 2005). Each narrative could relate the biographical history of both pots and potters, situating them within landscapes and communities over the course of their life histories.

Conclusions

This research program unites the methods of INAA and contextual interpretation toward understanding Latter-day Saint immigrant potters in the Mormon domain. The analytical framework presented here permits archaeologists to begin measuring various exchange and distribution systems of locally made pottery among Latter-day Saint communities and the wider world. Given the distinct compositional signature(s) for each producer, it is highly probable that additional study of Utah's 19th-century potteries will yield important data about economic networks. This study illustrates the complexity of Utah's transformations during the rise of the industrial era and America's 20th century. What little historical data exists showed that assumptions about the differences between urban and rural production, market decisions, and economic decision making are perhaps overly simplified and misleading. Religion, a frequently overlooked venue of social interaction, played a very important role in these developments, permeating every part of work and life for potters, clay workers, and their families.

As more samples are added from the 26 potteries that operated in Utah's 19th century, researchers will undoubtedly refine the group classification. This first study points clearly to future ability to model the movement of domestic crockery and "homemade" tableware among Latter-day Saint settlements. Future archaeometric study will permit proxy study of inter- and intra-village barter, trade, and exchange for an industry that left very few business records. These studies will permit examination of diverse

social factors of economy, including kinship networks, the official Latter-day Saint redistribution system for poverty relief, the increasing penetration of globalized market agents, and other subtle elements of political and economic geography. This study is essential before domestic earthenware can be used in studies of consumption that purport to model any material expression of Latter-day Saint identity.

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References

- ARRINGTON, LEONARD J.
1958 *Great Basin Kingdom: Economic History of the Latter-Day Saints, 1830–1900*. Harvard University Press, Cambridge, MA. Reprinted in 1970 by University of Nebraska Press, Lincoln.
- ADAMS, WILLIAM H.
1977 *Silcott, Washington: Ethnoarchaeology of a Rural American Community*. Report of Investigations, No. 54, Laboratory of Anthropology, Washington State University, Pullman.
- BISHOP, RONALD L., PATRICIA FOURNIER, M. JAMES BLACKMAN, AND LAMBERTUS VAN ZELST
2004 Compositional Perspectives on Mexican Glaze Ware Production. Paper presented at the 37th Annual Conference on Historical and Underwater Archaeology, The Society for Historical Archaeology, St. Louis, MO.
- CARTER, KATE B. (COMPILER)
1940 *Heart Throbs of the West*, Vol. 2. Daughters of the Utah Pioneers, Salt Lake City, UT.
- CHIDESTER, IDA, ELEANOR BRUHN, AND ALICE HAYCOCK
1949 *Golden Nuggets of Pioneer Days: A History of Garfield County*. Garfield County News, Panguitch, UT.
- CHRESTIEN, JEAN-PIERRE, AND DANIEL DUFOURNIER
1995 French Stoneware in North-Eastern North America. In *Trade and Discovery: The Scientific Study of Artefacts from Post-Medieval Europe and Beyond*, Duncan R. Hook and David R. M. Gaimster, editors, pp. 91–104. Occasional Paper, No. 109, British Museum Press, London, England.
- CHRISTENSEN, GROVER
1969 Pioneer Business and Industry: Pottery. In *Home in the Hills of Bridger Land: History of Hyrum, 1860–1969*, Earle W. Allen, Bessie Brown, and Lila Eliason, compilers, pp. 91–92. City of Hyrum, Hyrum, UT.
- COWELL, M. R. AND DAVID R. M. GAIMSTER
1995 Post-Medieval Ceramic Stove Tiles Bearing the Royal Arms of England. In *Trade and Discovery: The Scientific Study of Artefacts from Post-Medieval Europe and Beyond*, Duncan R. Hook and David R. M. Gaimster, editors, pp. 105–116. Occasional Paper, No. 109, British Museum Press, London, England.
- DRAKICH, SOPHIE
1982 Eighteenth-Century Coarse Earthenwares Imported into Louisbourg. *Material History Bulletin* 16: 83–98.
- FERG, ALAN
1993 Behrman Pottery Excavated in Brigham City. *Arizona Clay News*, February:1–2.
2005 Brother Behrman's Pottery. *Archaeology Southwest* 19(2):7.
- FORSGREN, LYDIA WALKER (COMPILER)
1937 *History of Box Elder County*. Daughters of the Utah Pioneers, Box Elder County, UT.
- FRANCAVIGLIA, RICHARD V.
1970 The Mormon Landscape: Definition of an Image in the American West. *Proceedings of the Association of American Geographers* 2:59–61.
1978 *The Mormon Landscape: Existence, Creation, and Perception of a Unique Image in the American West*. AMS Press, New York, NY.
- GAIMSTER, DAVID R. M., AND DUNCAN R. HOOK
1995 Post-Medieval Stoneware Manufacture and Trade in the Rhineland and Southern Britain: A Programme of Neutron Activation Analysis at the British Museum. In *Trade and Discovery: The Scientific Study of Artefacts from Post-Medieval Europe and Beyond*, Duncan R. Hook and David R. M. Gaimster, editors, pp. 69–90. Occasional Paper No. 109, British Museum Press, London, England.
- GIBBLE, PATRICIA, AND META JANOWITZ
2002 Redware Discussion Forum. Discussion forum held at the 15th Annual Conference of the Council for Northeast Historical Archaeology, Wilmington, DE.
- GILBERT, ALLAN S., GARMAN HARBOTTLE, AND DANIEL DENOYELLES
1993 A Ceramic Chemistry Archive for New Netherlands/ New York. *Historical Archaeology* 27(3):17–56.
- GLASCOCK, MICHAEL D.
1992 Characterization of Archaeological Ceramics at MURR by Neutron Activation Analysis and Multivariate Statistics. In *Chemical Characterization of Ceramic Pastes in Archaeology*, Hector Neff, editor, pp. 11–29. Monographs in World Archaeology, No. 9, Prehistory Press, Madison, WI.
- GOODSELL, TODD
2000 Maintaining Solidarity: A Look Back at the Mormon Village. *Rural Sociology* 65(3):357–375.
- HARDESTY, DONALD L., AND DONALD D. FOWLER
2001 Archaeology and Environmental Changes. In *New Directions in Anthropology and the Environment*, Carole L. Crumley with A. Elizabeth van Deventer and Joseph J. Fletcher, editors, pp. 72–89. Altamira Press, Walnut Creek, CA.

- HARTLEY, WILLIAM G.
1987 Ward Bishops and the Localizing of LDS Tithing, 1847–1856. In *New Views of Mormon History*, Davis Britton and Maureen Ursenbach Beecher, editors, pp. 96–114. University of Utah Press, Salt Lake City, UT.
- HEATH, BARBARA
1988 *Afro-Caribbean Ware: A Study of Ethnicity on St. Eustatius*. Doctoral dissertation, Department of Anthropology, University of Pennsylvania, Philadelphia. University Microfilms International, Ann Arbor, MI.
- HENRICHSEN, KIRK
1988 Pioneer Pottery of Utah and E. C. Henrichsen's Provo Pottery Company. *Utah Historical Quarterly* 56(4): 360–395.
- HENRICHSEN, LYNN E., AND KIRK B. HENRICHSEN
1984 The Henrichsen Pottery: A Historical Sketch of the Provo Pottery Company and Its Proprietor/Operator: E. C. Henrichsen. Manuscript, Kirk Henrichsen papers, Sheri Slaughter Collection, Marriott Library Special Collections Department, University of Utah, Salt Lake City.
- HUGHES, MICHAEL J.
1995 Neutron Activation Analysis of Post-Medieval European Earthenware Ceramics: A Survey of Current Projects at the British Museum. In *Trade and Discovery: The Scientific Study of Artefacts from Post-Medieval Europe and Beyond*, Duncan R. Hook and David R. M. Gaimster, editors, pp. 55–68. Occasional Paper, No. 109, British Museum Press, London, England.
- KIMBALL, MONIQUE E.
1988 A Matter of Faith: A Study of the Muddy Mission. Master's thesis, Department of Anthropology, University of Nevada, Las Vegas.
- LEONE, MARK P.
1978 Archaeology as the Science of Technology: Mormon Town Plans and Fences. In *Historical Archaeology: A Guide to Theoretical and Substantive Contributions*, Robert L. Schuyler, editor, pp. 191–200. Baywood Publishing Co., Farmingdale, New York.
1979 *The Roots of Modern Mormonism*. Harvard University Press, Cambridge, MA.
- LYONS, PATRICK
2001 *Winslow Orange Ware and the Ancestral Hopi Migration*. Doctoral dissertation, Department of Anthropology, University of Arizona, Tucson. University Microfilms International, Ann Arbor, MI.
- MAY, DEAN
1992 A Demographic Portrait of the Mormons, 1830–1980. In *The New Mormon History*, D. Michael Quinn, editor, pp. 121–126. Signature Books, Salt Lake City, UT.
- MEINIG, DONALD W.
1965 The Mormon Culture Region: Strategies and Patterns in the Geography of the American West, 1847–1964. *Annals of the Association of American Geographers* 55:191–220.
- NEFF, HECTOR
2000 Neutron Activation Analysis for Provenance Determination in Archaeology. In *Modern Analytical Methods in Art and Archaeology*. Enrico Ciliberto and Giuseppe Spoto, editors, pp. 81–134. Chemical Analysis Series, Vol. 155. John Wiley & Sons, New York, NY.
- NEFF, HECTOR (EDITOR)
1992 *Chemical Characterization of Ceramic Pastes in Archaeology*. Monographs in World Archaeology, No. 7, Prehistory Press. Madison, WI.
- NELSON, LOWRY
1952 *The Mormon Village: A Pattern and Technique of Land Settlement*. University of Utah Press, Salt Lake City.
- NIELSON, EMMA CYNTHIA
1963 The Development of Pioneer Pottery in Utah. Master's thesis, Department of Art, Brigham Young University, Provo, UT.
- OWEN, J. VICTOR
1997 Quantification of Early Worcester Porcelain Recipes and the Distinction between Dr. Wall- and Flight-Period Wares. *Journal of Archaeological Science* 24(4):301–311.
2001 Geochemical and Mineralogical Distinctions between Bonnin and Morris (Philadelphia, 1770–1772) Porcelain and Some Contemporary British Phosphatic Wares. *Geoarchaeology: An International Journal* 16(7):785–802.
2003 The Geochemistry of Worcester Porcelain from Dr. Wall to Royal Worcester: 150 Years of Innovation. *Historical Archaeology* 37(4):84–96.
- OWEN, J. VICTOR, BRIAN ADAMS, AND ROY STEPHENSON
2000 Nicholas Crisp's "Porcellien": A Petrological Comparison of Sherds from the Vauxhall (London; ca. 1751–1764) and Indeo Pottery (Bovey Tracey, Devonshire; ca. 1767–1774) Factory Sites. *Geoarchaeology: An International Journal* 15(1): 43–78.
- OWEN, J. VICTOR, AND DENISE HANSEN
1996 Compositional Constraints on the Identification of Eighteenth-Century Porcelain Sherds from Fort Beausejour, New Brunswick, and Grassy Island, Nova Scotia, Canada. *Historical Archaeology* 30(4): 88–100.
- OWEN, J. VICTOR, AND MAURICE HILLIS
2003 From London to Liverpool: Evidence for a Limehouse-Reid Porcelain Connection Based on the Analysis of Sherds from the Brownlow Hill (ca. 1755–1767) Factory Site. *Geoarchaeology* 18(8):851–882.

- PENDERY, STEPHEN
1985 Ceramics and the Colonial System: The Charlestown Example. In *Domestic Pottery of the Northeastern United States, 1625–1850*, Sarah Peabody Turnbaugh, editor, pp. 67–80. Academic Press, New York, NY.
- ROBERTS, STEPHEN WILLIAM
[1950] Biography of William Evermont Roberts. Compiled by his Son. Manuscript, folder 1143, Regional Room, Utah County Library, Vernal, UT.
- ROSENVALL, LYNN A.
1978 Defunct Mormon Settlements: 1830–1930. In *The Mormon Role in the Settlement of the West*, Richard H. Jackson, editor, pp. 51–74. Brigham Young University Press, Provo, UT.
- SALT LAKE DAILY HERALD
1880 No title. *Salt Lake Daily Herald*, 22 April. Salt Lake City, UT.
- SCARLETT, TIMOTHY JAMES
2002 *Potting in Zion: Craft and Industry in Utah, 1848–1930*. Doctoral dissertation, Department of Anthropology, University of Nevada, Reno. University Microfilms International, Ann Arbor, MI.
2006 Globalizing Flowscapes and the Historical Archaeology of the Mormon Domain. *Journal of International Historical Archaeology* 19(2): 109–134.
[2008] Commodity Phases and Utah's Domestic Pottery. In *Science in Historical Archaeology*, Timothy James Scarlett, editor. University Press of Florida, Gainesville, FL.
- SCARLETT, TIMOTHY JAMES, ROBERT J. SPEAKMAN, GARRETT TIMMERMAN, AND MICHAEL D. GLASCOCK
2005 Religion and Environmental Learning: The Latter-day Saints' Nineteenth-Century Pottery Industry. Paper presented at the 103rd Annual Meeting of the American Anthropological Association, Atlanta, GA.
- SKOWRONEK, RUSSELL K.
2004 Ceramic Distribution Patterns in Spanish and Mexican Period California. Paper presented at the 37th Annual Conference on Historical and Underwater Archaeology, The Society for Historical Archaeology, St. Louis, MO.
- SLAUGHTER, SHERI EARDLEY
2001 *Bedson Eardley and Mary Ann Holding, Their Families and their Histories*. Privately printed, Salt Lake City, UT.
- SORENSEN, JOHN L.
1997 *Mormon Culture*. New Sage Books, Orem, UT.
- STEEN, CARL
1999 Pottery, Intercolonial Trade, and Revolution: Domestic Earthenwares and the Development of an American Social Identity. *Historical Archaeology* 33(3): 62–72.
- THOMAS DAVENPORT FAMILY ORGANIZATION
1981 *Thomas Davenport: His Life, History, and Posterity*. Community Press, Provo, UT.
- THOMAS, WILLIAM J., NATHAN BOWER, JOHN KANTNER, MARIANNE STOLLER, AND DAVID SNOW
1992 An X-Ray Fluorescence-Pattern Recognition Analysis of Pottery from an Early Historic Hispanic Settlement near Santa Fe, New Mexico. *Historical Archaeology* 26(2):24–36.
- TURNBAUGH, SARAH PEABODY
1983 Seventeenth- and Eighteenth-Century Lead-Glazed Redwares in the Massachusetts Bay Colony. *Historical Archaeology* 17(1):3–17.
- TURNBAUGH, SARAH PEABODY (EDITOR)
1985 *Domestic Pottery of the Northeastern United States, 1625–1850*. Academic Press, New York, NY.
- VAZ, J. E., J. J. LABRECQUE, AND J. M. CRUXENT
1997 Determination of the Provenance of Majolica Ceramics from Europe by Thermoluminescence Employing Principal Components. *Journal of Analytical Chemistry* 358:229–232.
- WAHLQUIST, WAYNE L.
1978 Population Growth in the Mormon Core Area: 1847–1890. In *The Mormon Role in the Settlement of the West*, Richard H. Jackson, editor, pp. 107–134. Brigham Young University Press, Provo, UT.
- WATKINS, LURA WOODSIDE
1950 *Early New England Potters and Their Wares*. Archon Books, Hamden, CT.
- YOUNG, MICHAEL L.
2002 *Technological Style and Typology: A Study of Colono Ware Ceramics from Galways Village, Montserrat*. Volumes in *Historical Archaeology* 42. The South Carolina Institute of Archaeology and Anthropology, Columbia.
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