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Shards in sherds: Identifying production locations and exchange patterns using electron microprobe analysis of volcanic ash temper in northern Rio Grande Biscuit ware

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ABSTRACT

The research presented here focuses on the composition of Biscuit ware ceramics produced during the Classic period (1325–1650 CE) in the northern Rio Grande region of New Mexico. Data from sites in the southern part of the Pajarito Plateau are compared with those from the Chama area to the north to identify production sites. We employ petrographic analysis to determine the composition of lithic inclusions in clay plus electron microprobe chemical analysis of the glass shards in the characteristic volcanic ash temper to identify production location. We combine analysis of temper and paste composition with analysis of mechanical characteristics and design to identify production specialization in specific parts of the region. Examination of Biscuit ware distribution indicates that a specific set of ritual practices in the production area was expressed using a characteristic set of designs and icons. The limited circulation of only larger sizes of Biscuit ware serving bowls to more southerly sites, outside of the production area, likely represents an increase in inter-area communal feasting and the intentional production of goods for use in communal rituals.

1. Introduction

Our goal in this paper is to determine the production location of Biscuit ware found in northern Rio Grande ceramic assemblages through the fifteenth century A.D. and to assess whether standardized functional and performance characteristics indicate specialized production for exchange and can be used to imply an extended network of social and religious relationships.

Biscuit, or black-on-gray, ware is the last in the matte-painted black-on-white series that dominated ceramic assemblages at sites north of Water Canyon on the Pajarito Plateau and in the Chama region through the fifteenth century A.D. (Fig. 1) (Fig. 2). To the south and east, glaze-paint designs on red- and yellow-slipped surfaces, most likely introduced by migrants from the Western Pueblo area, appear alongside black and-white service wares beginning in the early fourteenth century (Adams, 1991; Duff, 2002; Eckert, 2006; Habicht-Mauche, 1993; Huntley, 2008; Peckham, 1990; Shepard, 1965).

Biscuit ware vessels are distinctive for their large size, thick walls, characteristic designs, and paste (Graves and Eckert, 1998; Kidder, 1931; Shepard, 1936). The paste consists of volcanic ash temper in a moderately well-sorted, medium-to-coarse, porous, light brown, lumpy montmorillonite clay matrix containing varying amounts of sand-sized rock fragments (Fig. 3a and b).

Biscuit A, contemporaneous with Glaze A (Table 1), first appeared in the Chama area around 1340 CE (Habicht-Mauche, 1993:10, Table 2, based on data from Breternitz, 1966; Honea, 1968; Smiley et al., 1953; Sundt, 1987) and outside this area around 1370 CE (Habicht-Mauche, 1993). Biscuit A is characterized by grayish-white slipped bowl interiors decorated with carbon paint; unslipped, undecorated exteriors; everted rims with interior framing lines and characteristic motifs; and flat lips with rim ticks (Kidder, 1931:72–73). Biscuit B, contemporaneous with Glaze C, is dated from 1400–1500 CE using dendrochronology (Breternitz, 1966:70; Kidder and Amsden, 1931; Mera, 1934; Shepard, 1936) and is distinguished from Biscuit A primarily by slipped and decorated bowl exteriors, a greater range of bowl sizes, and decorated jars.

Production was limited by accessibility to the appropriate clay and volcanic ash deposits. Biscuit ware found at sites far from ash deposits, such as Pecos Pueblo (LA 625), suggests participation in long-distance social and exchange networks (Kidder and Shepard, 1936; Powell, 2002; Shepard, 1936).

Despite the presence of ash deposits on the southern Pajarito

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Fig. 1. Biscuit B (Bandelier Black-on-gray) Bowl from LA 82 (Tyuonyi) at Bandelier National Monument, on the southern Pajarito Plateau, New Mexico.
Diameter 38.5 cm, Height 19.5 cm, Thickness 0.7 cm.
http://www.nps.gov/museum/exhibits/band/exb_archeology/BAND1571_bowl_exb.html

Plateau, sites there are dominated by Glaze ware. At Bandelier National Monument (BNM), Biscuit ware makes up between 15 and 26% of all service ware at Tyuonyi (LA 82) and Tyuonyi Annex (LA 60550). However, Biscuit ware bowls larger than 32 cm in diameter make up between 47 and 66% of the total (Curewitz, 2008: Table 9.5a & b) (Fig. 4).

North of Water Canyon, at Pajarito sites such as Tsirege (LA 170) and Tsankawi (LA 211), and in the Chama region, service ware assemblages consist almost entirely of Biscuit ware. (Curewitz, 2008: Table 6-14b).

Significant quantities of Biscuit ware are found south of the Pajarito Plateau in the Cochiti area (Warren, 1976). Southeast of the Pajarito, however, in the Santa Fe area and Galisteo Basin, sites contain little or none (Habicht-Mauche, 1993; Schaafsma, 1995; Warren, 1968, 1979).

Hypotheses tested in this study are that

- Identification of production locale using temper sources and differential distribution of large serving vessels documents long-distance exchange of ritually significant vessels;
- Standardization of functional and performance-related characteristics documents an increase in specialized production;
- Data showing type diversity, mechanical and design-attribute standardization, and the geographic range of temper sources, suggest the existence of production centers for exchange; and
- Relative frequency of design constituents suggests standardization related to social identity and ritual requirements

(Costin, 1991; Costin and Hagstrum, 1995; Habicht-Mauche, 1993; Vint, 1999).

2. Theory/calculation

2.1. Communal feasting and risk reduction

Communal feasting within and between communities reinforces social norms, strengthens alliances, and promotes cooperation. Population increase and aggregation into large sites, which began in the Early Coalition (1150–1250 CE) in the northern Rio Grande and continued through the Late Coalition (1250–1325 CE), limited the mobility which had previously helped mitigate potential conflict over resources; alternative strategies for promoting cooperation and decreasing conflict were required (Fowles et al., 2007; Haas and Creamer, 1996; Hunter-Anderson, 1979; Kohler, 1989; Kohler and Van West, 1996; Kohler et al., 2014; Lipe, 1995; Powers and Orcutt, 1999; Preucel, 2000).

Studies of communal feasting and ritual systems by Graves (1996), Potter (2000), and Spielmann (1998) demonstrate the development of these communal ritual institutions at the Coalition-to-Classic transition (1275–1350 CE) and their persistence through the Classic period, supported by social integrative architecture, ceramics and faunal remains.

Graves and Eckert (1998:264) and Spielmann (1998) argue that icons and vessel size suggest the association of Biscuit ware with communal feasting within and between communities, strengthening alliances and promoting cooperation (see Hayden, 2001:Fig. 2.1). An increase in ritual-related communal feasting could require food preparation and serving vessels meeting ideological as well as performance standards, and would increase demand for ceramic vessels with specific, ritually determined attributes (Dietler, 2001; Graves, 1996; Hayden, 2001; Potter, 1997a, 1997b, 2000; Snow, 1981; Spielmann, 1998, 2002). Brandt (1994), Hegmon (2005) and Spielmann (2002) have suggested that only certain people would be permitted to have the ritual knowledge required to produce the vessels, limiting the number of producers to those specialists.

2.2. Determining production location

Ritual knowledge and proximity to raw materials are both factors which limit the number of ceramic producers and increase the degree of ceramic specialization. Our research focused on defining geologic factors which determined the degree to which Biscuit ware production was concentrated in particular locations and using this source information to define Biscuit ware distribution patterns.

The Provenience Postulate (Bishop et al., 1982) states that in mid-range, non-industrial societies lacking large-scale markets, pottery will most often be found closest to the raw material source. Conversely, pottery containing raw materials found at some distance from a site will have arrived through gift exchange or barter.

Arnold (1985: Tables 2.1 and 2.2) concluded that about 90% of all temper materials (inclusions) were found within 9 km of a production site and around 50% came from within 1 km. Detailed knowledge of regional geology is therefore essential in identifying the source materials available to potters at archaeological sites and determining whether the site occupants are producers or consumers of specific ceramic types.

The Pajarito Plateau is blanketed with volcanic ash deposits (Fig. 5) and underlain with extrusive volcanic rocks. The Lower Bandelier Plinian Ashfall (Guaje Pumice) erupted 1.6 million years ago and formed the lowest layer of the Otowi Member. The Upper Bandelier Plinian Ashfall (Tsankawi Pumice) erupted from the Jemez volcanic field around 1.2 million years ago and formed the lowest layer of the Upper Bandelier (Tshirege Member) Tuff (UBT), or ignimbrite. The UBT consists of four cooling units, with Unit I directly above the Tsankawi Pumice. The lower half of Unit I is the least welded and is separated from the upper half by a Vapor Phase Notch (VPN) (Fig. 6). The upper half of Unit I and Units II-IV are welded through heat, vapor, and compaction, which deforms and devitrifies the glass. The latest deposit, El Cajete, is dated between 50 and 60 mya (Broxton and Reneau, 1996; Broxton et al., 2008; Caress, 1996; Goff et al., 2002; Stimac, 1996).

The Sangre de Cristo Mountains to the east of Santa Fe are largely comprised of granite and metagranites. Lithic inclusions derived from volcanic rock (rhyolites, andesites, or basalts) and/or ash could contain biotite, but not muscovite mica. Volcanic rock fragments would also contain plagioclase or alkali feldspar with the exception of microcline. Inclusions derived from granitic rock fragments such as granite or diorite, and metagranites such as gneiss or schist, would likely contain biotite and/or muscovite and alkali feldspars including microcline.

Granitic or metagranitic rock fragments or minerals in Biscuit ware paste would suggest a production site off the Pajarito Plateau. The presence of both volcanic and granitic rock fragments and minerals would suggest production near streams containing sands from both volcanic and granitic terrains.