Identity and Material Practice in the Chacoan World: Ornamentation and Utility Ware Pottery

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Hannah V. Mattson  
Candidate

Anthropology  
Department

This dissertation is approved, and it is acceptable in quality and form for publication:

Approved by the Dissertation Committee:

Dr. Patricia L. Crown, Chairperson

Dr. Wirt H. Wills

Dr. James L. Boone

Dr. Barbara J. Mills
IDENTITY AND MATERIAL PRACTICE IN THE CHACOAN WORLD:
ORNAMENTATION AND UTILITY WARE POTTERY

BY

HANNAH VICTORIA MATTSON

B.A., Anthropology, Oregon State University, 2000
M.A., Anthropology, University of New Mexico, 2002

DISSERTATION

Submitted in Partial Fulfillment of the Requirements for the Degree of

Doctor of Philosophy
Anthropology

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DEDICATION

I dedicate this dissertation to my grandfather, Dr. Bruce D. Mattson. With his lifelong passion for education, critical thinking, family, and music, by example he taught me to strive for both excellence and balance.
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ABSTRACT

The papers that comprise this dissertation all explore the intersection of material culture and social identity. The central theme of these studies is that social identity is actively created and maintained through the production, consumption, and discard of material objects. In the first paper, I examine the distribution of ornament styles and practices of adornment across the prehispanic Southwest in relation to traditionally defined regional and culture-historical boundaries. Jewelry items of similar forms are widely distributed across cultures/groups; however, specific practices in the use and deposition of ornaments are not random within particular sociohistorical contexts.

In the second paper, I explore the relationship between identity and demographic reorganization through an examination of the extent to which Chacoan identity and practice, as demonstrated by the social values attributed to ornaments at Pueblo Bonito during the Chaco florescence, were maintained or transformed by the post-Chaco period inhabitants of Aztec’s West Ruin. I argue that at Pueblo Bonito, ornaments were
necessary in renewing the existing ritual-ceremonial order through the assembling of essential components of the natural and cultural worlds. It is proposed that these social values attributed to ornaments were directly cited at Aztec Ruin after the decline of Chaco Canyon as a central place in the San Juan Basin.

The third study, published in *The Pueblo Bonito Mounds of Chaco Canyon: Material Culture and Fauna*, edited by Patricia L. Crown, focuses on practices of production, use, and discard of utilitarian gray ware ceramics from Pueblo Bonito. The attributes of the culinary ware pottery assemblage from the large middens at the site are consistent with household-level cooking activities. However, there is also evidence for suprahousehold feasting using large imported Chuska cooking vessels, which may have held special meaning through their associations with an important place on the landscape. This dissertation demonstrates that the materiality of social existence extends to all types of practice; people continually define their identities through activities and performances involving both commonplace and rare objects /materials.
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Chapter 1
Introduction

Material Style, Social Identity, and Practice

On the morning of the fifth day, Tiyo decided that it was time for him to start back to his own people. He went into a small chamber on the north side of the Hurung Whuti’s [a female deity] kiva and took from it one turquoise bead; from a similar room on the west side, he took another turquoise bead; from a room on the south, a red coral bead; and from an east room, a white shell bead.


A theoretical and methodological issue fundamental to the interpretation of the archaeological record is the identification of the value and meaning associated with or encoded in material culture. In the past, the majority of the scholarly dialogue on this topic revolved around the analysis and interpretation of various aspects of the material style of artifacts. Within the last two decades, archaeological discourse on the subject has increasingly focused on the role of material culture in identity construction. This dialogue reflects a fundamental shift in the understanding of social identity within the discipline—from something inherent, fixed, and objective that can be equated with cultures or ethnicities to a social process that is contingent, flexible, and created and negotiated through practice. In contemporary archaeological perspectives, it is people’s interaction with the material world that actively and continually constitutes their social identities, as material culture is the vehicle through which social relations are generated and
reproduced. Social existence, then, is a material act; people define who they are, either consciously or not, through *doing*.

The papers that comprise this dissertation all explore the ways in which social identity is expressed in material culture through practice. This theme is examined at various temporal and geographic scales, including that of a single site (Pueblo Bonito, A.D. 900 to 1130), a region (San Juan Basin, A.D. 900 to 1300), and a macroregion (U.S. Southwest from A.D. 900 to 1450). Such a multiscalar approach highlights the dynamics of past materiality, allowing for new views of both correspondent and divergent social processes over short and long-term historical trajectories.

In addition, these studies focus on two very different artifact classes—ornaments and utilitarian pottery. These two categories of objects lie at apparently opposite ends of the spectrum in terms of worth and functionality. Ornaments are often assumed to represent wealth and luxury, while undecorated cooking pots are typically associated with mundane and basic household activities. However, as the following papers demonstrate, the default interpretations of the social value of these objects are not always warranted. The first paper presents a broad synthesis of ornamentation across the prehispanic U.S. Southwest from A.D. 900 to 1450, highlighting both larger patterns and specificities in practices of adornment. The distributions of the majority of ornament forms and materials cross-cut regional and culture-historical boundaries as they have been traditionally defined. In addition, these cross-cutting spatial distributions differ depending on the specific physical attribute considered. However, this does not mean that ornamentation was not an integral part of identity construction. Rather, ornaments of similar forms and/or materials were polysemic depending on their context of display; general stylistic
similarities mask underlying diversity in meaning and value, as expressed through variation in use. Although these practices may be arbitrary across cultures/groups, they do not appear to be random within specific sociohistorical contexts. In order to examine the link between ornaments and social identity, I argue that we must go beyond delineating geographic distributions of material style and attempt to situate practices of adornment in their distinct contexts.

The second paper explores the relationship between identity and demographic reorganization through an examination of the extent to which Chacoan identity and practice, as demonstrated by the social values attributed to ornaments at Pueblo Bonito during the Chaco florescence (A.D. 900 to 1130), were maintained or transformed by the post-Chaco period inhabitants of Aztec’s West Ruin (A.D. 1110/1130 to 1290s). The study includes the analysis of the large ornament assemblages from both of these sites, with an emphasis on identifying socially significant dimensions of physical variation through a contextual approach. Utilizing the concepts of value gradations, inalienability, and structured deposition, both similarities and differences in the social use and potential meaning of ornaments at the two sites are identified. Based on similarities in the attributes of ornaments associated with structured ritual deposits and high-status interments, it appears that the residents of Aztec Ruin continued to participate in at least some elements of the Chacoan ritual-ideological complex. I suggest that the depositional practices associated with these socially valuable goods served as citations or references to Chacoan cosmology and the powerful leaders and/or ancestors connected to Pueblo Bonito. Local leaders at Aztec Ruin may have used these references to legitimize their authority by affirming real or reconstructed historical links to Chaco Canyon.
The third paper examines practices of production, use, and discard of utilitarian gray ware ceramics at Pueblo Bonito. The study included the analysis of over 97,000 gray ware ceramic sherds from the two large trash mounds located directly in front of the structure. These artifacts were collected by the Chaco Stratigraphy Project (directed by Dr. Wirt H. Wills from UNM) during re-excavation of three trenches placed through the mounds in the 1920s by Neil Judd. The purpose of the project was to expose the stratigraphy in the trench profiles in order to examine the formation history of the mounds and investigate possible agricultural features. Analysis of the resulting assemblage of artifacts was the aim of the subsequent Pueblo Bonito Mounds project, directed by Dr. Patricia L. Crown from UNM. The third study appears as a chapter in the publication reporting the results of these analyses, The Pueblo Bonito Mounds of Chaco Canyon: Artifacts and Fauna.

A large percentage of the gray ware ceramics in the assemblage were imported from the Chuska area, located 70 km west of the canyon. Based on previous investigations, it has been proposed that the material in the Pueblo Alto midden resulted from feasting activities and the ritual breakage of pottery vessels. It has likewise been suggested that Pueblo Bonito served as a center of large-scale communal feasting and ceremony, and that these activities included Chuska Gray Ware vessels. Although the gray ware ceramic assemblage from the Pueblo Bonito mounds is largely consistent with household-level domestic activities, the study does find supporting evidence for suprahousehold food preparation based on Chuska Gray Ware cooking pots. In addition to being potentially functionally superior to their Cibola counterparts, I suggest that these vessels may have held symbolic value, perhaps representing links to a meaningful place.
or to important regional social ties. Other important topics addressed in the paper include the identification of different pottery production groups based on low-visibility elements of technological style.

**Social Identity and Material Culture: A Background**

In anthropological research, identity has traditionally been defined in terms of ethnic affiliation or membership within a group with common “religious beliefs and practices, language, a sense of historical continuity, and real or fictitious common ancestry and origin” (Kamp and Yoffee 1980:87-89). Particularly under the culture historical theoretical framework, such groups were thought to be manifested archaeologically by spatially and temporally bounded complexes of material culture resulting from shared rules and norms of behavior. The degree of homogeneity or continuity in these material distributions was assumed to be related to interaction or contact between different groups. Past archaeological research on identity largely focused on distinguishing these material correlates of social identity, particularly through various aspects of the material style of artifacts (e.g., Carr and Neitzel 1995; Hodder 1982; Plog 1982; Sackett 1982; Wiessner 1983; Wobst 1977). However, current definitions of social identity emphasize the relational, multifaceted, and dynamic aspects of group membership and personal identification; identity is seen as actively created and negotiated, primarily in relation to others (Diaz-Andreu et al. 2005, Jones 1997; Varien and Potter 2008). Much of the identity research conducted during the last two decades has been subsumed within larger migration studies. In order to identify social groups, these investigations rely on the conservative and context-independent aspects of material
culture, including elements of technological style, which are not readily altered (Clark 2001, 2004; Dietler and Herbich 1998; Dobres 2000; Hegmon 1998; Lechtman 1977). On the other hand, archaeological and cross-cultural research supply numerous examples where there is no clear association between certain scales of group identity or degrees of interaction and specific aspects of technology and style (Hegmon 1998; Jenkins 1996; Mills 2004, 2007; Stark et al. 1998).

Within contemporary archaeological approaches, individuals are seen as actively participating, either intentionally or nondiscursively, in the formation and negotiation of their own identities. Agency is thus embodied within, and identity is materialized through, the practices of individuals (Fowler 2004; Joyce 2005). The roles of individuals in the process of self-identification, and the material practices by which these roles are enacted, are both constrained and enabled by larger social structures, sociohistorical circumstances, and environmental limitations and opportunities (Bourdieu 1977, 1990; Dornan 2002; Giddens 1979; Varien and Potter 2008). Archaeological studies of personhood and embodiment/corporeality focus on this complex intersection between identity and materiality at the level of the individual “self” and the individual “body” (Fowler 2004; Joyce 2005; Thomas 2002). Recent research on the materialization of practices has also focused on the identification of socially valuable objects and inalienable possessions, items that are vital to social transactions, ritual performance, and the creation of social memories (Lesure 1999; Mills 2000, 2002, 2004, 2008; Walker et al. 1996; Walker and Lucero 2000; Weiner 1992, 1994). Specific practices involving these items, which are part of the active construction of identity, may be studied through examination of their use-lives, including deposition within certain contexts.
**Material Style**

Although definitions of style vary among researchers, depending on the theoretical approach employed, the term is generally used to refer to formal variation that expresses, either iconologically or symbolically, some aspect of identity. The major theories of stylistic variation are distinguished by which behavioral processes are thought to most influence stylistic decisions and how actively or consciously individuals participate in these decisions. In addition, researchers disagree about which attributes are most appropriate for stylistic analyses and how these attributes should be measured.

The information exchange (Braun and Plog 1982; Conkey 1978, 1980; Wobst 1977) and iconographic (Wiessner 1984, 1985) approaches conceptualize style as determined primarily by a need to communicate information to others. Stylistic aspects of artifacts therefore represent messages that are intentionally and actively transmitted and received (see also DeMarrais et al. 1996). In the iconographic approach, Wiessner (1983:259) refers to this same communicative aspect of style as "emblemic," distinguished from "assertive" style, which is not intended for an audience and is related solely to the identity of an individual. Style is also seen as active within the action/social dialectical theoretical perspective (Hodder 1982), although the justification of social relations and the creation of strategies for action are seen as primary determinants. By contrast, the social interaction or isochrestic (Sackett 1982, 1985, 1986) approach views style as a nonutilitarian aspect of formal variation that is expressed as a result of passive enculturation. Stylistic decisions, or the choice between functional equivalents (isochrestic variation), represent learned behaviors and reflect cultural norms. Therefore,
stylistic differences may be used to differentiate groups, and stylistic similarities may be used to measure the degree of social interaction between groups.

Another major issue in the style debate concerns the choice of attributes pertinent to stylistic analysis. According to Wobst (1977) and proponents of the social information exchange theory of style, the types of messages coded in artifacts are directly related to the visibility of stylistic elements, as vision is the mode of reception of target audiences (also Friedrich 1970). For example, stylistic forms that are visible from great distances generally represent group affiliation (Wobst 1978:333), those that are visible from intermediate distances contain information about within-group social identity, and the least visible elements are indicative of personal identity. Therefore, visibility is the main criterion for selecting attributes for analysis. Others focus on designs themselves, debating over the extent to which structural (the layout and symmetry of the design field) and iconic (the content of the design field, including motifs) aspects of style are related to groups or processes of different scales and levels of participation (e.g., Graves 1982; Lyons 2003; Plog 1982; Washburn 1982, 1983).

These various approaches to style are not necessarily mutually exclusive. As Carr (1995b:152) notes, "each school focuses on only a subset of all the factors that determine material style, different schools consider different subsets of factors, and these may operate at only some and varying formal levels." He proposes instead the integration of these theories, where behavioral processes and constraints that determine style and formal attributes relevant to stylistic analysis are each arranged within hierarchical or embedded structures. For example, personal identity and self-expression are embedded within social processes, which are in turn embedded within technological constraints. In
agreement with Wobst (1977) and Friedrich (1970), Carr (1995b) emphasizes visibility as the most essential dimension of attribute variation, in that it links behavioral processes with formal variation by determining the contexts in which an artifact is or is not seen. The main variables that determine an attribute's visibility are both physical (size, contrast, range of alternative states, complexity, and frequency) and contextual (including the physical and social contexts in which an object is used).

Group Identity and Style

The degree to which stylistic similarity reflects discrete or bounded social units has been the subject of much debate (e.g., Hegmon 1998; Stark et al. 1998). Research is increasingly demonstrating that the relationship between various aspects of technology and style is complex and determined by specific sociohistorical circumstances. In his study of the material correlates of tribal identity in Kenya, Hodder (1982:58) concludes that material style encompasses symbols used to actively negotiate both tension and reciprocity between groups, and therefore stylistic differences may be manipulated as components of social strategies. Furthermore, since symbols are actively selected rather than passively adopted, the particular attributes or objects that are most reflective of group identity depend on “the internal organization of a society and the symbolism of objects in that society” (Hodder 1982:85). The meaning ascribed to material culture, and to symbolic objects in particular, is thus culturally specific; material symbols serve to “elicit and convey specific responses and social messages within the context of the society making and utilizing such symbols” (Newell et al. 1990: 77).

Since identity is created, maintained, and renegotiated within the larger social and political context and through social interaction, periods of rapid change in these factors,
such as those occurring during demographic upheavals and subsequent reorganization, are conducive to shifts in self-identification (e.g., Hegmon 1995; Nelson and Hegmon 2001). In particular, changes in ideology are associated with conditions of “social and ecological disruption” characteristic of periods of abandonment and migration (Aldenderfer 1993; Rappaport 1968:234). These shifts are generally attributed to failure of previously held ideologies, the adoption or influence of the ideologies of other groups, and/or the emergence of new integrative ideologies (Adams 1991; Aldendenfer 1993; Cordell 1995; Crown 1994; Nelson and Schachner 2002; Schachner 2001; Ware and Blinman 2000). Environmental change is often implicated in the rejection of ideologies, as they, “failed to offer explanations for changes that were occurring and may have been abandoned by their practitioners” (Judge 1989; Judge and Cordell 2006; Nelson and Schachner 2002:194). In addition, within the dynamic social landscape accompanying population movement and settlement rearrangement, the nature and degree of interaction between groups with differing social identities changes. Depending on the intensity of this interaction, from occasional contact to coresidence, for example, ideologies that foster social integration may emerge or be adopted (e.g., Adams 1991; Lekson and Cameron 1995). Furthermore, transformation in the composition of these groups themselves is expected as individual perception of shared identity and ideology changes (Clark 2001, 2002; van Haeran and d’Errico 2006).

Large regional abandonments in the Southwest—including the Chaco region in the San Juan Basin in the middle A.D. 1100s, the northern San Juan Basin in the late A.D. 800s and late A.D. 1200s, and the Hohokam region in the early to middle A.D. 1400s—are all widely associated with major shifts in ideology (Adams 1991; Crown
1994; Judge 1989; Lipe 1995; Nelson and Schachner 2002; Ware 2014; Ware and Blinman 2000; Wilshusen and Van Dyke 2006). For example, in his study of transformations in ritual practice associated with migration out of the northern San Juan region in the Pueblo I period, Schachner (2001:168) found significant changes in, “the control of communal ritual and the negotiation of social power,” as seen through ritual architecture. Similarly, Wilshusen and Wilson (1995) conclude that northern San Juan migrants underwent major cultural changes in their move to the south in the late ninth century, including shifts in subsistence, ritual, and social organization. Wilshusen and Van Dyke (2006) note that such shifts “are not uncommon in migrant groups, and often result in new and pluralistic social identities” (2006:257; Waters 1995).

Archaeological research on migration highlights the importance of both the scale of population movement and the social context at the destination in the degree to which group identity, and changes therein, are visible in the archaeological record. Migration is typically defined as population movement across a large-scale social boundary (e.g., Cameron 2010, 2013; Clark 2001, 2002; Cameron and Ortman 2011; Stark et al. 1995). Alternatively, this scale of movement is termed “external migration” (Duff 1998) or “long-distance migration” (Anthony 1990), in contrast to “internal migration” which refers to “movement within a boundary” among “habitually interacting groups within a region” (Anthony 1990:901). However, because social and political boundaries are constantly redefined, deciding when a boundary has or has not been crossed can be difficult.

In mixed cultural settings resulting from external movement to pre-existing communities, material culture rapidly conforms to that of the recipient population as the
migrating group suppresses overt symbols of their dissimilarity in identity and ideology (Clark 2001, 2002). This conscious avoidance of symbols of identity in association with population movement is common only when certain conditions are met—namely, when a cultural enclave is present. However, the low visibility material traits associated with “enculturative behavior” resulting from “basic cultural training” (or *habitus*, see below) are more difficult to suppress intentionally (Bentley 1987; Clark 2001, 2002; Dietler and Herbich 1998; Lemonnier 1986, 1992; Lightfoot et al. 1998; Netting 1993; Wilk 1991; Wilk and Netting 1984). Therefore, it has been argued that the specific steps and choices involved in the production of artifacts, which constitute technological style, may have more utility in tracking the movement of migrants than less conservative aspects material culture (Clark 2001; Dobres 2000; Hegmon 1998; Lemonnier 1986, 1992; Reed 2006, 2008b; Stark et al. 1998; Zedeño 1994, 1998). However, more common than long-distance migration are smaller-scale movements, such as those involved in changes in settlement patterns within a region, where the motivations for signaling (or not signaling) of social identity are not as clear.

**Individual Identity and Embodiment**

Within contemporary approaches, the relationship between individuals and their larger social conditions is often explained within the framework of practice theory (Bourdieu 1977, 1990) and structuration (Giddens 1979, 1984). In these perspectives, individuals establish and signal their identities within the bounds (both rules and resources) of their social milieu (Sewell 1992; Joyce and Lopiparo 2005). Individual actions—including choices, perceptions, and techniques—are patterned because they are influenced by social prescriptions and structural conditions; this forms the basis of the
concept of *habitus* (Bourdieu 1977, 1990). Bourdieu emphasized that such ‘habituated’ practices or *dispositions* result from the “unintentional internalization of different external structures” (1990:60). Although Bourdieu’s (1977) basic concepts are widely utilized by contemporary researchers, it has been argued that his emphasis on the passive or unintentional role of individuals in social change is too limiting. Giddens (1979), on the other hand, conceived of individual action as both shaped and empowered by larger structures—while individual practice is largely habituated, it is not necessarily unconscious or non-reflexive (Dornan 2002; Joyce 2000; Meskell 2002).

While agency is generally understood as operating at the level of the individual or person, notions of what constitutes “the individual” vary cross-culturally (Fowler 2004; Geertz 1974; Johnson 2000; Shweder and Bourne 1982). The concept of the self/person is a social construct that may take many alternate forms. In Western culture, an individual is defined as an internal “self” that is comprised of feelings/thoughts and is impartible, autonomous, and discrete. However, other forms of personhood, which diverge significantly from contemporary western individuality, have been documented. Within such alternate modes of self-definition, persons may be conceived of as “dividual and composite, as permeable and partible” (Fowler 2004:20). For example, in both India and Melanesia, people are considered to be comprised of multiple parts, products, or substances derived from their interactions with others. In this form of dividual and partible personhood, the concept of the aggregate or hybrid nature of a person is emphasized more than the singularity of the physical body (Fowler 2004; Thomas 2002:215). In India, dividuality is expressed through the flow of substances or qualities from one person to another. People are considered to be distinct entities with boundaries
that are permeable to the essences or substance-codes of others (Busby 1997; Fowler 2004; Marriott 1976). The combination of essences that exist within the self, and the nature in which these essences are transmitted, are fundamental to “the attainment of personhood” (Fowler 2004:25) and social identity. Thus, while persons in the past would have had “individuality in the sense of conscious self-awareness and reflexive agency,” personal identity may have been relational and contextual, with certain aspects/parts of the self expressed over others at different times (2004:16).

In anthropological and social theory of the last several decades, the body has come to be viewed as the primary means through which identity or personhood is materialized and/or communicated (Cerezo-Román 2015; Joyce 2000, 2005; Kus 1992; Meskell 2002; Rautman 2000; Tarlow 1999; Williams and Sayer 2009). Bodily practices such as modification (including tattooing, scarification, piercing, and other alterations), adornment (including both ornamentation and dress), and treatment of the deceased have long been cited as external expressions of internalized social structures or dispositions. Within information transmission and related identity-signaling approaches in archaeology, for example, the surface of the body is portrayed as a means through which signals are broadcast to others. These signals are social messages about various aspects of identity that are conveyed through the display of publicly legible and visible symbols contained within material culture. Underlying the identity-signaling approach is the assumption that social conditions are replicated (to various degrees and at different levels of visibility) symbolically upon the surface of the body, and like a text, this information may be “read” or deciphered by others. Such perspectives assign a passive role to the body as a public canvas of display/inscription or as a reflection/artifact of societal norms,
and assume that there are independent or given identities that clearly correspond to specific types/attributes of material culture. Prestige goods and aggrandizer models, which focus the material signaling of differential status, may also be included in this approach (Bayman 2002; Clark and Blake 1994; DeMarrais et al. 1996; Earle 1987; Hayden 1998; Peregrine 1991).

In contemporary archaeological work, the body is conferred with an increasingly active role as the medium through which the individual/self/person as constituted through social practices acts in the material world; personhood is seen as ‘embodied’ within social actions (Butler 1993; Csordas 1999). The notion that bodies mediate the relationship between the self and the world, and thereby act as the vehicles of agency, lies at the heart of corporeality and embodiment approaches. The body is seen as an “instrument of lived experience” (Joyce 2005) and as the location of the “articulation of agency and structure” (Meskell 2000:18). These approaches challenge the long-held dichotomies of exterior object and interior subject.

**Study Areas: Chaco Canyon and the Totah Area**

This research primarily focuses on two study areas within the San Juan Basin of northwestern New Mexico—Chaco Canyon and the Totah area. The decline of the regional system centered on Chaco Canyon in the first half of the twelfth century coincides with a period of demographic upheaval within the San Juan Basin. An important aspect of the subsequent population reorganization was the growth of Aztec Ruin, a pre-existing Chacoan great house located on the lower Animas River in the Totah/Middle San Juan region. There is much debate surrounding the relationship, if any,
between Aztec Ruin and Chaco during and following the decline of the central canyon communities (Wills 2009). Researchers argue variously that the post-Chacoan residents of Aztec Ruin were the descendants of migrants from the canyon (Lekson 1999; Vivian 1990; Van Dyke 2008), indigenous inhabitants of the Totah area (Reed 2008; Rohn 1989), or migrants from the Mesa Verde and Northern San Juan regions (Brown et al. 2008; Morris 1919; Windes and Bacha 2006). Although significant population reorganization is generally thought to entail social disruption and structural change, including the redefinition and transformation of social identities and practices, several researchers have suggested that the post-Chaco residents of Aztec Ruin continued to associate themselves with Chaco through continuation of the Chacoan ceremonial order or the “Chacoan ritual-ideological complex” (Cameron and Duff 2008; Lekson and Cameron 1995; Lipe 2006; Toll 2006). The persistence of Chacoan traits in post-Chacoan communities in other parts of the San Juan Basin has also been interpreted as evidence for revitalization or continuation, to varying degrees, of Chacoan ideology and ritual practices (Duff and Lekson 2006; Kantner and Kintigh 2006; Kintigh et al. 1996; Lipe 2006).

San Juan Basin

The San Juan Basin is located within the southwestern portion of the Colorado Plateau, a physiographic province that includes most of the northwestern corner of New Mexico. The San Juan Basin is a large, geologic structural basin comprised of highly eroded Mesozoic sedimentary deposits that form badlands, canyons, mesas, dune fields, and broad plains. The Basin ranges in elevation from 5,000 to 9,000 feet above mean sea level and is drained by the eastern portion of the San Juan River. The Animas River, a
perennial drainage that originates in the San Juan Mountains in southern Colorado, runs through the town of Aztec and joins the San Juan River near Farmington. The Chaco Wash is a small, intermittent drainage that flows through Chaco Canyon before joining with Escavada Wash to become the Chaco River, another tributary of the San Juan River. Many areas in the San Juan Basin are marginal with respect to agriculture. The basin is largely semiarid, rainfall is seasonal and highly variable, temperature shifts dramatically both seasonally (from -20°F in the winter to over 100°F in the summer) and diurnally, and soils tend to be highly saline. However, there is significant variability in the factors affecting agricultural potential from region to region, especially between the central and northern portions of the Basin.

Chaco Canyon represents the lower extreme in terms of both precipitation, with an average of 203 to 220 mm per year, and growing season length, averaging 110 frost-free days a year (Schelberg 1992; Windes 1993). Variation in annual plant productivity in the canyon mirrors the high annual variability in precipitation (Jones 1972; Scott 1980). Based on geomorphic studies, Chaco Wash was incised during different periods of occupation in the canyon (Force et al. 2002; Love 1980). Despite these environmental obstacles, it appears that farmers were relatively successful based on the presence of large sites in and around the canyon, the volume of corn recovered from these sites, and the presence of prehistoric fields and water control systems (Dorshow 2012; Wills et al. 2015; Wills and Dorshow 2012).

The Animas River Valley, on the other hand, is an agriculturally productive area. While the number of frost-free days is similar to that of Chaco Canyon, the average annual precipitation is 249 to 276 mm per year, and the valley bottom contains fertile
alluvial soils. In addition, the Animas River flows year-round and is amenable to irrigation agriculture. Prehistoric agricultural fields and water control features, such as canals, have been documented within the valley below the main ruins group (Lister and Lister 1987).

**Chaco Canyon**

During the eleventh and early twelfth centuries, Chaco Canyon was the center of a complex cultural system that extended across the San Juan Basin (Doyel and Lekson 1992). This regional system is defined primarily by shared styles of architecture and pottery (Marshall and Doyel 1981; Toll 1981). The most visible hallmarks of Chacoan communities are great houses—massive structures with distinctive masonry, formal layouts, large rooms, and associated great kivas (Lekson 1991). Small residential sites typically surround great houses, and these together are interpreted as discrete communities (Doyel et al. 1984). To date, over 100 Chacoan great houses have been identified outside of Chaco Canyon itself (Mahoney and Kantner 2000; Marshall et al. 1979; Powers et al. 1983). These structures are often linked to the canyon or each other by a network of wide, straight roads, and their locations map out the geographically known extent of Chacoan influence (Judge 1989, 1991; Kantner and Kintigh 2006; Neitzel 1989; Powers et al. 1983).

Although first emerging in other portions of the San Juan Basin during the Pueblo I period (Lipe 2006; Vivian 1990; Wilshusen and Van Dyke 2006;), the architectural elements typically associated with this system appeared in Chaco Canyon during the Early Bonito phase (A.D. 900 to 1020). In the subsequent Classic Bonito phase (A.D. 1020 to 1115), thought to be the peak of the system, Chacoan traits were formalized and
outlier construction reached its maximum extent (Judge 1989). From A.D. 1115 to 1140, the first part of the Late Bonito or McElmo phase (A.D. 1115 to 1180), the Chacoan system appears to have undergone dramatic reorganization. The architectural characteristics displayed in both new buildings and in the remodeling of existing structures during this time resemble those seen in the northern San Juan Basin (Sebastian 1992; Van Dyke 2004; Vivian 1990; Vivian and Mathews 1965; Wills 2009). There also appears to have been an increase in small site or village occupation in the canyon (Lekson and Cameron 1995). The latest construction element in the canyon dates to A.D. 1125/1130, coinciding with the onset of a major drought from A.D. 1130 to 1180 (Dean et al. 1994). By A.D. 1150, Chaco Canyon’s position as a regional center had deteriorated and the system is thought to have collapsed (Judge and Cordell 2006; Kantner 1996, 2004; Sebastian 1992, 2006).

Even though the Chaco system has been the subject of archaeological research for over a century, there is still much disagreement over the level of sociopolitical organization it may represent, the functions of great houses and roads, the relationships between the residents of the central canyon to those of outliers, and the nature and areal extent of Chacoan cultural influence and contact. While some researchers view Chaco as the capital of a militaristic and expansionistic state, forcefully extracting tribute from surrounding communities (e.g., Wilcox 1993, 1999), most argue for a more moderately stratified social organization (e.g., Neitzel 1995, 2003; Lipe 2006; Kantner 1996, 2004; Sebastian 1988, 1991, 1992, 2006; Tainter and Gillio 1980; Van Dyke 1999). Other researchers believe that the Chacoan system entailed relationships that were more communally, rather than hierarchically, based (e.g., Toll 2006; Wills 2000; Saitta 1997,
1999; but see Lekson 1999). Judge (1979), Marshall et al. (1979), and Powers et al. (1983) argue that Chaco was a center for the exchange or redistribution of foodstuffs and other goods. While most researchers agree that goods moved through the system (Kantner and Kintigh 2006; Toll 2006), the pure redistribution model has fallen out of popularity due to a lack of evidence of goods leaving the canyon (Mills 2002; Kantner 2004).

There is now a general consensus among researchers that Chaco Canyon was a center for ceremonial activity (Earle 2001; Kantner 2004; Lekson 2006; Mills 2002; Stein and Fowler 1996; Stein and Lekson 1992; Renfrew 2001; Yoffee 2001). Some researchers view the canyon’s suggested ritual importance as the major underlying factor in the development and functioning of the Chacoan system. For example, Stein and Lekson (1992) propose that Chaco was the manifestation of a pan-Pueblo cosmography, or “Big Idea,” and Yoffee (2001) labels the canyon as a “rituality,” the existence of which depended on ritual practice. Renfrew (2001) calls Chaco a “location of high devotional expression” at which the production and consumption of goods was of primarily ritual significance, a view recently upheld by Toll (2006). Recent literature also tends to support Judge’s (1989) suggestion that the canyon was a pilgrimage destination for populations from surrounding regions (Judge 1993; Kantner 2004; Malville and Malville 2001; Toll 2006) or an “empty ceremonial center” (Judge and Cordell 2006; Mills 2002:79). However, based on re-examinations of artifactual evidence from the Pueblo Alto trash mounds, Wills (2001) and Plog and Watson (2012) argue that the midden contents are most consistent with domestic consumption, episodes
of construction, and smaller scale feasting and ritual events. This is supported by evidence from the Pueblo Bonito middens as well (Crown 2016; Wills et al. 2015).

Although most researchers agree that the canyon had symbolic or ideological importance within its region, there is disagreement over the extent to which leadership was based on ritual power. For example, Judge and Cordell (2006) and Toll (2006) suggest that the control or manipulation of ritual, perhaps through scheduling of large ceremonial events, was the primary (and perhaps only) way that individuals attained status. Sebastian (1991, 1992, 2006), Van Dyke (1999), and Kantner (1996) suggest that leadership was based on competition over followers, fueled by the accumulation of surplus and the construction of great houses.

**Pueblo Bonito**

Pueblo Bonito, the largest Chacoan great house, appears to have been the major center, ceremonial and/or political, for the Chacoan regional system. The massive structure, including an estimated 800 rooms and four stories, is located within a cluster of five other large great houses in the central canyon bottom. In conjunction with other structures in the canyon, Pueblo Bonito forms part of a formal built landscape, the layout of which some researchers suggest may be related to the canyon’s ideological significance (Farmer 2003; Fritz 1978; Renfrew 2001; Sofaer 1997; Van Dyke 2008). Based on dendrochronological, archeomagnetic, and ceramic data, the earliest major building events at Pueblo Bonito occurred from A.D. 860 to the 900s with the construction of an arc of rooms similar to other Pueblo I and early Pueblo II pueblos in the San Juan Basin (Windes 2003). The structure was expanded throughout tenth and eleventh centuries, with the last major construction event occurring from A.D. 1077 to
1082. However, occupation and remodeling continued into the early A.D. 1100s. By the middle twelfth century, architectural elements were added only sporadically (2003:23).

The majority of Pueblo Bonito was excavated during two large projects—the Hyde Exploring Expedition and the National Geographic Society Expedition. The Hyde Exploring Expedition, conducted from 1896 to 1899 under the direction of F.W. Putnam of Harvard University, was sponsored by the American Museum of Natural History (AMNH) and financed by the Hyde brothers. Both George Pepper and Richard Wetherill supervised the field investigations, which included the excavation of 198 rooms and kivas (Pepper 1920). From 1921 to 1927, most of the remaining rooms and kivas were excavated under the supervision of Neil Judd during the National Geographic Society Expedition, which was teamed with the Smithsonian Institution (Judd 1954). The collections from these projects are currently housed at AMNH, the National Museum of Natural History (NMNH), and the National Museum of the American Indian (NMAI).

An astounding volume of imported and unique items were found in Pueblo Bonito, including objects made from turquoise, shell, jet, shale, and other minerals; copper bells; macaw feathers; and other items such as cylinder vessels and ceremonial sticks. Many of these valuable items are associated with burials, caches in rooms, and offerings in kivas (Akins 1986, 2003; Neitzel 2003; Mathien 2003; Mills 2008). Other great houses also contain some of these items, but none rival Pueblo Bonito in either quantity or concentration. Two main burial clusters, both located in the older part of the structure or “Old Bonito,” contain the majority of the ornaments and other fancy objects collected. The northern burial cluster, identified by Pepper (1920), includes Rooms 32, 33, 53, and 56. Approximately 24 to 28 individuals were buried in these rooms; based on
long bone measurements, these individuals have the tallest stature represented by any human remains documented in the Southwest to date (Akins 1986, 2003; Stodder 1989). Room 33, one of the richest burials documented in North America, includes two males associated with thousands of ornaments (particularly those produced from turquoise) and ceremonial items, among other objects. The western burial cluster—comprised of 95 individuals interred within Rooms 320, 326, 329, and 330—was documented by Judd (1954). Based on craniometric data, Akins (1986:75, 2003:101) suggests that the two burial clusters represent separate lineages or populations. This is also corroborated by subsequent analysis utilizing craniofacial variables (Schillaci and Stojanowski 2002). For more detailed discussions of the burials, the reader is referred to Akins (2003), Heitman (2007, 2015), Mills (2015), and Plog and Heitman (2010).

Pueblo Bonito contains 35 kivas of different sizes, including great kivas, court kivas, and room block kivas (Mills 2008). Great kivas are the largest of these and contain the most numerous and formal suite of floor features. Ritual deposits, both dedicatory and termination/retirement, are associated with kivas of all sizes at Pueblo Bonito and were commonly placed within wall niches, under floors and vaults, and within pilasters and benches. These deposits tend to be somewhat standardized in that they almost all contain ornaments, turquoise, and marine shell; in addition, many also contain materials representing particular colors and other physical properties such as reflectivity and smoothness (Mills 2008:89). Mills (2008) suggests that the sizes of the kivas at Chacoan great houses are related to the sizes of the social groups participating in ritual activities associated with the structures.
Two large mounds—the East and West Mounds—are located in front of Pueblo Bonito. While some have interpreted these as accumulations of refuse deposits associated with the occupation and construction of the pueblo, others view them as formal platform mounds. Judd (1954) placed several trenches through the mounds in order to examine the subsurface stratigraphy outside of the structure. Based on possible wall segments documented by Judd and the shape of the mounds, some researchers have proposed that the mounds were rectangular and enclosed, serving as important elements in the ideologically charged ritual built landscape within the central canyon (Lekson 1986; Stein and Lekson 1992; Stein et al. 2003). However, the recent re-excavation of Judd’s trenches during the Chaco Stratigraphy Project (directed by Dr. Wirt H. Wills from UNM) revealed that the possible wall segments are neither formal nor continuous, and that the content of the mounds is largely consistent with domestic and construction refuse (Crown 2016; Wills et al. 2015; see also Wills 2000, 2001). Based on both stratigraphic (Wills et al. 2015) and artifactual (Crown 2016) data, it appears that the mounds accumulated relatively rapidly during the Classic Bonito phase, although accumulation of the East Mound continued later than that in the West Mound.

Although it is clear that Pueblo Bonito had a preeminent position among Chacoan sites, at least in terms of size, its function is still debated. Researchers interpret it variously as a large residential pueblo (Vivian 1990; Wills 2000), a political and/or elite center (Kantner 1996; Lekson 1999; Lipe 2006; Schelberg 1982; Sebastian 1992, 2006; Tainter and Gillio 1980), guest quarters for pilgrims (Lekson et al. 1988; Windes 1991), a ritual center that was inhabited either periodically or permanently (Bernardini 1999; Judge 1989; Judge and Cordell 2006; Mills 2008; Renfrew 2001; Stein and Lekson 2003).
The Totah Area

Aztec Ruin, the largest Bonito-style structure outside of Chaco Canyon, is located in the “Totah,” a Navajo name for the area of northern New Mexico where the San Juan, Animas, and La Plata Rivers join (McKenna and Toll 1992). Geographically, this area is halfway between Chaco Canyon and the Mesa Verde core area. And, in many respects, the same appears to be true culturally. Although Aztec Ruin was originally built while the Chaco system was still intact, the most intensive period of occupation occurred during the A.D. 1200s and is associated with a mix of Cibola, Northern San Juan, and local “Animas” ceramic traditions.

Aztec Ruin

Located along the lower Animas River on the northern fringe of the San Juan Basin in northwestern New Mexico, the Aztec Ruin community is centered on two large great houses, West Ruin and East Ruin. West Ruin is a 450-room, multi-storied pueblo exhibiting classic Chacoan great house architecture. The building, which encloses a great kiva and a large plaza, is the largest Chacoan great house outside of Chaco Canyon and the third largest Chacoan great house overall (next to Pueblo Bonito and Chetro Ketl). East Ruin, built after the West Ruin but with a strikingly similar layout, has 200 to 300 rooms, a great kiva, and is also multi-storied.

The majority of West Ruin was excavated by Earl Morris from 1916 to 1927 under the auspices of AMNH. After encountering both classic Chacoan and classic Mesa Verdean material culture, Morris argued for the existence of two distinct occupations at
the site. He concluded that there was an initial occupation by Chacoans followed by a later occupation by migrants from the Mesa Verde region, separated by a period of abandonment coinciding with the collapse of the Chacoan system. Archaeologists accepted this interpretation for decades, as similar evidence found in Chaco Canyon (Vivian and Mathews 1965) and the nearby Salmon Ruin great house (Irwin-Williams 1972) seemed to support Morris’ conclusions.

Since the 1920s and after the site became a national monument, additional research, particularly extensive tree-ring dating (Brown et al. 2008), has allowed for a more refined examination of the occupational history of the community. The building sequence of the structures, particularly of West Ruin, has been reconstructed with a great deal of confidence. The majority of West Ruin was built from A.D. 1110 to 1115, with a second smaller building episode taking place from A.D. 1118 to 1130. Construction at the East Ruin was much less rapid, beginning just as West Ruin was completed and with major building activity occurring in the thirteenth century. Based on the dendrochronological dating of construction elements to the mid-to-late A.D. 1100s at East Ruin, it is now thought that Aztec Ruin was occupied continuously. This is also corroborated by recent ceramic research (Reed 2008). Although the site was not abandoned, it does appear that the focus of habitation shifted from the West Ruin to the East Ruin in the A.D. 1200s, with large sections of the West Ruin used for burials and trash disposal. In fact, the majority of the material uncovered by Morris’ excavations is associated with either the intermediate or later occupations of the site.

A total of 216 individuals were interred within 174 burials, mostly located within rooms, within the West Ruin. Of these, 64 are adults and 129 are adolescents, children, or
infants. The majority of the burials appear to be associated with the post-Chacoan occupation of the site. As at Pueblo Bonito, ornaments tend to be concentrated in a few burials or burial groups. Two of the most ornament-rich burials include mass infant/small child interments (25 individuals total), which contained abundant turquoise, stone and shell beads, and beads in the process of manufacture. Similar to other Chacoan great houses, the kivas at West Ruin are also associated with ornaments, turquoise, and shell. Since Morris’ work, additional research has also revealed the extent and formality of the “Bonito-style landscape” linked to and centered upon the two great houses, a symmetrical spatial arrangement of buildings, roads, middens, and auxiliary structures that was apparently planned in the late Bonito phase but not brought to completion until the middle thirteenth century (Brown et al. 2008). The major architectural features thought to comprise this formal layout include the two large great houses, three tri-wall structures, and a road leading to the small early great house of Aztec North (Stein and McKenna 1988) located on the alluvial terrace above the main ruins group.

Based on recent research conducted by Reed (2008), the ceramic assemblages from Aztec Ruins, Salmon Ruin, and the Tommy Site (a smaller great house near Farmington) are comprised of a complex mix of local and imported wares. While a portion of the ceramics are clearly derived from the Cibola and Mesa Verde traditions, local varieties of both of these were also produced in the Totah area. These locally produced “Animas” varieties have silty pastes that are brownish-yellow in color; soft, silty slips; and are typically decorated with organic paint (2008:198-202). Reed (2008:204) also points to similarities in specific design elements on McElmo and Mesa Verde Black-on-white pottery found at Aztec Ruin with those from Pueblo I ceramics.
from sites in the Animas Valley, suggesting that the post-Chaco inhabitants of Aztec Ruin have ancestral connections to both the Middle and Northern San Juan regions.

The Middle San Juan region truly appears to be a multicultural landscape. Aside from Aztec and Salmon Ruins, numerous smaller Chacoan great house communities have been identified in the Totah area. While Salmon Ruin and Aztec Ruin contain more evidence for direct contact with Chacoan populations and possibly for continued identification with a Chacoan identity into the post-Chaco period, other residential sites appear to be the products of local developments and/or greater interaction with the Northern San Juan or Chuska areas (Reed 2008).

**Organization of the Dissertation**

This dissertation follows the “hybrid” format, wherein published papers or manuscripts submitted for publication are substituted for a formal monograph. While a traditional dissertation focuses on a specific research topic, the hybrid approach allows for an exploration of interrelated research themes or different facets of a broader theme. This section has introduced the major themes forming the framework of the dissertation: 1) the materiality of social identity as expressed through practices of production, use, and discard; and 2) transformations in material practices over various temporal and spatial scales, including social transitions such as demographic upheavals. In addition, it has provided a general cultural and environmental background for the study areas that serve as my primary case studies.

Chapter 2 presents the first paper, titled “Ornaments and Individual Identity in the Prehistoric Southwest: the Practice of Personal Adornment”, which was submitted to
American Antiquity in October of 2014. The manuscript comprising Chapter 3, “Ornaments as Socially Valuable Objects: Jewelry and Identity in the Chaco and Post-Chaco Worlds”, is the product of research funded through a National Science Foundation (NSF) Dissertation Improvement Grant (Award BCS-0968853); this manuscript will be submitted to the Journal of Anthropoligical Archaeology in 2015. Chapter 4 includes the paper, “Gray Ware from the Pueblo Bonito Mounds”, which appears as a chapter (Mattson 2016) in the book The Pueblo Bonito Mounds of Chaco Canyon: Material Culture and Fauna, edited by Patricia L. Crown (2016). The chapter is included in this dissertation with the permission of UNM Press. Finally, Chapter 5 summarizes each of these papers in the context of the major research themes outlined in Chapter 1, discusses methodological issues and contributions, and presents directions for future research.
Chapter 2

Ornaments and Personal Identity in the Prehispanic Southwest:
The Practice of Adornment

Within archaeology, the value and meaning of ornaments is typically assumed rather than demonstrated. Ornaments are most commonly considered to be objects of wealth and are widely used as indicators of social stratification, especially when they can be associated with individuals in mortuary contexts as grave accoutrements (e.g., McGuire 1992; Neitzel 1991, 2000). Items of adornment have also been used to examine ethnic/social group affiliation, as cross-cultural anthropological research indicates they are often key visual indicators of social group identity (e.g., Hodder 1982).

While ornamentation has been generally linked to identity in archaeological research, there is a growing realization that this relationship is not necessarily direct or straightforward. Ornaments of similar, or even identical, forms may be used within diverse practices associated with different aspects of personhood and, therefore, may possess dissimilar meanings. In addition, individual ornaments may be combined within composite pieces in various groupings; displayed on the human body in a myriad of ways; and deposited within caches, offerings, or burials in specific contexts and with other objects. This composite or fragmented nature of ornaments—that is, the ability to be assembled, disassembled, and reassembled—adds another layer of potential meaning to these items. In the U.S. Southwest, both larger ornamental pieces (e.g., necklaces) and ritual deposits commonly contain individual ornaments of multiple forms and materials. Based on ethnographic research, these composites or gatherings (sensu Mills 2008) may represent enchained relationships between people, and between people and things, both
contemporaneously and over time through citation to the past, including specific places, events, and persons (e.g., Butler 1993; Chapman 2000; Mills and Walker 2008).

Evidence for social value conferred upon such “fractal objects”—those that are complete individually and yet also comprise larger, compound wholes—has been cited as a probable archaeological indicator of the existence of dividual or partible concepts of personhood in the past (Fowler 2004:70).

Practices involving ornaments, including both personal adornment and deposition, are thus closely tied to identity, but in variable ways. While these practices may be arbitrary across cultures/groups, they are likely not random within particular sociohistorical contexts (Jones 1997:125). In order to examine the role of ornamentation in identity construction archaeologically, we must go beyond the delineation of material culture distributions and observations of morphological similarity or difference in artifact form and attempt to situate material practices in their distinct contexts.

**Personal or “Individual” Identity**

The extent to which material culture distributions correlate with past cultural entities, such as social groups with common self-ascribed identities or spheres of interaction, continues to be a major topic of discussion in archaeological research, particularly within scholarly discourse concerning identity (e.g., Deitler and Herbich 1998; Jones 1997; Hegmon 1998; Varien and Potter 2008). Within this body of work, there is an increasing recognition not only of the complex and multidimensional nature of social identity, but also of the lack of clear association between certain scales of group identity or degrees of interaction and specific aspects of technology and style.
Ethnoarchaeological studies, in particular, demonstrate this context-specific nature of the relationship between material culture and social identity; depending on the specific sociohistorical context examined, both overt stylistic similarities and more subtle technological distinctions have been found to both correspond with and cross-cut recognized social and culture-historical boundaries (e.g., Childs 1991; Croes 1989; Gosselain 1998; Sterner 1989).

Current identity research draws attention to the many different aspects of self-definition included within social identity, including ethnicity or other social group affiliation, age, sex, gender, religion, status/class, position or office, and disability, among others. Until recently, personal identity has been construed as small in scale, as primarily involving certain facets such as age or gender that are considered to be more proximate to the individual, and as subsumed within broader categories such as ethnicity or class in an embedded and hierarchical fashion. While this characterization is heuristically useful, lacking is the explicit recognition that identity only resides at the level of the individual; there is no broader form of identity, such as ethnicity, which is not constituted by, and expressed at the level of, the individual. Personal identity is thus simultaneously comprised of numerous aspects of self-definition, which cross-cut one another, exist at multiple scales, and are highlighted or de-emphasized depending on the situation. Identity construction is, therefore, a dynamic and active process whereby people continually define themselves through their interactions with others within specific contexts.

The study of personal identity is also contingent on the way in which ‘the individual’ is defined; although the singular physical being is a biological reality,
concepts of personhood or “the self” are social constructs (Carrithers 1985; Lambek and Strathern 1998). Our current understanding of the individual as a category is tied to Western conceptions of personhood that reference autonomous and discrete internal “selves” comprised of thoughts and feelings. Ethnographic research demonstrates that personal identity as construed within this framework is not necessarily applicable to other cultures. Within alternate forms of self-definition, persons may be conceived of as “dividual and composite, as permeable and partible” (Fowler 2004:20); people may contain multiple parts, products, or substances derived from their interactions with others (Alvi 2001; Busby 1997; Strathern 1999). In Melanesian society, for example, gift-giving represents the removal of a discrete portion of the giver and its transfer to the self of the recipient (be it person, family, or clan) (Strathern 1988). Through giving and reciprocation, portions of a person may reside in or be owned by others; personal identities are thus continually transformed as the internal compositions of persons are reconfigured over time. It is not unlikely that concepts of personhood in past societies may have differed from that of Western individualism, and that personal identities may have incorporated various degrees of dividuality, partibility, permeability, or other aspects of personhood that have yet to be identified (Fowler 2004).

**Ornamentation Across the Prehispanic U.S. Southwest, A.D. 900 to 1450**

The following discussion presents a summary of the spatial and temporal distribution of ornament forms and their contextual associations in the prehispanic U.S. Southwest from A.D. 900 to 1450. The primary aim of this study is to examine patterns in both styles of ornaments and bodily and depositional practices associated with
ornamentation across geographic areas. The ways in which these patterns correlate with and depart from regional/culture-historical boundaries, as they have been traditionally defined, has implications for our understanding of how people may have identified themselves at different scales, both within regions through time and across larger portions of the Southwest during specific periods of time. I focus on the temporal span of A.D. 900 to 1450 for two reasons. First, this period encompasses the development of significant regional variation resulting from substantial increases in population, the growth of permanent villages and towns, and the appearance of more defined territories on an increasingly circumscribed landscape. Second, major demographic changes occurred during this period, including cycles of expansion, coalescence, decline, and abandonment. Population and settlement reorganizations are thought to be associated with significant shifts in social identity. The persistence of, or changes within, specific material practices can highlight continuities or transformation in different aspects of social identity across these dynamic periods.

As this is a broad overview with space limitations, the following discussion is necessarily general. The data from which this synopsis is derived are based almost entirely on the published literature, as well as on my own research on Ancestral Pueblo ornamentation. The literature included is primarily comprised of academic articles, books, and site monographs; large academic, government, and private Cultural Resource Management (CRM) excavation reports for sites/projects including substantial ornament assemblages; and Master’s theses and Ph.D. dissertations. The literature sample was also determined by accessibility through publishers, university libraries, and open access forums such as The Digital Archaeological Record (tDar). Smaller gray literature reports,
particularly those for survey projects, are generally not included. Future research efforts will focus on expanding the literature sample to include a significantly greater number of reports generated by CRM data recovery projects. Based on the literature sample, certain biases exist, including an emphasis on the Hohokam and Ancestral Pueblo culture areas, large excavated sites and burials, and items made from turquoise and shell.

As a class of material culture, ornaments are poorly defined and encompass significant variability. Here, “ornament” is considered to be any non-utilitarian object used for decoration of the human body—namely, jewelry items such as beads, necklaces, and bracelets. This definition also includes items removed from the context of bodily display, such as beads placed within ritual deposits. During the literature review, the data collected was mostly comprised of relative abundance of different ornament types, forms, and materials; and general contextual information associated with ornaments (e.g., association with adult male burials, presence in middens, or deposition in ritual structures). The following review is organized by major geographic area, with major temporal periods discussed separately.

San Juan Basin and Rio Grande Valley

A.D. 900 to 1150

In general, shell and local stone appear to be the preferred materials for personal ornamentation in the U.S. Southwest before A.D. 900. Both the frequency of ornaments and the occurrence of exotic materials such as marine shell and turquoise within the San Juan Basin increases dramatically after this time, concurrent with the cultural developments centered on Chaco Canyon. Turquoise, in particular, occurs in the greatest
quantities in the area between A.D. 900 and 1150, although a variety of local stone is also used. Compared to other regions, a more limited variety of marine shell species is utilized for ornaments, and *Haliotis* (abalone), found along the Pacific coast, becomes relatively more common. Discoidal (disc) beads are particularly prevalent, especially those made from local shales (including jet or lignite) and turquoise. Turquoise disc beads are primarily strung and worn as bracelets, although mortuary data also indicate their use in necklaces and earrings (beaded strands suspended from the ears; this practice appears to be unique to this region and persists over time) (Jernigan 1978:159). *Olivella* shell beads are also quite common and are worn by both sexes and individuals of all ages. Necklaces are typically comprised of simple arrangements of small stone disc beads or *Olivella* shell beads.

Tabular pendants of quadrangular shapes are also frequently found in Pueblo II period contexts and are typically made from turquoise. These are worn primarily as matching ear pendants, a widespread practice across the Southwest, but are also incorporated into necklaces. Round tabular pendants are often produced from stone, especially shale or jet; round or ovoid shell pendants are usually made from *Haliotis* shell. Zoomorphic pendants are less common than in other areas during this period, and relatively fewer forms are represented; the most common forms are birds, both stylized and three-dimensional, and frogs. At Pueblo Bonito, there is evidence that stylized bird pendants were worn as earrings (Judd 1954:95). Side-drilled tadpole pendants/beads, likely worn as necklaces, are also found at Pueblo Bonito in association with ritual deposits and in burials with many other grave goods. Mosaic pieces are produced from turquoise, shell, jet, and shale; these are commonly inlaid into jet plaques or zoomorphic
sculptural forms rendered in shell. *Glycymeris* bracelets are less common in the Ancestral Pueblo area compared to other areas and are typically undecorated. Plaques (large tabular pieces with double perforations within one surface) or buttons of jet and other stone are also common in this area during this time.

Chaco Canyon is unusual for the amount of turquoise and imported materials its sites contain, and some researchers propose that the canyon may have functioned as a center for turquoise trade (Judge 1989). Although Pueblo Bonito contains the greatest quantity of both turquoise and ornaments, Chacoan great houses in general contain more of these items than the small houses surrounding them (Mathien 1997, 2001). Ornaments, particularly those made from turquoise and shell, are thought to have had strong ritual associations, as they form the majority of items associated with kiva offerings in niches and under benches, floors, and pilasters (Mills 2000, 2008; Neitzel 2003). While an assortment of ornaments are found within kiva offerings, repetition in the specific array of materials and forms is apparent, including turquoise disc beads, pendants, mosaic pieces, and production debris; shale and jet disc beads; *Haliotis* pendants; *Spondylus* dentate beads; *Glycymeris* bracelets; shell bilobe beads; and whole *Olivella* shell beads (Figure 1). These items typically occur singly, rather than as composite pieces such as necklaces, although strands of beads were placed in some offerings, such as the niches of the great kiva at Chetro Ketl. Mills (2008) interprets these dedication and termination offerings as “citations to what was considered the proper way to adorn a body, animating the ritual structure” (2008:98).
In addition to offering contexts, ornaments are also present in Chacoan burials and rooms with other distinctive and valuable items such as effigies, painted wooden artifacts, and cylinder vessels (Crown and Wills 2003; Mills 2002, 2008; Toll 2001). Neitzel (1995) suggests that turquoise, along with the Gallup-Dogoszhi style of decoration applied to cylinder vessels, was an important ceremonial and status symbol of Chacoan society, perhaps even serving as a badge of office. Mills (2004, 2008) corroborates this view and identifies turquoise—along with cylinder vessels, staffs, shell trumpets, altar pieces, and dance wands—as items that were likely ritually important to the construction of corporate identity and the maintenance of status in Chacoan society (Judge and Cordell 2006; Mills and Ferguson 2008; Saitta 2000).
A.D. 1150 to 1300

Although ornaments are consistently found in the Ancestral Pueblo area in Pueblo III period contexts, they generally do not occur in great frequencies, with the exception of sites in the middle San Juan River Valley, such as Aztec and Salmon Ruin, and in the Western Anasazi area. Disc beads are still common and are worn as beaded strands in the ears, bracelets, or necklaces, as in earlier periods. Turquoise disc beads, in particular, continue to be used for beaded bracelets and are worn by both children and adults; in the Western Anasazi area, they are commonly worn as anklets (Jernigan 1978:98).

A greater variety of materials is used for geometric tabular pendants, including jet, *Haliotis* shell, gypsum, hematite, and various other local materials. *Olivella* shell beads are widespread and used within both necklaces and anklets. *Spondylus* dentate beads and shell bilobed beads continue to be used in ornamentation but in lower frequencies compared to the Pueblo II period. *Conus* shell tinklers become much more common and are worn in variety of ways, including within necklaces and bracelets, around the waist in belt-like fashion, and as attachments to clothing. *Nassarius* shell beads also appear during this period, albeit in small numbers (Mathien 1997). *Glycymeris* bracelets are rarely worn during this period.

The largest concentration of ornaments in the northern Southwest during the Pueblo III period occurs at Aztec Ruin. The large majority of the ornaments from site are from burial contexts in the West Ruin, as originally reported by Morris (1919, 1924). These mortuary accompaniments include ornaments of turquoise, shell, and various types of stone in the form of pendants, strings of beads, single beads, beads stored in ceramic and basket containers, bracelets, ear bobs, tinklers, and mosaic pieces. Turquoise,
Olivella shell beads, and Conus shell tinklers are particularly numerous at the site. Two of the most ornament-rich burials include mass infant/small child interments that contain abundant turquoise, local stone, and shell beads. Mosaic pieces, inlaid shell, and pendants are also found in single-child burials. The practice of placing ornaments, particularly turquoise and shell beads, in offerings within kivas is similar to Classic Bonito period Chacoan sites.

A.D. 1300 to 1450

During the Pueblo IV period, ornaments common in the Ancestral Pueblo area include stone disc beads, Olivella beads, tabular stone pendants, whole shell pendants, bone hairpins, and Conus shell tinklers. Turquoise continues to be used for mosaics, although the complexity and craftsmanship of these pieces declines compared to previous periods. Bone hairpins, the ends of which are commonly inlaid or carved in either zoomorphic shapes or flattened and stepped geometric shapes, become more widespread. Tabular pendants of the period are comprised of a greater variety of material, and the use of jet declines significantly. The wearing of beads as bracelets and as strands in the ears remains a common practice, as evidenced by depictions on kiva murals and the positioning of these items in mortuary contexts. Conus tinklers continue in popularity, perhaps due to their role in ritual performances associated with katsina ceremonialism (Adams 1991). Shell pendants are also common, and whole bivalve shell species such as Glycymeris are used for the first time. Glycymeris shell bracelets, on the other hand, continue to decline in frequency. Olivella beads remain widespread and are worn in various pieces, including necklaces, bracelets, and around the waist.
The depiction of ornaments on kiva murals from Pueblo IV period sites suggests possible associations between specific practices of adornment and different aspects of identity during this time. In her examination of kiva-mural iconography, Crotty (1995) notes several patterns in the portrayal of jewelry and zoomorphic/anthropomorphic figures. The styles of necklaces worn by the figures is similar among all of the murals examined, consisting of strands of beads wrapped around the neck several times choker-style, with either the last strand hanging lower and looped to form a figure eight on the chest or with a large pendant suspended from the last strand (Figure 2). When individual beads are depicted, they are usually red and white in color, perhaps representing local stone. Necklaces are shown on both male and female figures, as well as on composite human/animal/vegetable figures, although those including large shell pendants are more often associated with females than males. While bead bracelets are mostly depicted on females at Kuaua, they are shown with both males and females at both Pottery Mound and Jeddito. In addition, most male figures from Kuaua have straps around their left wrists thought to be leather bow guards. Although the ears of figures are not often visible, when ear ornaments are depicted, they appear to be both rectangular and ovoid and are shown in association with both male and female figures. Feather ear bobs, on the other hand, are only shown with male figures.

At several Pottery Mound kivas, strings of beads, along with painted textiles, are depicted on murals in altar-like settings or surrounding wall niches. Similar to the preceding period, there appears to be an association between ornaments and ritual contexts. For example, _Olivella_ beads were placed under the floor of a kiva at Pecos Pueblo, a mosaic including shell and turquoise was found embedded in a kiva floor at
Tijeras Pueblo (Schuyler 2010), and a large quartz effigy statue carved to resemble a spire-lobbed *Olivella* bead was found on an altar at Pueblo Largo (Figure 3). Given that the placement of ornaments in offerings was a longstanding tradition throughout the prehistoric Pueblo world, it seems probable that the depictions of ornaments on the kiva murals themselves represent such offerings. Mills (2008) interprets these iconographic offerings as representing the dressing or adornment of ceremonial rooms, similar to the placement of offerings within kivas during the Pueblo II period and the decoration of the inside of homes with jewelry in contemporary Pueblo society.

Figure 2. Kiva mural from Pottery Mound depicting necklace and bracelets (Courtesy of the Maxwell Museum of Anthropology, University of New Mexico, Catalog No. 76.70.386).
Mimbres Valley and Mogollon Highlands

A.D. 900 to 1150

In the Mogollon region from A.D. 900 to 1150, ornaments are most common in the Mimbres Valley. Shell is frequent in Mimbres assemblages, and both the forms and species associated with shell ornaments are similar to those from the Hohokam region; the exception to this is the greater occurrence of *Haliotis*, which is used for tabular pendants as in the Ancestral Pueblo area (Anyon and LeBlanc 1984; Haury 1936; Shafer 2003). *Nassarius* shell beads are particularly common in the Mimbres area at this time, as
are *Glycymeris* shell bracelets. Carved *Glycymeris* bracelets are thought to be Hohokam trade pieces based on similarities in motifs and workmanship. Disc beads are widespread and produced from both shale and shell. Although turquoise occurs in relatively small quantities, it is used for both disc beads (typically worn as necklaces) and as the primary material for geometric tabular pendants. Unique pendants forms appearing in both the Mimbres Valley and larger Mogollon area include both sculptural quadrupeds and zoomorphs enclosed within circles (Jernigan 1978:119).

Some insight into the meaning of ornamentation in the Mimbres Valley may be inferred from offerings, burials, and iconography on ceramic vessels. As at Chaco Canyon, ornaments are included within votive offerings in community structures. For example, at Galaz Ruin, a military macaw wrapped in strands of turquoise and shell beads was found buried within a communal structure (Anyon and LeBlanc 1984). Approximately 10 to 20 percent of Classic Mimbres burials contain jewelry, typically including shell bracelets or small turquoise pendants and turquoise, shell, or stone beads (Gilman 1990:463). Since burials do not appear to be differentiated based on vertical social status, grave goods may represent horizontal social differences. At the NAN Ranch site, for example, pendants are found in both male and female burials, are differentially associated with children, and are found in positions suggesting use as earrings and necklaces. *Glycymeris* shell armbands, on the other hand, are associated only with adult males (Shafer 2003:207). Items such as *Glycymeris* shell bracelets, *Pecten* shell, and *Nassarius* shell beads are also found within cremation deposits. Shafer (2003:207) notes that shell bracelets, turquoise pendants and beads, and beads of red and black stone all
occur independently of bowls within mortuary contexts, suggesting that these items “may be marking certain individuals as members of specific kin groups or sodalities.”

In her study of gender roles as portrayed through iconography on Mimbres vessels, Munson (2000) notes the association between depictions of jewelry and gendered figures. Of all the jewelry forms, necklaces are most often portrayed, typically appearing as a “checkerboard or looped around the neck like a collar” (2000:138). Along with shell bracelets, necklaces are differentially associated with women, strands of beads worn around the ankles are associated only with male figures, and earrings are associated with both females and males. *Glycymeris* shell bracelets, on the other hand, are shown alone and unassociated with human subjects on some vessels.

**A.D. 1150 to 1450**

Ornaments are common at larger settlements in the Mogollon Highlands during the thirteenth and fourteenth centuries. Mosaics increase in frequency during this period, particularly shell pieces with turquoise overlay, as do *Conus* shell tinklers and beads of *Nassarius* shell (Vokes and Gregory 2007:351). Decorated and thick-banded *Glycymeris* shell bracelets appear to have been obtained from the Hohokam, as they are carved with early Classic period Hohokam designs. In particular, the occurrence of turquoise disc beads (typically worn as anklets), pendants, and mosaic tesserae increases significantly in the Grasshopper area during this time.

In her analysis of burials from Grasshopper Pueblo, Whittlesey (1978) found that differences in grave goods are most correlated with age and sex. Subadult burials are most closely associated with nonutilitarian items, including ornaments. Male and female burials are associated with similar proportions of ornamental items, although *Glycymeris*
shell pendants only occur with males and shell and bone rings only occur with females. In addition, women are associated with more discoidal beads, turquoise mosaic pieces, and non-*Glycymeris* shell pendants than men. In addition, Whittlesey (1984; Reid and Whittlesey 1982) suggests that some of the ornaments included with burials are components of ritual costumes associated with various sodalities. Specifically, she posits the existence of at least five sodalities at Grasshopper—three male societies associated with bone hairpins, *Conus* shell tinklers, and *Glycymeris* shell bracelets, respectively; one male and female society associated with *Glycymeris* shell bracelets; and one female society associated with *Conus* shell rings.

*Coconino Plateau and Verde River Valley*

**A.D. 900 to 1175**

On the Coconino Plateau, ornaments include a wide array of stone beads, particularly gray and black shale disc beads; and argillite quadruped pendants, lip plugs, and nose plugs. The latter three forms are particularly prevalent in the Sinagua area compared to other regions in the Southwest, and these persist into the thirteenth century. Shell artifacts typically include *Conus* tinklers, truncated *Olivella* beads, shell bilobe beads, small ovoid shell pendant beads, two-dimensional or silhouette zoomorphic pendants, plain *Glycymeris* bracelets, and bone hairpins with perforated geometric heads. Turquoise mosaics on shell backing have also been recovered from northern Sinagua sites and are similar in arrangement to Hohokam pieces; the stylized bird-in-flight shape is the most common form for these pieces. Turquoise and shell ornaments appear to be trade items,
given the lack of evidence for local manufacture, and are concentrated in larger sites such as Ridge Ruin, Winona Village, Juniper Terrace, and Wupatki.

One of the most famous burials in the Southwest is the “Magician’s Burial” (ca. A.D. 1175) from Ridge Ruin, which contained an abundance of ornamental items (McGregor 1941, 1943). Objects that appear to have been worn by the interred individual (a 40-year old male) include an argillite noseplug with bright blue circular turquoise inlays, Conus shell tinklers likely attached to clothing on the lower body and perhaps as part of a bracelet on the right wrist, and other turquoise and shell items. Ornaments included in the offerings associated with the burial include mosaics of turquoise and shell, a necklace comprised of mountain lion teeth and claws, a shell bracelet with a turquoise mosaic in the shape of a bird, a basketry cylinder covered in mosaic (turquoise, argillite, and rodent teeth), and whole marine shells. The mosaic cylinder may be a variation of the painted armband seen in other Sinagua burials (Whittaker and Kamp 1992). O’Hara (2008) suggests that distinct groups of offerings interred with the Ridge Ruin burials indicate the various roles this individual had within ritual sodalities; for example, he proposes that Conus tinklers, in particular, are associated with a male weather control sodality on the Mogollon Rim during the thirteenth century.

A.D. 1175 to 1300

In the Sinagua region, the same types of ornaments present during the preceding period persist and are more elaborate during the thirteenth century. Argillite noseplugs become larger, more curvilinear, and occasionally include turquoise insets at the ends (McGregor 1941). Turquoise remains a valuable import, although local stone continues to be used for ornaments, particularly disc beads worn as components of bracelets,
quadruped pendants, and nose and lip plugs. Turquoise mosaics in the shape of stylized birds and frogs, or as discs with patterns of concentric circles, are common in the Verde River Valley and Coconino Plateau during this time. *Conus* shell tinklers are more numerous during this period, as are two-dimensional zoomorphic (especially lizards and frogs) pendants cut from shell resembling those from the Hohokam area. Another form unique to the Sinagua area at this time is the painted armband comprised of a bark, wood, or woven material painted with bright colors. The armbands occasionally incorporate ornaments, such as turquoise pendants, as seen at Turkey Hill Pueblo (Whittaker and Kamp 1992). These pieces are associated with relatively elaborate burials that include other ornaments, particularly shell bracelets; interestingly, the armbands appear to be worn on the left side, as are shell bracelets. Bone hairpins are also fairly common in the Sinagua area during this time and are either incised along the shaft as in the Western Ancestral Pueblo area, or have carved ends in zoomorphic shapes similar to those found in the Mimbres area.

A.D. 1300 to 1450

After A.D. 1300, ornaments also occur in greater numbers at large sites in the Verde River Valley, such as Tuzigoot and Montezuma’s Castle. Most ornaments are produced from shell, followed by turquoise and local shale and slate. Common ornaments include shell and stone disc beads worn as bracelets and anklets, tabular pendants worn in both the ears and as components in necklaces, and *Conus* shell tinklers. At Tuzigoot, the quantity of jewelry buried with individuals appears to be related to age—burials with the highest total numbers of ornaments are those of adults, while subadult burials contain the highest average number of ornaments (Anderson 1992:25-27). Although shell jewelry is
associated with individuals of all ages in burial contexts, infants are buried only with shell jewelry. At the site of Montezuma’s Castle, infant and child burials include shell ornaments in addition to beads of turquoise and argillite (Schroeder 1947). At Tuzigoot, only infants wear shell anklets, whereas necklaces are found with individuals older than six years of age. Only adult burials are associated with black slate beads, turquoise mosaics, *Conus* shell tinklers, and turquoise ear pendants. Males are generally buried with more ornaments than females, although there is one elaborate female burial that includes a necklace of disc beads of many colors, a turquoise pendant, shell bracelets, and fragments of turquoise mosaic. Turquoise disc beads are generally worn as bracelets (Jernigan 1978:97).

**Sonoran Desert**

**A.D. 900 to 1150/1175**

In the Hohokam area during the late Colonial and Sedentary Periods, ornaments include disc beads of stone, whole shell beads, geometric and zoomorphic pendants of stone and shell, and shell bracelets. Although turquoise is more common than in earlier periods, shell is still the dominant material used. Compared to other regions, Hohokam shell ornaments are more diverse in both form and species utilized. Trade in both raw shell and finished shell ornaments peaks during the Pre-Classic period (Nelson 1981). Although the degree to which shell ornament production was specialized is debated, it appears that plain Glycymeris bracelets were manufactured most intensively at Pre-Classic sites, particularly those in the western Papagueria close to the Gulf of California (Bayman 2002; McGuire and Howard 1987). The frequency of finished ornaments
generally correlates with site size rather than distance from this area. Based on the association of ornaments with sites containing ballcourts, and the relatively widespread distribution of many styles of shell ornaments (such as *Glycymeris* bracelets and various kinds of shell pendants and beads) within these sites, Bayman (2002:79-81) suggests that these goods served as symbols of social group affiliation.

Disc beads are predominantly manufactured from black and red shales, although turquoise is also used. When turquoise disc beads are present in quantity, they show evidence for individual, versus bulk, manufacture. Disc beads are typically worn in strands as necklaces; based on depictions of these pieces on human figurines, the predominant necklace styles include one or two loops around the neck, either hanging down on the chest or close to the neck, choker-style (Jernigan 1978:38). There is no evidence that the Hohokam wore strings of beads as earrings, as in the Ancestral Pueblo area. Other shaped beads include stone and shell bilobed beads, rectangular side-drilled stone beads, and dentate or irregularly shaped beads of *Spondylus* shell. Both turquoise disc beads and irregular/dentate *Spondylus* beads are worn as anklets during this period (vs. bracelets later on). Whole shell beads are produced from *Vermetus, Olivella, Oliva, Nassarius,* and *Columbella*. Based on figurines and burials, *Nassarius* sp. and *Columbella* sp. shells are used for anklets and bracelets; *Olivella, Oliva* (and *Spondylus*) shells are most commonly worn in anklets; and *Vermetus* sp. shells are used for necklaces.

A wide variety of pendant forms are represented among the Hohokam, particularly during the Pre-Classic period, including rectangles, ovals and circles, elongated or needle shapes, sunbursts or serrated circles, zoomorphic and
anthropomorphic forms, and whole shell forms. Geometric tabular pendants of quadrangular and ovoid shapes are commonly made from turquoise, although other materials such as shale and schist are also used. Turquoise tabular pendants are often worn in the ears, as in the Ancestral Pueblo area, although they also appear as components in necklaces and bracelets. It is likely that both geometric forms with large perforated centers and sunburst forms may have originated in the Hohokam area (Jernigan 1978:50). *Pecten, Glycymmeris, Turitella,* and *Haliotis* (to a lesser degree) are typically used for shell pendants, especially zoomorphic and whole-shell forms. The most common depictions are birds (particularly waterfowl), frogs, lizards, and snakes. The stylized bird form is most common and similar to that found in both the Ancestral Pueblo and Mogollon areas. Other bird pendant forms are used as well, including both in-flight and silhouetted birds. In general, most of the zoomorphic forms rendered in ornamentation in the Hohokam area are also depicted on pottery. Frog and lizard pendants also become increasingly stylized over time. In general, zoomorphic pendants are most often worn as central pieces within necklaces. Zoomorphic bracelets and pendants may serve as “markers of totems of descent group affiliation” or “participation and membership within specific religious cults” (Bayman 2002:83).

Compared to other regions in all time periods, whole shell pendants are much more common in the Hohokam area. Whole *Pecten* pendants appear primarily during the Pre-Classic period and are differentially associated with mortuary contexts at larger ballcourt sites such as Snaketown and Grewe (Bayman 2002:84; Nelson 1991:78). *Pecten* pendants are also associated with objects of Mesoamerican origin. Based on these associations, Bayman (2002:85) interprets *Pecten* pendants as insignia of office within an
“individuated power” structure. Tinklers fashioned from Conus shell are also numerous and are used both as pendants within necklaces and to adorn clothing. Although not serving as items of personal adornment, other shell items of value include etched Laevicardium shell and shell trumpets (typically Strombus). During the Pre-Classic period, shell trumpets are primarily associated with male burials and may represent “inalienable instruments of prestige and episodic power” (Bayman 2002:85; Mills and Ferguson 2008; Vokes 1987).

Glycymeris shell bracelets are very common in the Hohokam area during this period. Based on the lack of evidence for the manufacture of shell bracelets in any other area, Glycymeris bracelets found throughout the Southwest were most likely obtained as finished pieces from the Hohokam region. These bracelets are generally of medium thickness between A.D. 900 and 1150 (thin bands predominate in the earlier Colonial period) with a perforated umbo. Carved bracelets, particularly with a serpent motif, are also common. While Glycymeris bracelets occur at most habitation sites in the Hohokam area and occur both in both males and female burials, they do not appear to be worn in great quantity by any single individual. Whereas Haury (1976:321) suggests that these are low-value or ordinary items given their unrestricted distribution, Bayman (2002:86) considers them to be valuable symbols of group membership.

Mosaic work appears earlier in the Hohokam area than in other parts of the Southwest. Among the Pre-Classic Hohokam, mosaics are most commonly comprised of shell tesserae of complex shapes; turquoise mosaic pieces, on the other hand, tend to be rectangular or triangular and arranged in rows. Finished pieces are both geometric and zoomorphic in shape. The ornament assemblage from Snaketown includes hundreds of
turquoise tesserae, beads, and pendants (Gladwin et al. 1937:146-147; Haury 1976:299). Although these materials are found in various deposits, they are concentrated within two different residential areas associated with Mesoamerican goods and shell ornament production debris (Seymour 1988:26). Bayman (2002: 85) suggests that mosaic ornaments may have served as insignia of office, along with whole *Pecten* pendants.

In the Hohokam area, shell jewelry is particularly concentrated within mortuary contexts and caches (McGuire and Howard 1987). In general, men are more likely to be buried with ornaments than women during the Pre-Classic Period; male burials are associated with shell ornaments, turquoise, and bone hairpins (Crown and Fish 1996:808; McGuire 1992). Although female burials also contain ornaments, they are more commonly associated with utilitarian items (Crown and Fish 1996). In his study of burials and cremations from the site of La Ciudad, McGuire (1992) finds that the occurrence of grave goods such as ornaments correlates with sex and age. Male burials are generally wealthier than female burials (with ornaments considered to be high-value items), and sub-adults are associated with the greatest quantity and variety of grave goods, including shell beads and bracelets. This is also the case at the ballcourt community of Las Colinas. Interestingly, only adults are associated with bone hairpins at the site; McGuire (1992) interprets these individuals as the heads of courtyard groups.

**A.D. 1150/1175 to 1300/1350**

In general, most of the forms and materials utilized in Pre-Classic ornamentation persist into the Classic Period. While turquoise ornaments—consisting primarily of tabular pendants, beads, and mosaic tesserae—are consistently present in Classic-period assemblages, most ornaments are made from shell. Unlike the previous period, turquoise
is not differentially associated with mortuary contexts or with Mesoamerican artifacts, suggesting a shift in the meaning of this material. Turquoise disc beads, in addition to *Spondylus* shell beads, appear to be worn primarily as bracelets.

During the Classic Period, shell ornament production shifts away from the western Papagueria to platform mound settlements in the Phoenix, Tonto, and Tucson Basins. Although it appears that the individuals residing in platform mound compounds both produce and consume more shell jewelry, shell ornaments are widely associated with household contexts in these communities (Bayman 1996, 2002:78; McGuire and Howard 1987). While the total quantity of shell ornaments generally increases during this period, fewer, less elaborate, and more standardized forms are produced (Haury 1945:159; Neitzel 1991: 188). The majority of the ornaments from Classic Period contexts are comprised of shell beads and bracelets. *Nassarius* shell beads and *Conus* tinklers also become more common, while the use of etched shell diminishes. *Conus* tinklers are either sewn onto clothing or worn as necklaces; these ornaments are most often found on or near platform mounds, suggesting their association with ritual performances (Bayman 2002:83).

After A.D. 1100, *Glycymeris* bracelets become more standardized, and both thin and carved forms decline in popularity compared to simple, thick-banded forms (Neitzel 1991). Shell bracelets are widespread and found in all contexts, suggesting they may have continued to serve as symbols of group membership. While bracelets are less common in mortuary contexts compared to preceding periods, when they do occur, they are found with both male and female burials (albeit in greater quantities with male burials). Although the consumption of shell bracelets is relatively unrestricted, production appears
to be concentrated in platform mound communities, particularly after A.D. 1200. Along with evidence for standardization and craft specialization, this may indicate some level of elite involvement and/or manipulation of the material symbols of social identity; however, there is no evidence that production was attached to or controlled directly by elites (Bayman 2002:81; Neitzel 1991).

In general, fewer and more stylized pendant forms are produced during the Classic Period, particularly lizard, frog/toad, and bird-in-flight zoomorphic shapes. Shell pendants with turquoise mosaic overlay become relatively rare; most of the known examples are from Casa Grande and Los Muertos and are not associated with individuals within mortuary contexts or in caches (Bayman 2002:85; Haury 1945; Nelson 1991). The most common forms are frogs, which may have been associated with water, and bird forms outlined in turquoise mosaic (Jernigan 1978:84). When found either in isolation or within larger mosaic pieces, tesserae are of simpler shapes than in the Pre-Classic period, suggesting that mosaic ornaments are overall simpler in their design. Bayman (2002:85) suggests that mosaic frogs were symbols/badges of leadership, but within a more corporate/less “individualized” framework than in the Pre-Classic period.

During the Classic Period, males are generally interred with more ornaments than females (Crown and Fish 1996). Based on his analysis of burials from Pueblo Grande, Mitchell (1994) finds several associations between ornaments and sex, age, burial type, and burial location. Of more than 800 burials, a total of 17 percent contain beads, 10 percent contain bracelets, and 12 percent contain pendants. Greater numbers of ornaments are associated with inhumations and the central burial group. In addition, the ‘wealthiest’ graves (those with the highest Grave Lot Values) are those of young adults
and old adults. Though present in both male and female burials, beads are more numerous in those of males, particularly beads made from shell. Adult male burials are also associated with pendants. Infant burials contain the fewest ornaments and do not include pendants, turquoise, or shell. In the Hohokam area as a whole, however, necklaces of small Glycymeris beads and gastropod shell are common in infant and juvenile burials (McGuire and Howard 1987).

A.D. 1300/1350 to 1450

During the first portion of this period, ornaments remain common at large sites in the Hohokam area, such as Pueblo Grande, Casa Grande, and San Cayetano. The ornament types utilized do not change significantly, although the relative frequencies of these types shift slightly. Greater quantities of Olivella and Conus shell and more ornaments made from stone, particularly turquoise, are represented in late Classic-period assemblages. Olivella shell beads are typically worn as anklets, and rings are fashioned from Conus shells. Vermetus beads, which were used during the Sedentary Period, reappear in the late Classic period (Jernigan 1978:44).

At Pueblo Grande, late Classic period burials contain a more even ratio of shell-to-stone ornaments and fewer Olivella shell beads compared to the early Classic period (Foster 1994:245). In addition, shell disc beads are most often associated with males, while stone disc beads are commonly found in female burials. In late Classic-period burials at San Cayetano, males are generally buried with more jewelry than females, although ornaments occur with both sexes and all ages. Interestingly, all rings, bracelets, and armlets are worn on the left side of the body (DiPeso 1956:95). Conus rings, for example, are worn around the first three fingers of the left hand. Bracelets, typically
numbering from three to six, are very common in burials. Of all of the ornaments observed, *Glycymeris* bracelets comprise the only class of ornaments found in greater quantities with females than with males. Adult males are also typically buried with an average of two shell armbands. While both *Olivella* and *Nassarius* beads are worn as anklets, shell and stone disc beads are mostly worn as necklaces and associated with adult males. Matched turquoise ear pendants are also associated with adult males, as are bone hairpins.

*Tonto Basin*

A.D. 1300/1350 to 1450

Compared to pre-A.D. 1200 contexts, ornaments are fairly numerous in the Tonto Basin during the fourteenth and fifteenth centuries. The most common ornaments include *Olivella* beads, *Conus* tinklers, shell and stone (turquoise, steatite, and argillite) disc beads, *Glycymeris* bracelets and rings, *Laevicardium* pendants, shell pendants carved into zoomorphic shapes, turquoise pendants and mosaic pieces, and carved bone hair pins. Shell disc beads are most often strung into necklaces and anklets, and bone hairpins are typically carved parallel to the shaft (vs. perpendicular as in other areas). Although most of the marine shell ornaments occur as finished pieces, there is evidence that *Laevicardium* pendants were produced locally at the Cline Terrace platform mound. *Conus* tinklers and *Olivella* beads also appear to be differentially associated with the Cline Platform Mound and with other platform mound sites, supporting the interpretation that the mounds served specialized functions (Rice 1987:148).

Apart from ceramics, ornaments are the most common class of artifacts in Tonto Basin burials, particularly those of adults. Among burials at the Cline Mesa Sites, *Conus*
tinklers are coated with hematite and yellow ochre. Two subadult burials are associated with large quantities of shell, including shell disc beads (one worn as an anklet), *Conus* tinklers, and *Glycymeris* bracelets and pendants. Although turquoise is more common in residential contexts than in mortuary contexts at Tonto Basin sites, when present, it is associated with more elaborate interments (Vokes and Gregory 2007:346). This may indicate that turquoise symbolized certain roles in ceremonial societies, as suggested by Loendorf (1997:798).

Bone hairpins appear to be associated with adult males and may be indicative of sodality membership. In burials at the Cline Mesa sites, hairpins are associated with two adult males and one young adult of unknown sex. At Mazatzal house, Whittlesey et al. (2000:258) report that four out of five male burials are associated with bone hairpins. One of these burials also includes a shell pendant, a shell bracelet, and two projectile points near the left shoulder, similar to a segment of the male burials at Grasshopper (Whittlesey 1984).

**Discussion**

To summarize, several ornament forms and materials cross-cut both temporal divisions and regional boundaries (Figure 4). These similarities may be related to the high visibility of ornaments, owing to the manner in which they are worn, and raw material constraints that limit the possibilities of form. In addition, ornament production generally involves low levels of knowledge, which could be easily attained through trial and error. Despite broad similarities in the styles of individual ornaments, however, the association of certain forms with specific aspects of identity, and the way in which ornaments are
arranged into composite pieces and displayed on the body, varies across space and time (Table 1).

Figure 4. Spatial distribution of selected ornament forms across the Southwest. Ornament photographs include AMNH Catalog Nos. 29.0/5391, 29.0/7448, 29.0/8776 (Courtesy of the Division of Anthropology, American Museum of Natural History), NMAI Catalog No. 51124 (Courtesy of the National Museum of the American Indian, Smithsonian Institution), NMNH Catalog No. H/4117 (Courtesy of the Department of Anthropology, Smithsonian Institution). All AMNH, NMAI, and NMNH photos by Hannah Mattson. Illustrations of disc bead and Olivella shell bead are from Judd 1954 (Figures 14 and 15). The remaining illustrations are adaptations from Jernigan 1978 (Plates 4 through 8) (illustrations by Hannah Mattson).
Table 1. Summary of ornament types and arrangements by time period and geographic/culture area.

<table>
<thead>
<tr>
<th>Geographic Area</th>
<th>Period</th>
<th>Ornament Type(s)</th>
<th>Common Ornament Arrangement(s)</th>
<th>Context/Association</th>
</tr>
</thead>
<tbody>
<tr>
<td>San Juan Basin</td>
<td>A.D. 900 to 1150</td>
<td>Turquoise disc beads</td>
<td>Bracelets and ear strands</td>
<td>Whole and fragmentary ornaments: Turquoise pendants; Disc beads of turquoise, shell, jet, and shale; Halloitis shell pendants; Glycymeris shell bracelets; Spondylus shell dentate beads; Olivella shell beads; Turquoise and stone tesserac; Turquoise production debris</td>
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<tr>
<td></td>
<td></td>
<td>Stone disc beads</td>
<td>Necklaces (single element)</td>
<td>Both sexes</td>
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<td></td>
<td></td>
<td>Olivella shell beads</td>
<td>Necklaces</td>
<td>All ages and sexes</td>
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<td></td>
<td></td>
<td>Turquoise tabular pendants</td>
<td>Ear tabs and elements in necklaces</td>
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<td></td>
<td></td>
<td>Jet buttons and plaques</td>
<td>Chest plaques/pendants/clothing elements</td>
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<tr>
<td></td>
<td>A.D. 1150 to 1300</td>
<td>Turquoise tadpole beads;  Halloitis shell pendants; Stylized bird tabular shell pendants; Turquoise, shell, and jet mosaic; Stone disc beads; Shell bilobe and disc beads; Glycymeris shell bracelets; Turquoise production debris</td>
<td>Necklaces</td>
<td>Pueblo Bonito burials (mostly adult males and females) and associated offerings</td>
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<td></td>
<td></td>
<td>Turquoise disc beads</td>
<td>Ear pendants</td>
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<td></td>
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<td>Olivella shell beads</td>
<td>Pendants/chest plaques</td>
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<td>Turquoise tabular pendants</td>
<td>Necklaces</td>
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<td>Jet buttons and plaques</td>
<td>Bracelets and necklaces</td>
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<td>Turquoise and shell beads</td>
<td>Bracelets or armlets</td>
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<td></td>
<td></td>
<td>Turquoise disc beads</td>
<td>Ear strands, bracelets, and necklaces</td>
<td>Adults and children</td>
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<tr>
<td></td>
<td></td>
<td>Olivella shell beads</td>
<td>Necklaces and anklets</td>
<td>Adults and children</td>
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<td></td>
<td></td>
<td>Conus shell tinklers</td>
<td>Attached to clothing, around waist, elements of necklaces and bracelets</td>
<td>Infant and children mass burials (Aztec Ruin)</td>
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<td>Turquoise, stone and shell beads</td>
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<td>Adults</td>
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<td></td>
<td></td>
<td>Stone and hell disc beads, pendants, inlaid shell, tesserac, turquoise</td>
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<td>Kiva Offerings</td>
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<tr>
<td>Geographic Area</td>
<td>Period</td>
<td>Ornament Type(s)</td>
<td>Common Ornament Arrangement(s)</td>
<td>Context/Association</td>
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<td>Rio Grande Valley</td>
<td>A.D. 1300 to 1450</td>
<td>Stone disc beads</td>
<td>Ear strands, bracelets, and necklaces</td>
<td>Males, females, part animal and vegetable figures</td>
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<td>Red and white disc beads</td>
<td>Necklaces and bracelets</td>
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<td>Beaded choker-style necklaces with central shell pendants</td>
<td>Looped around the neck choker-style between four and ten times with a lower figure-eight strand or a whole shell pendant</td>
<td>Females</td>
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<td>Conus shell tinklers</td>
<td>Attached to clothing</td>
<td>Males</td>
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<td>Olivella shell beads</td>
<td>Necklaces, bracelets, around the waist</td>
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<td>Tabular pendants</td>
<td>Ear tabs</td>
<td>Males and females</td>
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<td>Feather ear bobs</td>
<td>Ear ornaments</td>
<td>Males</td>
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<td>Olivella shell beads</td>
<td>Loose and strung</td>
<td>Kivas</td>
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<td>Disc beads</td>
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<td>Shell and turquoise mosaic</td>
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<td>Mimbres Valley</td>
<td>A.D. 900 to 1150</td>
<td>Halioit tabular pendants</td>
<td>Elements within necklaces</td>
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<td>Turquoise disc beads</td>
<td>Necklaces</td>
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<td>Glycymeris bracelets</td>
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<td>Burials, general</td>
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<td>Turquoise pendants</td>
<td>Bracelets and necklaces (looped around neck in collar-like fashion)</td>
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<td>Discoidal beads</td>
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<td>Tesserae</td>
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<td>Glycymeris shell bracelets</td>
<td>Necklaces</td>
<td>Females</td>
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<td>Tabular pendants</td>
<td>Necklaces and ear tabs</td>
<td>Children</td>
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<td>Glycymeris shell armbands</td>
<td>Armband</td>
<td>Adult males</td>
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<td>Disc beads</td>
<td>Anklets</td>
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<td>Earrings</td>
<td>Males and females</td>
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<td>Bone hairpins, zoomorphic</td>
<td>Hair ornaments</td>
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</table>
Table 1. (continued)

<table>
<thead>
<tr>
<th>Geographic Area</th>
<th>Period</th>
<th>Ornament Type(s)</th>
<th>Common Ornament Arrangement(s)</th>
<th>Context/Association</th>
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<tbody>
<tr>
<td>Mogollon Highlands</td>
<td>A.D. 1150/1175 to 1450</td>
<td>Turquoise disc beads, Ornaments, general, Glycymeris shell pendants, Glycymeris shell bracelets</td>
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<td>Conus shell and bone rings, Disc beads, Turquoise tesserae, and Non-Glycymeris shell pendants, Glycymeris shell bracelets</td>
<td>Rings, Necklace elements</td>
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<td></td>
<td></td>
<td>Bone hairpins, Conus tinklers, Glycymeris shell bracelets</td>
<td>Hair ornaments, Attached to clothing, Bracelets</td>
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<tr>
<td>Coconino Plateau</td>
<td>A.D. 900 to 1175</td>
<td>Bone hairpins with carved geometric heads</td>
<td>Hair ornaments</td>
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<td>Inlaid argillite noseplug, Conus shell tinklers, Mountain lion teeth and claws, Shell bracelet with bird turquoise mosaic, Possible painted armband</td>
<td>Nose ornament, Attached to clothing and possibly as a bracelet around right wrist, Bracelet, Armband</td>
<td>“Magician’s” Burial (adult male) and associated offerings (Ridge Ruin)</td>
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<tr>
<td>Coconino Plateau and Verde River Valley</td>
<td>A.D. 1175 to 1300</td>
<td>Stone disc beads, Argillite and stone cylinders, Stone quadruped pendants, Painted armbands (sometimes with other ornaments), Glycymeris shell bracelets, Bone hairpins, incised or zoomorphic, Stone disc beads</td>
<td>Bracelets, Nose ornaments, Necklace elements, Armbands worn on the left side, Bracelets worn on the left side, Elaborate burials</td>
<td>Elaborate burials</td>
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Table 1. (continued)

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<tr>
<th>Geographic Area</th>
<th>Period</th>
<th>Ornament Type(s)</th>
<th>Common Ornament Arrangement(s)</th>
<th>Context/Association</th>
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<td><strong>Verde River Valley</strong></td>
<td>A.D. 1300 to 1450</td>
<td>Shell and stone disc beads</td>
<td>Bracelets and anklets</td>
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<td>Turquoise disc beads</td>
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<td>Tabular pendants</td>
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<td>Black disc beads</td>
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<td>Turquoise mosaic</td>
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<td>Shell beads</td>
<td>Necklaces</td>
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<td>Ornaments, in general</td>
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<td>Disc beads</td>
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<td>Turquoise tabular pendant</td>
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<td><em>Glycymeris</em> bracelets</td>
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<td><em>Conus</em> shell tinklers</td>
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<td><em>Glycymeris</em> shell bracelets</td>
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<td><em>Conus</em> shell tinklers</td>
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<td>Conus shell tinklers</td>
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<td>Glycymeris shell bracelets</td>
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<td>Shell ornaments, turquoise, bone hairpins</td>
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<td>Shell ornaments, turquoise, bone hairpins</td>
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<td><em>Glycymeris</em> shell bracelets</td>
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<td></td>
<td>Bone hairpins</td>
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<tr>
<td><strong>Sonoran Desert</strong></td>
<td>A.D. 900 to 1150</td>
<td>Discoidal beads</td>
<td>Necklaces (looped around neck in choker-like fashion or loosely hanging down the chest)</td>
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<td>Turquoise discoidal beads</td>
<td>Anklets</td>
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<td><em>Nassarius</em> shell beads</td>
<td>Anklets and bracelets</td>
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<td><em>Columbella</em> shell beads</td>
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<td><em>Vermetus</em> shell beads</td>
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<td>Turquoise tabular pendants</td>
<td>Ear tabs, necklace and bracelet elements</td>
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<td><em>Zoomorphic</em> shell pendants</td>
<td>Necklace elements</td>
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<td></td>
<td></td>
<td><em>Conus</em> shell tinklers</td>
<td>Attached to clothing and as elements within necklaces</td>
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<td></td>
<td></td>
<td><em>Glycymeris</em> shell bracelets</td>
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<td>Shell ornaments, turquoise, bone hairpins</td>
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<td>Shell ornaments, turquoise, bone hairpins</td>
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<td><em>Glycymeris</em> shell bracelets</td>
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<td>Bone hairpins</td>
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<td>Geographic Area</td>
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<td>Ornament Type(s)</td>
<td>Common Ornament Arrangement(s)</td>
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<td>Sonoran Desert</td>
<td>A.D. 900 to 1150</td>
<td><em>Pecten</em> shell pendants</td>
<td>Mortuary contexts at large ballcourt sites and Mesoamerican goods</td>
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<td></td>
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<td>Turquoise tesserae, beads, and pendants</td>
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<td></td>
<td>A.D. 1150 to 1300</td>
<td>Turquoise discoidal beads</td>
<td>Bracelets</td>
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<td></td>
<td><em>Spondylus</em> shell beads</td>
<td>Bracelets</td>
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<td></td>
<td><em>Conus</em> shell tinklers</td>
<td>Attached to clothing or necklace elements</td>
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<td><em>Glycymeris</em> shell bracelets</td>
<td>Bracelets</td>
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<td>Shell pendants with turquoise inlay</td>
<td>Non-mortuary contexts</td>
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<td>(especially frogs)</td>
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<td>Ornaments, in general</td>
<td>Subadults and old adults</td>
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<td>Beads, especially shell</td>
<td>Males</td>
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<td>Pendants</td>
<td>Adult male</td>
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<td>Pendants, turquoise, and shell</td>
<td>Non-infants</td>
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<td><em>Glycymeris</em> shell and gastropod beads</td>
<td>Necklaces</td>
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<td>A.D. 1300 to 1450</td>
<td><em>Olivella</em> and <em>Nassarius</em> shell beads</td>
<td>Anklets</td>
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<td>Shell disc beads</td>
<td>Necklaces</td>
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<td></td>
<td></td>
<td><em>Glycymeris</em> shell armbands</td>
<td>Armbands worn on left side (n=1-2)</td>
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<td></td>
<td>Bone hairpins</td>
<td>Hair ornaments</td>
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<td>Turquoise pendants</td>
<td>Ear tabs</td>
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<td>Stone disc beads</td>
<td>Bracelets worn on left wrist (n=3-6)</td>
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<td></td>
<td><em>Glycymeris</em> shell bracelets</td>
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<td></td>
<td><em>Conus</em> shell rings</td>
<td>First three fingers of the left hand</td>
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<td>Geographic Area</td>
<td>Period</td>
<td>Ornament Type(s)</td>
<td>Common Ornament Arrangement(s)</td>
<td>Context/Association</td>
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<td>Tonto Basin</td>
<td>A.D. 1300 to 1450</td>
<td>Shell disc beads</td>
<td>Anklets</td>
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<td></td>
<td></td>
<td>Stone disc beads (especially steatite)</td>
<td>Anklets and necklaces</td>
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<td></td>
<td></td>
<td><em>Conus</em> shell tinklers</td>
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<td>Platform mound sites</td>
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<td></td>
<td><em>Olivella</em> shell beads</td>
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<td></td>
<td>Bone hairpins, carved Shell pendants and bracelets</td>
<td>Hair ornaments</td>
<td>Adult males</td>
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<td></td>
<td></td>
<td>Turquoise ornaments</td>
<td></td>
<td>Elaborate male burials and habitation contexts</td>
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<td></td>
<td>Shell and stone disc beads</td>
<td>Anklets</td>
<td>Subadults</td>
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<td><em>Conus</em> shell tinklers</td>
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<td></td>
<td><em>Glycymeris</em> bracelets and pendants</td>
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Widespread ornament forms include whole shell beads (particularly those made from *Olivella*, and to a lesser extent *Nassarius*), mosaics (especially turquoise), disc beads (particularly turquoise and shale), geometric tabular pendants (particularly rectangular shapes made from turquoise and stylized bird shapes made from shell), *Conus* shell tinklers, and bilobed beads (especially shell). Based on this review, some of the most obvious practices of adornment shared across regional boundaries include: 1) the wearing of turquoise tabular pendants in the ears, *Conus* shell tinklers on clothing (particularly costumes used within ritual performances), and stone disc beads as necklaces (although the manner in which strands of beads were wrapped around the neck varies); 2) the differential association of males with ornaments; 3) the inclusion of ornaments in mortuary contexts with greater quantities of grave goods; and 4) the placement of shell and turquoise ornaments in ritual deposits. Mills (2004, 2008) notes that turquoise mosaics may have served as inalienable possessions across the Southwest, along with items such as masks, fetishes, dance costumes, mirrors, and palettes. In addition, as noted by Neitzel (2000) in her examination of burial populations in the Southwest, there may be some broad patterns in the associations of certain ornament types by gender. In general, male burials tend to be associated with turquoise beads, shell pendants, shell tinklers, and stone rings. Female burials tend to include turquoise pendants, shell beads, shell rings, and stone beads. However, as demonstrated by this review, these trends subsume considerable variation.

Some ornament forms have relatively restricted distributions. In the Sonoran Desert, these include etched shell (restricted to the Sedentary Period), perforated *Glycymeris* and *Pecten* pendants, shell tabular pendants displaying zoomorphic forms in
silhouette, and elaborately carved *Glycymeris* bracelets. Characteristic of the Mogollon Highlands and Mimbres Valley are sculptural stone quadruped pendants and certain styles of bone hairpins. The use of jet is distinctive of the Colorado Plateau area, particularly when used for rings or paired with turquoise in mosaic pieces. Noseplugs, especially those made from argillite with turquoise inlay, are more numerous in sites on the Coconino Plateau and Verde River Valley than in any other area. Within regions, certain adornment practices appear to be widespread and relatively unrestricted. These practices, rather than particular ornament forms, were likely used to express affiliation with broad social groups. Examples include the wearing of ear strands of stone disc beads, bracelets of turquoise disc beads, and necklaces of *Olivella* shell in the Ancestral Pueblo area, and the wearing of *Glycymeris* bracelets and *Olivella* shell anklets in the Hohokam area.

Distinctive adornment practices within regions likely indicate affiliation with specific aspects of personal identity, such as age, gender, or social status. Examples include the association of beaded anklets with men and necklaces of shell and stone beads with women in the Mimbres area; the association of bilobe and dentate shell beads, turquoise, and *Haliotis* pendants with burials containing larger quantities of grave goods at Chaco Canyon; the association of greater quantities of shell beads and bracelets with subadults in the Hohokam area; and the association of men with *Glycymeris* shell pendants and women with non-*Glycymeris* shell pendants in the Grasshopper area.

The incorporation of ornaments in ritual deposits within ceremonial structures, caches, and burials containing abundant and/or exotic items indicates these objects were accorded with social value. For example, individual ornaments (particularly whole or
broken beads and pendants) and materials related to the production of ornaments were placed within offerings in communal structures in the Mimbres Valley and in kiva offerings in the Ancestral Pueblo area. Some ornaments with strong ritual associations likely served as inalienable possessions, or “symbolic repositories of genealogies and historical events” (Weiner 1994:33) that are “imbued with intrinsic and ineffable identities of their owners which are not easy to give away” (Weiner 1992:6). As such, these objects would have been important in constructing and authenticating social identities (Mills 2004). Possible inalienable ornamental pieces may have included elaborate mosaic items (including a cylindrical basket covered in turquoise mosaic) in Chaco Canyon during the Pueblo II period and shell pendants with turquoise mosaic during the Classic Period in the Hohokam area.

The use of ornaments within material practices, and therefore in identity construction, may be related to their partibility; ornaments served as both composite objects displayed on the bodies of people or curated as inalienable possessions, and as fragmented or disassembled objects deliberately gathered together with other meaningful items and placed within either burials or specific ritual contexts. As discussed earlier, this may indicate the existence of dividual (Fowler 2004) or fractal conceptions of personhood in the prehistoric Southwest, in which “fragmented things were vehicles for memory that formed a tie to the past, and denoted a shared perspective,” along with “a need to separate out elements of the world and redirect them in renewing the social world.” (Fowler 2004: 69-70; Chapman 2000; Mills and Walker 2008).
Conclusion

Material culture is fundamental to the production of personal identity through embodied practices. However, since identity is relational, subjective, and mutable, the articulation of material culture in this process is necessarily variable over time and space. The values and meanings of objects of specific forms and materials derive from their uses within social practices; therefore, objects of morphologically similar form may have multiple meanings, both within and across cultures/social groups. In other words, material symbols may be polysemic, conveying multiple meanings despite physical uniformity.

Ornamentation is one aspect of materiality that is intimately tied to both concepts of personhood and bodily practice. When worn as items of adornment, ornaments are physically situated on or near the body of the individual, yet are oriented outwards and are visible to others. Based on ethnographic research, we know that ornamentation is often inextricably linked to social identity. As with other classes of material culture, however, this relationship is culturally and historically specific. Rather than serving simply as signals of pre-existing aspects of identity, which may then be “read off” the body, ornamentation may be an important part of identity construction as an ongoing and active process; as with other material practices, repeated and patterned acts of personal adornment generate and shape individual identity. Therefore, we need to consider the manner in which specific ornaments appear to have been worn, particularly within larger pieces, and the specific contexts with which ornaments are associated. The spatial and temporal distributions of these particular practices of ornament use are likely to relate
more closely with past social boundaries than regional inventories of ornament styles and materials.
Chapter 3
Ornaments as Socially Valuable Objects:
Jewelry and Identity in the Chaco and Post-Chaco Worlds

Introduction

The prehistory of the American Southwest is marked by periods of demographic upheaval and attendant social and settlement reorganization. Such dynamic periods of abandonment, population movement, and reorganization are generally thought to entail social disruption and structural change, including the redefinition of identity. Central components of this renegotiation of identity are transformations in both social relationships and ritual practice linked to the failure and rejection of previously held ideologies, the adoption of the ideologies of other communities or groups, and/or the appearance of new integrative ideologies (Adams 1991; Aldendenfer 1993; Cordell 1995; Crown 1994; Nelson and Schachner 2002; Schachner 2001; Ware and Blinman 2000).

The collapse of the regional system centered on Chaco Canyon, circa A.D. 1130 to 1150, coincides with a period of demographic upheaval within the San Juan Basin. An important aspect of the subsequent population reorganization was the expansion of Aztec Ruin, a pre-existing Chacoan great house located 50 km to the north on the lower Animas River in the Totah or Middle San Juan district. There is much debate surrounding the relationship, if any, between Aztec Ruin and the communities in Chaco Canyon during and following the decline of the central canyon communities (Clark and Reed 2011; Lekson 2006; P. Reed 2008b, 2011; Wills 2009). Researchers argue variously that the post-Chaco residents of Aztec Ruin were related to populations from Chaco Canyon (Durand et al. 2010; Lekson 1999; Van Dyke 2008; Vivian 1990; Washburn 2008;
Webster 2008), indigenous inhabitants of the Totah area (Rohn 1989), migrants from the Mesa Verde and Northern San Juan areas (Adams 2008; Morris 1919; Brown et al. 2008; Clark and Reed 2011; Windes and Bacha 2008), or some combination of all these (Glowacki 2006; L. Reed 2008; P. Reed 2011; Stein and McKenna 1988). Several researchers have suggested that the post-Chaco residents of Aztec Ruin continued to associate themselves with Chaco through continuation of the Chacoan ceremonial order (e.g. Lekson 2006, ed.; Toll 2006; Webster 2008) or the “Chacoan ritual-ideological complex” (Lipe 2006). The persistence of Chacoan traits in post-Chacoan communities in other parts of the San Juan Basin has also been interpreted as evidence for revitalization or continuation, to varying degrees, of Chacoan ideology and ritual practices (e.g., Kintigh et al. 1996; Lekson 1999).

Transformations in identity are particularly pronounced in the use and meaning of socially valuable goods—objects that are embedded within social transactions and embody symbols of identity, including cultural and/or sacred principles and values (Lesure 1999:25; Spielmann 2002). Ornaments, both those used for personal adornment and those used in ritual contexts, comprise a class of objects that appear to have been symbolic and valuable in Chacoan society. In this paper, I explore the relationship between identity and demographic reorganization through an examination of the extent to which elements of Chacoan identity and practice, as demonstrated by the social values attributed to ornaments at Pueblo Bonito during the Chaco florescence, were maintained or transformed by the post-Chaco period inhabitants of Aztec Ruin. Specifically, I attempt to identify socially significant dimensions of physical variation in ornaments by
utilizing the concepts of value gradations (Lesure 1999), alienability (Weiner 1992, 1994; Mills 2004, 2008), and structured deposition (Walker 1995).

**Chaco Canyon**

During the eleventh and early twelfth centuries, Chaco Canyon appears to have served as the major ritual and sociopolitical center in the San Juan Basin of northwestern New Mexico (Figure 5). The most visible hallmarks of Chacoan communities are great houses—massive structures with distinctive masonry, formal layouts, and associated great kivas (Lekson 1991). These structures, which are often associated with road segments, map out the geographically known extent of Chacoan influence (Judge 1989, 1991; Kantner and Kintigh 2006; Neitzel 1989; Powers et al. 1983). Although first emerging in other portions of the San Juan Basin during the Pueblo I period (Lipe 2006; Wilshusen and Van Dyke 2006), the architectural elements associated with this system appeared in Chaco Canyon just before during the Early Bonito phase (A.D. 850/900-1020). In the Classic Bonito phase (A.D. 1020-1115), thought to be the peak of the system, Chacoan traits were formalized and outlying great house construction reached its farthest extent (Judge 1989). During the Late Bonito phase (A.D. 1115-1140), the Chacoan system appears to have undergone dramatic reorganization. The architectural characteristics displayed in both new buildings and in the remodeling of existing structures during this time resemble those seen in the northern San Juan Basin (Sebastian 1992; Van Dyke 2004; Vivian and Mathews 1965; Wills 2009). The latest known Ancestral Pueblo construction element in the canyon dates to A.D. 1125/1130, and by A.D. 1150, Chaco Canyon’s position as a regional center had deteriorated and the system
appears to have collapsed (Judge and Cordell 2006; Kantner 1996, 2004; Sebastian 1992, 2006).

Figure 5. Map of a portion of northwestern New Mexico showing the location of Chaco Canyon and Aztec Ruin (drafted by Darryl DelFrate).
The Chaco system has been the subject of archaeological research for over a century, but there is still much disagreement over the level of sociopolitical organization it may represent, the functions of great houses and roads, the relationships between the residents of the central canyon to those of outliers, and the nature and areal extent of Chacoan cultural influence and contact. The current, and general, consensus among Chacoan researchers is that Chaco Canyon was a center for ceremonial activity to some degree (Earle 2001; Kantner 2004; Lekson 2006; Mills 2002; Stein and Fowler 1996; Stein and Lekson 1992; Renfrew 2001; Yoffee 2001). Some researchers implicate the canyon’s ritual importance as the major underlying factor in the development and functioning of the Chacoan system. For example, Renfrew (2001) calls Chaco a “location of high devotional expression” at which the production and consumption of goods was of primarily ritual significance, a view upheld by Toll (2006). Recent literature also tends to support Judge’s (1989) suggestion that the canyon was a pilgrimage destination for populations from surrounding regions (Judge and Cordell 2006; Kantner 2004; Lipe 2006; Malville and Malville 2001; Mills 2002:79; Toll 2006).

Pueblo Bonito, the largest Chacoan great house, appears to have been the major center, ceremonial and/or political, for the Chacoan regional system (Neitzel 2003). The massive structure, including as many as 800 rooms and four stories, is located within a cluster of five other large great houses in the central canyon bottom (Figure 6). In conjunction with other structures in the canyon, Pueblo Bonito is part of a formal built landscape, the layout of which some researchers suggest may be related to the canyon’s ideological significance (Farmer 2003; Fritz 1978; Lekson 2006; Renfrew 2001; Stein and Lekson 1992; Sofaer 1997; Van Dyke 2008). An astounding volume of imported and
unique items were found in Pueblo Bonito, including objects made from turquoise and shell, copper bells, macaw feathers, and other distinctive objects such as cylinder vessels and ceremonial sticks. Many of these valuable items are associated with burials, caches in rooms, and offerings in kivas (Akins 1986, 2003; Neitzel 2003; Mathien 2003; Mills 2008). Other great houses also contain some of these items, but none rival Pueblo Bonito in either quantity or concentration. Two main burial clusters, both located in the older part of the structure or “Old Bonito,” contain the majority of the ornaments and other fancy objects collected. The northern burial cluster includes Rooms 32, 33, 53, and 56. Approximately 24 to 28 individuals were buried in these rooms; based on long bone measurements, these individuals have the tallest stature represented by any human remains documented in the Southwest to date (Akins 1986, 2003; Stodder 1989). Room 33, one of the richest collections of burials documented in North America, includes two males (and several other individuals) associated with thousands of ornaments and ceremonial items, among other objects (Pepper 1920). Based on several lines of evidence, the burial with the most associated artifacts (Burial 14) dates to the Pueblo I period, early in the Pueblo Bonito construction sequence (Coltrain et al. 2007; Plog and Heitman 2010). It appears that the Room 33 crypt remained accessible throughout the occupation of the site, and that offerings were placed in this location over the course of generations (Judd 1954; Marden 2011, 2015; Pepper 1920; Plog and Heitman 2010). The western burial cluster—comprised of 95 individuals interred within Rooms 320, 326, 329, and 330—was documented by Judd (1954). Based on craniometric data, Akins (1986:75, 2003:101) suggests that the two burial clusters represent separate lineages or populations.
Figure 6. Planview of Pueblo Bonito, showing the locations of the northern and western burial clusters (basemap from the Chaco Digital Archive, based on Plog and Heitman 2010: Figure 2, drafted by Darryl DelFrate).

More recently, it has been proposed that these burial clusters may reflect larger social units, such as houses within a house society model (Heitman 2007; Heitman and Plog 2005; Mills 2015: Wills 2005). In the house society concept, first described by Lévi-Strauss (1982), houses are flexible social formations that, while often based on descent, are not bound by specific categories such as clans or families (Gillespie 2007; Joyce and
Houses are anchored by persistent architectural spaces that not only encompass spheres of domestic and ritual activities, but also embody shared cosmologies and embedded values related to common ancestors/origins, heirlooms, and inalienable possessions (Heitman 2007; Mills 2015). Important for their recognition archaeologically, houses are physically recognizable by their associated material practices and performances, which are necessary in maintaining or perpetuating their existence (Gillespie 2007; Lévi-Strauss 1982; Marshall 2000).

Pueblo Bonito contains 35 kivas of different sizes, including great kivas, court kivas, and room block kivas (Judd 1954; Mills 2008; Pepper 1920; Windes 2014). Great kivas are the largest of these and contain the most numerous and formal suite of floor features. Ritual deposits, both dedicatory and termination/retirement, are associated with kivas of all sizes at Pueblo Bonito and were commonly placed within wall niches, under floors and vaults, and within pilasters and benches (Judd 1954). These deposits tend to be somewhat standardized in that they almost all contain ornaments, turquoise, and marine shell; in addition, many also contain materials of particular colors, textures, and degrees of reflectivity (Mills 2008:89). Mills (2008) suggests that the size of kivas at Chacoan great houses are related to the size/extent of the social groups participating in ritual activities associated with the structures.

Post-Chaco Reorganization in the Totah Region

Located along the lower Animas River in the Totah area of the Middle San Juan Basin, the Aztec Ruin community is centered on two large great houses, West Ruin (Figure 7) and East Ruin. West Ruin is a 450-room, multi-storied pueblo with classic
Chacoan great house architecture. East Ruin, built after the West Ruin but with a strikingly similar layout, has 200 to 300 rooms, a great kiva, and is also multi-storied.

The majority of West Ruin was excavated by Earl Morris (1919, 1924, 1928) under the auspices of the American Museum of Natural History. After encountering both classic Chacoan and classic Mesa Verdean material culture, Morris concluded that there was an initial occupation by Chacoans followed by a later occupation by migrants from the Mesa Verde region, separated by a period of abandonment coinciding with the collapse of the Chacoan system. Additional research, particularly extensive tree-ring dating (Brown et al. 2008), has allowed for a more refined interpretation of the occupational history of the community (Stein and McKenna 1988). Evidence now suggests that the community was occupied continuously during Morris’ interim period (Brown et al. 2013). In addition, major building activity and occupation took place in the A.D. 1200s. Since Morris’ work, additional research has also revealed the extent and formality of the “Bonito-style landscape” linked to and centered upon the two great houses, a symmetrical spatial arrangement of buildings, roads, middens, and auxiliary structures that was apparently planned in the late Bonito phase, but not brought to completion until the middle thirteenth century (Brown et al. 2008).

A total of 216 individuals were interred within 174 burials, mostly located in rooms, within the West Ruin (Morris 1919, 1924). Of these, 64 are adults and 129 are adolescents, children, or infants. The majority of the burials appear to be associated with the post-Chacoan occupation of the site. As at Pueblo Bonito, ornaments tend to be concentrated in a few burials or burial groups. Two of the most ornament-rich burials include mass infant/small child interments (25 individuals total), which contained
abundant turquoise, stone and shell beads, and beads in the process of manufacture (Morris 1919, 1924). Similar to other Chacoan great houses, the kivas at West Ruin are also associated with ornaments and turquoise.

Figure 7. Planview of Aztec West showing locations of Burial 14 (Room 52) and Grave 16 (Room 41) (basemap from the Chaco Digital Archive, drafted by Darryl DelFrate).
The post-Chacoan inhabitants of Aztec Ruin who possessed Northern San Juan material cultural traits were responsible for completing a very “Chacoesque” architectural plan (Brown et al. 2008; Van Dyke 2009). It remains unclear if these were actually migrants from the Mesa Verde area or were the descendants of migrants from Chaco Canyon and/or locals who had occupied the site continuously and who had adopted more Northern San Juan material culture late in the sequence. This same question also applies to the post-Chacoan occupation of Chaco Canyon itself (Wills 2009) and persists as a significant unresolved issue in Chacoan archaeology. The timing of both the construction and “reoccupation” of this Bonito-like structure and the incongruity between the architecture and material culture have led researchers to propose various scenarios for the function of Aztec Ruin and its relationship to the end of the Chacoan system.

Several researchers suggest that Aztec Ruin served as the new focus of the Chacoan world in the second half of the A.D. 1100s after the decline of centers in the Chaco Canyon area (Judge 1989; Lekson 1999, 2015; Lekson et al. 2006; Lister and Lister 1990; Sebastian 1992; Powers et al. 1983). Lekson (1999, 2015) proposes that elites residing in Chaco Canyon migrated to the Totah in response to droughts. He argues that Aztec Ruin was a “New Chaco,” serving as a political center for the Northern San Juan into the A.D. 1200s (1999:68; see also Van Dyke 2009). Lekson and others (2006) recently reiterated that “Aztec was the principal, and perhaps unrivaled, center in the northern San Juan region throughout the Pueblo III period, and it continued the canons and scales of downtown Chaco” (2006: 101, 2015; see also Cameron and Duff 2008). Sebastian (1991, 1992, 2006) also argues that the Totah area functioned as the new political center of power for the Chacoan system.
To some researchers, the persistence of Chacoan elements in post-Chaco communities in the San Juan Basin indicates a continuation, to some degree, of Chacoan ideology and ritual practice (e.g., Kintigh et al. 1996; Lekson 1999). It has been suggested that the appearance of Chacoan great houses in the Cibola area in the late A.D. 1100s to 1200s may be related to a revitalization of Chacoan ritual, manipulated to serve the political ends of local leaders (Cameron and Duff 2008; Kintigh 1994; Kintigh et al. 1996). Similarly, Bradley (1996) proposes that the post-Chacoan reuse of Aztec Ruin was part of a larger revitalization movement in the northern San Juan region in the mid-1200s. Fowler and Stein (1992) suggest that ideological and historical ties were made with the past through roads connecting post-Chacoan communities and Chacoan great houses (1992:118; also Kantner 1996; Stein and Lekson 1992), such as the North Road symbolically connecting Aztec Ruin and Pueblo Bonito (Lekson 1999). Other researchers emphasize the Totah area as the “last bastion of the Chacoan tradition” (Kantner 2004:1; Sebastian 2006). Toll (2006) stresses the ritual role of the Totah area after the collapse of the Chaco system, suggesting that the “location for high devotional expression” (sensu Renfrew 2001) moved from Chaco Canyon to Aztec Ruin. Recent research on the technological styles and depositional contexts of perishable ritual artifacts found in Aztec Ruin supports this view (Webster 2008; Webster and Jolie 2015).

Rohn (1989:163) argues that there was only a small and brief Chacoan presence at Aztec, and that the majority of the construction and occupation of the site may be attributed to the indigenous population of the area that identified itself as northern. The most recent research on this issue involves the comparison of low-visibility, technological traits of material remains from Chaco with those from Aztec and Salmon
Ruin (Brown and Paddock 2011; P. Reed 2006, 2008b, 2011; Washburn and Reed 2011; Webster 2008; Webster and Jolie 2015; Windes and Bacha 2008). The preliminary conclusions of these studies, which focus on material from the A.D. 1100s, lend support to both migration and local emulation to varying degrees. However, both Salmon and Aztec Ruin experienced major reoccupations during the A.D. 1200s; this later material includes the vast majority of ornaments from Aztec Ruin.

Object Biographies, Alienability, and Structured Deposition

One way that transformations in identity and practice may be examined in the material record is through a focus on the shifting meanings and uses of socially valuable goods, or “objects that are critical for ritual performance and necessary for a variety of social transactions” (Spielmann 2002:195; see also Crown and Wills 2003; Gell 1992; Lesure 1999; Mills 2000, 2002, 2004, 2008; Walker 1995; Walker et al. 1996; Walker and Lucero 2000; Weiner 1992, 1994). Since the meaning and categorization of objects is culturally specific (Kopytoff 1986:68), the context of an artifact’s use is most closely related to its social value (Mills 2004:238; Walker and Lucero 2000:133). Thus while socially valuable objects tend to possess certain aesthetic qualities, it is important that their identification in the archaeological record is independent of physical form. One way that recent studies have identified social valuables is through the application of a life history or object biography approach (Lillios 1999; Mills 2002, 2004, 2008; Pollard 2001; Walker 1995; Walker et al. 1996; Walker and Lucero 2000). In this approach, the social uses and changing meanings of objects are examined through their biographies; this includes production, distribution, consumption, reuse, and finally, disposal. Due to
greater archaeological visibility, patterns in the discard of these objects are especially useful for inferring past meaning and value (Mills 2008). Walker (1995; Walker et al. 1996; Walker and Lucero 2000) uses an artifact life history approach along with principles derived from behavioral archaeology (Rathje and Schiffer 1982; Reid, Rathje and Schiffer 1975; Schiffer 1976) to connect the systemic context of ritual objects, represented by their social use-lives, to the archaeological record, represented by the manner of their ultimate disposal. Ritual behavior, like any other type of human activity, consists of sequences of activities that leave material residues in the archaeological record. Practices of discard, in particular, constitute important ritual formation processes that create patterns in archaeological deposits (Schiffer 1987; Walker et al. 1996).

Material culture and exchange theory studies (e.g., Appadurai 1986; Kopytoff 1986; Weiner and Schneider 1989) support the link between the biographies of objects and their social values or meanings through the degree of control exercised over their movements within “segregated” spheres of use. Kopytoff (1986) posits that objects lie along a continuum of exchangeability, ranging from “commodities,” which are freely exchanged, to “singularities,” which are restricted from exchange. The life histories of objects classified as singularities are more carefully controlled, and therefore follow more unique or specific pathways of movement, than those classified as commodities. Weiner (1985, 1992, 1994) makes a similar distinction between “alienable” and “inalienable” possessions, which differ in the degree to which they are circulated. Inalienable wealth includes objects that are “symbolic repositories of genealogies and historical events” (1994:33) and are “imbued with intrinsic and ineffable identities of their owners which are not easy to give away” (1992:6). Inalienable objects are therefore important in
authenticating social identities and hence in the legitimization of existing hierarchies (Lesure 1999; Lillios 1999; Mills 2004). Thus, the concept of inalienability extends beyond exchange theory by its emphasis on objects that are, by definition, meant to be kept or only circulated rarely and within restricted social networks. Inalienable objects are analogous to Kopytoff’s (1986) singularities in that they are generally not relinquished easily, and thus have different life histories than commodities, and by their production in limited quantities. In addition, the production of these items is often gendered and necessitates particular forms of esoteric and technical knowledge or skill (Inomata 2001; Mills 2004; Weiner 1992). In terms of physical qualities, inalienable items tend to be more unique in appearance and less divisible than alienable items, and are generally made of relatively scarce raw materials (Lesure 1999:31; Lillios 1999). However, these are only broad generalizations; inalienable items are culturally specific, and as such, there may be many exceptions to these characterizations (e.g., inherited beer gourds among the Haya of Tanzania, sports trophies that are collectively owned and passed down in modern Western culture).

The ethnographic exchange studies of Kopytoff (1986) and Weiner (1992, 1994) have important implications for the archaeological recognition of socially valuable items—namely, that the restriction and control applied to the circulation of objects is closely related to their values and roles in social relations. The ultimate material consequences of the life histories of inalienable, ritual, or other singular objects are “discrete or singularized depositional contexts in the archaeological record” (Walker 1995:72). This behavioral correlate forms the foundation of the concept of structured deposition (Mills 2002, 2004, 2008; Richards and Thomas 1984; Walker 1995).
Structured deposits include objects that are deliberately buried or discarded in singular ways, often receiving special treatment. Ethnographic and cross-cultural research suggests that ritual objects and inalienable possessions are likely to be disposed of as structured deposits, particularly within sacred, rather than secular, places (Walker et al. 1996). Examples of structured deposition include mortuary offerings; termination and dedication caches within architectural sequences of construction, remodeling, and abandonment (Mills 2002, 2004a, 2005; Walker 1995; Walker et al. 1996; Walker and Lucero 2000); votive offerings in extramural spaces (e.g., Pollard 2001, 2008); and ritual caches or hoardes in non-domestic rooms. As Pollard (2008) emphasizes, the ontological status of an object is defined by its role in human practices, rather than any specific essential or inherent quality. The association of certain objects and materials with “the identity or substance of people, places, and supernatural entities” influences the manner in which these items are treated upon deposition (Pollard 2008:49).

**Ornaments as Socially Valuable Objects**

As a class of non-utilitarian goods, ornaments are generally considered to be items of luxury and value, and thus have been widely used as indicators of social inequality. However, the value and meaning of ornaments is often assumed rather than demonstrated. Cross-cultural research has shown that personal adornment is often a key visual indicator of social group identity; ornaments with particular traits (specific forms, sizes, materials, etc.) are markers of horizontal and vertical social differences, ethnic and tribal affiliation, and subscription to ideologies. Hodder (1977, 1982), for example, found that jewelry was a major indicator of tribal identity in Kenya and was symbolically
charged with meaning. Women of neighboring tribes signaled their affiliation through the form of their earflaps. Some prominent differences are apparent between the jewelry of different groups in the prehistoric Southwest as well; for example, shell zoomorphic pendants depicting snake and quadruped silhouettes are characteristic of the Hohokam area, rectangular pendants in jet and turquoise are more common among the Ancestral Pueblo, and round pendants made from shell or painted ceramic are often found in the Mogollon area (Jernigan 1978). Based on mortuary data, it appears that ornaments were also used to mark age, gender, kinship, and vertical status differences within these groups (e.g., McGuire 1992; Mitchell 1994; Morris 1924; Neitzel 2000; Shafer 2003; Pepper 1920).

Ornaments may also serve as corporately or individually-owned inalienable possessions and may be important in ritual practice. Turquoise and shell ornaments, in particular, appear to have been intimately linked with status and ritual in Chacoan society (Judge and Cordell 2006; Kantner 2004; Lewis 2002; Mathien 2001; Mills 2004, 2008; Neitzel 1995, 2003; Plog 2003; Toll 2006). Mills (2008) finds that ornaments and the debris from their production represent the majority of objects contained within structured depositional contexts in Chaco Canyon, including dedicatory offerings in kivas of all sizes. In addition, they comprise a significant portion of objects intentionally deposited in storage rooms as ritual retirements, along with other probable inalienable and ceremonially important items such as altar fragments, cylinder jars, and wooden staffs of office (Mills 2004, 2008; Mills and Ferguson 2008). Thus, ornaments from these contexts meet the criteria for objects of high social value—deliberate and discrete deposition.
within structured deposits, particularly in sacred contexts, and repeated association with other items that may have served as inalienable possessions.

Even minor variations in the physical attributes of ornaments have been shown to differentiate specific aspects of social identity. For example, among the Yurok and Tolowa of northwestern California, *Dentalium* sp. shell bead necklaces were important in distinguishing individuals in terms of social status (Lesure 1999:27). Specifically, variation in the length of otherwise identical beads comprising these necklaces correlated with variation in their social values. Necklaces of the shortest beads were used in small-scale display of horizontal social position, necklaces of medium-length beads were exchanged widely as social payments, and necklaces of the longest beads were elite items that served to legitimize authority and were carefully guarded from circulation. In Fiji during the nineteenth century, the degree of alienability associated with objects made of whale teeth varied with form; necklaces made of whale teeth were badges of office for chieftainship, whereas other items made from whale teeth were used in horizontal social transactions such as bridewealth payments (Lesure 1999:28). In Melanesia, the attributes of size, shape, and color of stone axes were found to be associated with the degree to which these items were used in ritual (Spielmann 2002:200; Strathern 1969). Such subtle aspects of variation may have been overlooked in past studies of ornaments in the Southwest but have the potential to detect significant changes in identity during periods of population upheaval.
Ornaments and Social Meaning at Pueblo Bonito and Aztec Ruin

For this study, I analyzed over 115,000 ornaments and related items—61,751 from Pueblo Bonito and 54,471 from Aztec’s West Ruin. All of these were subject to a simple analysis involving tabulations by artifact type, form, shape, and material. A sample of these, totaling 12,291 items, was analyzed in detail, including the collection of 28 quantitative and qualitative attributes. These artifacts are typically defined in functional terms as jewelry—items that are displayed on the body or clothing for the purposes of personal adornment (Adams 2002, 2010; Jernigan 1978; Mathien 1997). However, following Lesure (1999), it was necessary to also include other items made of the same materials (mostly mineral and shell) in order to examine relative value and social use. As a result, I also included artifacts such as isolated inlays/tesserae, production debris, mineral and shell specimens, paintstones and pigments, manuports, effigies, unique inlaid items, and worked pieces of unknown function. The artifacts are housed at the American Museum of Natural History (AMNH), the Smithsonian National Museum of Natural History (NMNH), the Smithsonian National Museum of the American Indian (NMAI), Aztec Ruins National Monument, and the Chaco Museum Collection at the University of New Mexico. Obtaining a representative sample from a variety of depositional contexts at each site was a major focus of data collection. The analyzed assemblage from Pueblo Bonito encompasses ornaments from 120 rooms, 21 burials (including the remains of at least 28 individuals), 25 kivas, and the extramural trash mounds; the assemblage from Aztec West Ruin includes 75 rooms, 14 burials (representing at least 32 individuals), and 12 kivas.
The study involved three major stages—the identification of patterns of variation in the physical characteristics of ornaments at each of the sites, the association of these characteristics with social use based on context, and the comparison of these linkages in physical attributes and social use between Pueblo Bonito during the Chaco florescence and Aztec Ruin during the post-Chaco period. As the meaning of objects is culturally specific, there are no particular attributes universally associated with social value. Furthermore, valuable objects are only distinguished as such through their similarity and contrast with ordinary objects. For example, the value of circular turquoise pendants depends on the value of pendants made of other materials, pendants with other shapes, circular turquoise pendants of different sizes, and other objects made of turquoise. Based on anthropological observation, Lesure (1999) suggests that potentially meaningful physical variation is likely to be contained within the categories of size, form, and material. Additional aesthetic qualities found to correlate with social value include reflectivity (e.g., Spielmann 2002; Saunders 1999) and texture (Macgregor 1999). It was expected that relatively few attributes would exhibit patterned variation significantly related to social use; however, since it was impossible to determine in advance what these specific attributes would be (e.g., pendant shape, bead length, the “blueness” of turquoise items, reflectivity, smoothness, etc.), numerous potentially meaningful characteristics were recorded. When considered individually, specific forms and materials of ornaments are significantly associated with different depositional contexts at each site, including domestic room floors, room fill/refuse, midden refuse, room offerings, specialized/ceremonial rooms, offerings in kivas of different sizes (great kivas, court kivas, and roomblock kivas), and burials (burial clusters or groups, males, females,
adults, subadults, children, and infants) (Table 2). In this paper, I focus primarily on variation in ornament type, form, shape, and material.

Following Lesure (1999), social uses associated with each of these contexts are inferred along three broad dimensions or axes: type of social relation (e.g., vertical, horizontal), scale of social relation (e.g., small, large), and degree of alienability (e.g., low, high). Following the assumption that access to objects symbolizing rank and social power is typically controlled (e.g., Brandt 1994; Earle 1982; Lesure 1999; Schachner 2001), items that are highly differentiated across rooms are interpreted as referencing vertical social relations, particularly when these same contexts contain other highly differentiated artifacts. Items not differentially distributed across rooms are considered to be related to horizontal social relations. Ornament types widely distributed across rooms, but particularly correlated with certain rooms or groups of rooms, are interpreted as referencing both vertical and horizontal social relationships. In addition, items associated with domestic room contexts are interpreted as having a low level of inalienability. Exceptions to this include ornaments found in structured depositional contexts, such as those intentionally deposited in sealed architectural contexts within rooms, under floors or floor features, or between floors; in this case, it is likely that these items served as termination or dedication offerings. Rooms are interpreted as non-domestic if there was evidence of specialized use, such as association with burials and caches of specialized items. Items associated with rooms containing caches, but not burials, are interpreted as relating to larger-scale social relationships. In addition, ornaments found within structured deposits in these rooms are considered to have a high degree of inalienability.
Table 2. Contextual Associations of Ornaments at Pueblo Bonito and Aztec West Ruin*

<table>
<thead>
<tr>
<th>Depositional Context</th>
<th>PUEBLO BONITO</th>
<th>AZTEC WEST RUIN</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Associated Ornaments</td>
<td>Related Items</td>
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<td></td>
<td>Shell disc beads</td>
<td>Turquoise matrix and production debris</td>
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<tr>
<td></td>
<td>Glycymeris sp. shell bracelets</td>
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<td></td>
<td>Trapezoidal pendants</td>
<td>Shell</td>
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<tr>
<td></td>
<td>Inlays</td>
<td>Glycymeris sp. and Haliotis sp.</td>
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<td></td>
<td>Ornament blanks</td>
<td>Jet</td>
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<tr>
<td>Unspecialized/ Domestic Rooms</td>
<td>Shell disc beads</td>
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<td></td>
<td>Shale disc beads</td>
<td>Shell</td>
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<td></td>
<td>Glycymeris sp. Shell bracelets</td>
<td>Glycymeris sp. and Haliotis sp.</td>
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<td></td>
<td>Shell pendants</td>
<td>Jet</td>
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<td></td>
<td>Spire-lopped Olivella sp. beads</td>
<td>Argillite</td>
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<tr>
<td></td>
<td>Shell bilobe beads</td>
<td>Turquoise matrix and production debris</td>
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<tr>
<td></td>
<td>Ornament blanks</td>
<td>(not specified, included with general room contexts)</td>
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<td></td>
<td>Trapezoidal pendants</td>
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<td>Rectangular pendants</td>
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<tr>
<td>Midden (Refuse)</td>
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<td>Shell</td>
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<td>Shale disc beads</td>
<td>Glycymeris sp. and Haliotis sp.</td>
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<td>Glycymeris sp. Shell bracelets</td>
<td>Jet</td>
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<td>Shell pendants</td>
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<td>Spire-lopped Olivella sp. beads</td>
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<td>Shell bilobe beads</td>
<td>Turquoise matrix and production debris</td>
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<td></td>
<td>Ornament blanks</td>
<td>(not specified, included with general room contexts)</td>
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<td>Trapezoidal pendants</td>
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<td>Rectangular pendants</td>
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<tr>
<td>Room Refuse</td>
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<td>Shale</td>
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<td></td>
<td>Shale disc beads</td>
<td>Jet</td>
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<td>Olivella sp.</td>
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<td>Argillite</td>
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<td>Turquoise matrix and production debris</td>
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<td>Truncated Olivella sp. beads</td>
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<td>(Foot/shoe forms)</td>
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<td>Depositional Context</td>
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<td>AZTEC WEST RUIN</td>
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<td>(Frog forms)</td>
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<td>Shell disc beads</td>
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Table 2. (continued)

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<th>AZTEC WEST RUIN</th>
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<td>Inlays</td>
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<td>Shell dentate beads</td>
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<td>Circular/ovoid pendants</td>
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<td>Rectangular pendants</td>
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<td>(Frog form (n=1))</td>
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<td>(Bifurcated forms)</td>
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<td>(Foot/shoe forms)</td>
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<td>Shale</td>
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<td>Shell disc beads</td>
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<tr>
<td></td>
<td>Shell bilobe beads</td>
<td>Olivella sp.</td>
</tr>
<tr>
<td></td>
<td>Shell dentate beads</td>
<td>Chama/Spondylus sp.</td>
</tr>
<tr>
<td></td>
<td>Spire-lapped Olivella sp. beads</td>
<td>Green turquoise</td>
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<tr>
<td></td>
<td>Shell pendants</td>
<td></td>
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<tr>
<td></td>
<td>Trapezoidal pendants</td>
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<tr>
<td></td>
<td>(Zoomorphic (bird) forms)</td>
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<tr>
<td></td>
<td>Inlays</td>
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<td>(Rings)</td>
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Table 2. (continued)

<table>
<thead>
<tr>
<th>Depositional Context</th>
<th>PUEBLO BONITO</th>
<th>AZTEC WEST RUIN</th>
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<tr>
<td></td>
<td>Associated Ornaments</td>
<td>Related Items</td>
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<tr>
<td>Burials, Grave 16 (Rm 41) [Aztec West]</td>
<td>(n/a)</td>
<td>(n/a)</td>
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<tr>
<td>Burials, Burial 14 (Rm 52) [Aztec West]</td>
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* Statistically significant associations (p=<0.05) by site and ornament type; parentheses denote small sample sizes
The large majority of burials from both of the sites included in this study were located within rooms. Following cross-cultural and specific mortuary studies (Carr 1995a; Kamp 1998; Meskell 1998; Tainter 1975), items differentially included in burials representing a high degree of energy expenditure (particularly elaborateness of tomb or pit construction and body preparation) are interpreted as referencing vertical social relations. Likewise, items associated with both low and high-energy burial contexts are interpreted as relating to aspects of horizontal social relations. In this case, an attempt was made to identify specific aspects of horizontal social identity that may be referenced by certain ornaments, or groups of ornament attributes, through identification of their correlations with the burials of individuals of different genders, ages, and social unit membership, such as lineages, clans, or houses (based on burial location, e.g., Akins 1986, 2003). The majority of the ornament assemblage from each site is associated with collective burial contexts. Determining the association of specific objects with certain individuals was not always clearcut, particularly given sometimes poor provenience information, post-depositional disturbance such as vandalism and roof collapses, and the repeated interment of individuals in the same room over time. In addition, some of the burial rooms contained additional ritual deposits/offeringst that could not be assigned to any specific individual. In this analysis, all of the objects included in a collective burial room or crypt, regardless of their position within the room, were assigned to the contextual categories of “burial” and “Room Number X.” However, objects were only classified as coming from a specific burial within these rooms when provenience and archival information supported a direct association (e.g., “right wrist of Skeleton 14” or “found with child skeleton”).
Items associated with kivas and rooms directly connected to and with access to kivas (excluding fill contexts) are interpreted as relating to relatively large-scale social relationships. Following the suggestion of Mills (2008) and others (Adler and Wilshusen 1990; Schachner 2001), the size of the kiva was used to infer the more specific scale of social relationship referenced, as size is related to the group that could be accommodated within each space and the degree of visibility associated with the construction and use of each structure. From largest to smallest, kivas present at both Pueblo Bonito and Aztec Ruin include great kivas, courtyard kivas (Windes 2014), and roomblock kivas. Items included in structured deposits within kivas are interpreted as having a high degree of inalienability, unless they are also associated with unspecialized room or refuse contexts. Ornaments associated with unstructured refuse deposits were interpreted as having a low degree of inalienability and referencing horizontal social relations, as items linked to vertical social position are more likely to be carefully controlled and not casually discarded.

**Pueblo Bonito**

The majority of the ornaments from Pueblo Bonito are discoidal (disc) beads produced from turquoise, shell, and shale. Other common ornament types include shell bilobe beads (figure-eight beads), spire-lopped *Olivella* sp. beads, inlays (primarily turquoise), pendants, truncated *Olivella* sp. shell beads (representing only a portion of the shell), *Glycymeris* sp. shell bracelets, dentate shell beads, and rings (Mattson 2016) (Figures 8 and 9). Most of the pendants are tabular in form, made from turquoise or shell, and are circular or rectangular in shape. Overall, turquoise accounts for over 60 percent of the assemblage, followed by shell (21%), shale (9%), and jet (3%). Of the ornaments
with zoomorphic shapes, birds and frogs are the most represented. Unique forms, which occur only in small numbers, include side-drilled turquoise tadpole or frog beads, bifurcated beads and pendants, and foot or shoe-shaped beads and inlays (Figure 10). Over 74 percent of the ornaments in the assemblage are from burial contexts, 11 percent are from kiva offerings, 7 percent are from domestic/unspecialized rooms, 7 percent are from room offerings, and 1 percent are from refuse contexts.

At Pueblo Bonito, shell disc beads, shale disc beads, and shell bracelets are found in virtually all depositional contexts, suggesting that they represent large-scale, horizontal aspects of social identity, such as group or tribal membership. Interestingly, shell disc beads are also associated with Great Kiva offerings and domestic room offerings, and shale disc beads are differentially associated with room offerings. Trapezoidal and rectangular tabular pendants are widely associated with unstructured contexts in both domestic rooms and refuse, and in an undifferentiated manner, reflecting elements of horizontal social relations, such as clan or house society membership; this is supported by the association of rectangular pendants with the northern burial cluster and trapezoidal pendants with the western burial cluster. The western burial cluster is also differentially associated with zoomorphic stylized bird pendants, particularly those made from shell, and jet rings.

The hue of turquoise may also relate to horizontal aspects of social identity, such as clan/house/kin group membership and sex. While bluer turquoise is associated with the northern burial cluster and male burials, greener hues of turquoise are associated with the western burial cluster, female burials, and offerings within kivas (of all sizes).
Figure 8. Selected ornaments from Pueblo Bonito. Left to right from upper left: shell disc beads (AMNH Catalog No. H/7361), shale disc beads (NMNH Catalog No. 335677), turquoise disc beads (AMNH Catalog No. H/9246), turquoise inlay (NMAI Catalog No. 51167), jet ring (NMNH Catalog No. 335764), shell dentate beads (NMNH Catalog No. 335752), *Haliotis* sp. circular pendants (NMAI Catalog No. 64095), shell stylized bird pendant (NMNH Catalog No. 335704), and rectangular turquoise pendant (NMAI Catalog No. 51124). Courtesy of the Department of Anthropology, Smithsonian Institution; the Division of Anthropology, American Museum of Natural History; and the National Museum of the American Indian, Smithsonian Institution. Photos by Hannah Mattson.
Figure 9. Content of subfloor offering from Room 310, Pueblo Bonito, NMNH Catalog No. 336028. Clockwise from top: *Glycymeris* sp. shell bracelets, shell bilobe beads, truncated *Olivella* sp. beads, and spire-lopped *Olivella* sp. beads. Courtesy of the Department of Anthropology, Smithsonian Institution. Photo by Hannah Mattson.
Figure 10. Examples of unique ornament forms (feet/shoes, bifurcated, and frog/tadpole) from Pueblo Bonito. AMNH Catalog Nos. H/3727, H/3793, and H/3794; NMAI Catalog No. 51163; and NMNH Catalog Nos. 335967, 335994, and 336011. Images courtesy of the Department of Anthropology and the National Museum of the American Indian, Smithsonian Institution. Photos by Hannah Mattson.
Turquoise exhibits significant intra-source variation in color, and thus color is a poor indicator of provenance (Hull et al. 2008, 2014; Thibodeau et al. 2012). However, this study is concerned with color only as an aesthetic attribute, rather than its representation of specific sources areas. Turquoise may also change color over time based on its exposure to sunlight, dehydrating to greener and lighter hues. I assume that the color of turquoise objects found in sealed or sheltered deposits, such as kiva offerings and interments within rooms, is generally similar to their color at the time of burial, as these items would have been protected from direct sunlight. Therefore, I argue that the appearance of greener or bluer turquoise within different sealed deposits suggests intentionality, either in color choice or for turquoise objects with life histories that entailed more or less restricted circulation (e.g., turquoise ornaments that were worn [perhaps even passed down and worn by multiple generations], refurbished, or discarded in open refuse contexts versus those that were either newly produced or stored in protected contexts such as caches or rooms).

Turquoise disc beads, inlays, bilobe shell beads, circular *Haliotis* sp. pendants, and dentate shell pendant beads (made of either *Chama* sp. or *Spondylus* sp.) are differentially distributed within higher-energy burial contexts but do not appear to be separated by burial location, suggesting they reflect vertical social relations. Although statistically associated with numerous contexts, shale disc beads appear in much larger quantities in the western burial cluster, indicating that they represent both social group membership and vertical social relations. Turquoise disc beads and inlays, while valuable, appear to have had a fairly low level of inalienability based on the lack of association with structured ritual deposits.
Shell disc beads, *Olivella* beads (both spire-lopped and truncated), bilobe shell beads, turquoise production debris, and ornament blanks (and objects broken in manufacture) are associated with court and roomblock kiva offerings, as are zoomorphic frog/tadpole beads, foot- and shoe-shaped forms, and bifurcated ornament forms. Spire-lopped *Olivella* sp. beads and shell bilobe beads are also associated with refuse and burial contexts, however, indicating that they were not necessarily inalienable. Several of the spire-lopped *Olivella* sp. beads included in court and roomblock kiva offerings exhibit a hole punched through the side, an apparently intentional modification, perhaps representing “killing” or sanctifying of an otherwise “ordinary” bead. Interestingly, Burial 14 includes one bilobe bead and one *Olivella*-effigy bead rendered in turquoise, rather than shell.

It appears that bifurcated, frog/tadpole, and foot/shoe forms appear only in specialized contexts at Pueblo Bonito—kivas, the northern burial cluster, and ceremonial rooms—and likely served as inalienable objects (Figure 10). Distinctive side-drilled turquoise frog beads were found in the general mixed fill of Room 33, offerings within Kivas I and R, and Room 38 (a room containing numerous ritual objects, including shell trumpets, ceremonial sticks, and macaw skeletons). Foot/shoe ornament forms appear in Burial 14, the fill of Room 33, and offerings within Kivas I, N, and R. Bifurcated forms, both turquoise and shell, were recovered from Burial 14, Room 33 in general, Room 28, and offerings in four kivas—B, C, I, and N. Bifurcated and foot forms appear together in a bracelet worn on the right (west) wrist of the male in Burial 14. This piece also includes a bilobe turquoise bead (described above) and two turquoise bird pendant beads, in addition to other turquoise disc beads and pendant beads. It appears that the unique forms
associated with Burial 14, and Room 33 in general, are part of a suite of interrelated motifs that serve as citations to objects placed in ritual contexts. This includes the same ornament types associated with kiva offerings (particularly bilobe beads, but also spire-lopped and truncated *Olivella* sp. beads), most of which are produced from shell, but also those emulated in turquoise, a material clearly associated with aspects of vertical social relations at Pueblo Bonito (Earle 2001; Lewis 2002; Mathien 1997, 2003; Neitzel 2003; Plog 2003).

Two cluster analysis methods were used to examine the relationship between attributes and between groups of attributes and depositional context. Given the volume of data, including numerous potentially meaningful variables with multiple levels, a cluster analysis was first performed within the Minitab® statistical package to assess which variables were correlated (Everitt et al. 2011; Kaufman 1990). Based on this analysis, a five-cluster grouping using a correlation coefficient distance and Ward linkage method was considered to best fit the data (Figure 11). The largest group is generally consistent with items associated with large-scale, horizontal social relations and vertical social relations, including shell and turquoise disc beads, shell pendants, dentate pendant beads, shell bracelets, inlays, turquoise, rectangular pendants, ovoid pendants, and foot/shoe forms. The second largest cluster or group includes ornament forms and materials found in structured kiva deposits, including bilobe beads, spire-lopped and truncated *Olivella* sp. beads, worked and unworked turquoise pieces, ornaments made from *Haliotis* sp. (both highly reflective and iridescent), bifurcated forms, and frog/tadpole forms. Two smaller clusters include ornament forms/shapes/materials that individually appear to be
Figure 11. Dendrogram of clustered variables for Pueblo Bonito ornament type, form, shape, and material.
differentially associated with the western burial cluster, domestic rooms, and room offerings. One of these groups includes shale disc beads, zoomorphic bird forms, shale, and jet; the other group is comprised of rings, non-ornamental inlaid items, trapezoidal pendants, and sunburst-shaped pendants. Finally, the fifth cluster is comprised of buttons, plaques, bone tube beads, azurite and malachite, argillite, and copper. This latter group of objects is associated with both domestic rooms and refuse contexts.

Latent Class Cluster Analysis (LCA) was then conducted within the Latent Gold® statistical package to assess the covariance between latent clusters of attributes and contextual categories (Magidson and Vermunt 2002, 2004). The LC Cluster model includes a K-category latent variable, each category representing a cluster. Each cluster contains a homogeneous group of cases that share common model parameters. Posterior membership probabilities are estimated directly from the model parameters and are used to assign cases to the modal class—the class for which the posterior probability is highest. Similar to the first cluster analysis, a five-cluster model was deemed most appropriate. Overall, context does have a significant effect (p=<0.01) on the latent distribution of the assemblage. However, this association is much stronger for certain contextual categories and groups of correlated ornaments than others (Figure 12). In this analysis, ornament attributes were not divided into mutually exclusive categories. Rather, several artifact types and materials contributed significantly to more than a single cluster, including shell disc beads, shale disc beads, shell bracelets, bilobe beads, turquoise disc beads, truncated *Olivella* beads, spire-lopped *Olivella* beads, azurite and malachite, and ornament blanks.
As can be seen in the LCA profile plot (Figure 12), certain clusters contribute differentially to the assemblages associated with burial, kiva, and domestic room contexts. The northern burial cluster is associated with Clusters 4 and 5. Cluster 4 includes a wide range of forms and materials, including turquoise, jet, shell, reflective materials (*Haliotis* sp. shell, galena, and quartz crystals), bifurcated and foot/shoe forms, bilobe beads, spire-lopped *Olivella* sp. beads, turquoise and shell pendants, shell bracelets, inlays, dentate beads, and pendants of multiple shapes (particularly ovoid and rectangular). Cluster 5 is comprised only of turquoise disc beads and turquoise in general. The western burial cluster, on the other hand, is primarily associated with Clusters 1 and 3. Cluster 1 includes argillite pendants, azurite and malachite, bone, and copper. Cluster 3 includes shell and shale disc beads, inlays, bird zoomorphic forms, trapezoidal pendants, quartz crystals, jet, shale, and shell. Cluster 2, most represented in offerings in kivas of all sizes and rooms, includes bilobe beads, bifurcated forms, spire-lopped and truncated *Olivella* sp. beads, shell bracelets, turquoise production debris, azurite and malachite, *Haliotis* sp. shell, sunburst pendants, and ornament blanks. Cluster 1 also contributes to the variation in the contents of court and roomblock kivas. Unspecialized rooms are associated with Clusters 1 and 3, while ceremonial rooms are associated with Clusters 2 and 3. Both midden and domestic/unspecialized room offerings are also associated with Cluster 2. Thus, specific ornaments forms and materials appear in multiple contexts at
Figure 12. Profile plot of conditional response probabilities associated with each depositional context (top) and latent class cluster (bottom), Pueblo Bonito.
Pueblo Bonito, suggesting their association with a variety of social uses, from large-scale group identity such as ethnic affiliation (including shell disc beads, shale disc beads, and shell bracelets) to vertical social differentiation (including turquoise disc beads, shale disc beads, and bilobe beads) and ritual practice at multiple scales (spire-lobbed and truncated *Olivella* sp. beads and bilobe beads).

**Aztec West Ruin**

Similar to Pueblo Bonito, the ornament assemblage from Aztec West Ruin is dominated by stone disc beads, particularly those produced from shale. Spire-lobbed and truncated *Olivella* sp. beads are also common, as are inlays, bone tube beads, and pendants (Figure 9). Inlays are made from a variety of materials, particularly turquoise, jet, galena, argillite, and *Haliotis* sp. shell. Although pendants appear in a wide range of materials and shapes, circular forms produced from shell are most common. Compared to the Pueblo Bonito assemblage, turquoise beads and pendants, dentate shell beads, bilobe beads, rings, *Glycymeris* sp. bracelets, and zoomorphic pendants are far less abundant. Shale comprises over 75 percent of the assemblage, followed by shell (9%), turquoise (6%), and argillite (5%). The most unique ornament forms at the site are composite beads, which include a stone or bone grooved backing and a flat front piece (typically galena or *Haliotis* sp.) adhered together with a pitch-like substance. Interestingly, side-drilled frog/tadpole beads, identical to those recovered from Pueblo Bonito, are also present. More than 95 percent of the assemblage is associated with mortuary contexts. Possible symbols of large-scale group membership at Aztec include bone tube beads; shell, shale, and turquoise disc beads; and both spire-lobbed and truncated *Olivella* sp. beads, as these are all widely distributed across depositional contexts. Some of these bead
Figure 13. Selected ornaments from Aztec West Ruin. Clockwise from upper left: jet and shale beads (AMNH Catalog No. 29.0/7212), bone tube beads (AMNH Catalog No. 29.0/9096), turquoise disc beads (AMNH Catalog No. 29.0/7205), shale and argillite disc beads (AMNH Catalog No. 29.0/7982), turquoise foot effigy (AZRU Catalog No. 2712), composite bead backings (AMNH Catalog No. 29.0/7973), frog/tadpole beads (AZRU Catalog Nos. 928, 934, and 943), circular Haliotis sp. pendant (AMNH Catalog No. 29.0/8776). Images courtesy of the Division of Anthropology, American Museum of Natural History and Aztec Ruins National Monument. Photos by Hannah Mattson.
types also occur in much larger quantities within certain higher-energy burial contexts, suggesting they also served as indicators of vertical social status. Turquoise disc beads are associated with Burial 14, a mass infant and child burial in Room 52; adult burials; and an adult in Grave 16, a burial including two adults and three children in Room 41. Shale disc beads are also associated with Burial 14 and Grave 16, but not with other child or adult burials. Although widely distributed, bone tube beads are particularly concentrated in child and infant burials, both singular and mass graves, indicating that this ornament type may have also served as an age-grade marker. Child and female burials are associated with greener hues of turquoise, while kiva offerings are associated with bluer turquoise items, suggesting that the color of turquoise related to aspects of horizontal social identity.

Composite beads are associated almost exclusively with Grave 16 and, to a lesser extent, Burial 14. This suggests that they may be related to both lineage/kin group identification (the rooms containing these burials are also located close to one another) and vertical social position. Grave 16, both the adult in that burial and the burial as a whole, is also associated with numerous side-drilled frog/tadpole beads, a form appearing primarily in ritual contexts at Pueblo Bonito. In addition, Grave 16 is differentially associated with circular shell pendants and inlays, similar to the northern burial group at Bonito.

A similar suite of ornaments is associated with kivas at Aztec West and Pueblo Bonito. This includes a Chaco-period kiva (Kiva L) at Aztec, as well as those constructed and remodeled between the tail end of the Late Bonito period through the McElmo and Mesa Verde periods (circa A.D. 1130 to the late 1200s). These items include shell disc
beads, *Olivella* sp. beads, and pieces of turquoise matrix and production debris. In addition, bilobe beads, bifurcated forms, and frog beads are associated with some kivas. Shell bifurcated pendants, reworked fragments of *Glycymeris* sp. shell bracelets, were recovered from Kiva G (Mesa Verde phase [A.D. 1200-1290] construction), and turquoise frog beads and were found in Kiva S (Late Bonito phase [A.D. 1110-1120] construction). Bilobe beads were also recovered from Kiva S, in addition to Kiva L (Late Bonito phase [A.D. 1100-1109] construction). A single bilobe shell bead was also included in each Grave 16 and Burial 14. Thus, a similar set of distinctive representations—including bilobe, frog, and bifurcated forms—appears to be associated with both ritual contexts and high-energy burial contexts at both sites. While not associated with burials, a single turquoise foot effigy or ornament blank was found in Kiva R [no date] at Aztec, suggesting that this symbol also continued be meaningful.

Another similarity between ritual deposits at the two sites is the inclusion of otherwise “mundane” items in Great Kiva and room offerings. The Great Kiva at Aztec West (initial construction ca. A.D. 1110-1120 with remodeling into the late 1200s) includes stone disc beads and ornaments made from argillite, and room offerings include truncated *Olivella* sp. beads, shale disc beads, and selenite. Unlike Pueblo Bonito, copper also appears in kiva contexts (Kivas G and S) at Aztec West Ruin.

Five groups of associated ornament forms and materials were defined during the initial cluster analysis (clustering of variables), following the same procedure outlined for the Pueblo Bonito assemblage (Figure 14). The largest cluster includes items associated with both large-scale social relations and/or vertical social differentiation, such as disc beads (shell, shale, and turquoise), spire-lipped *Olivella* sp. beads, composite beads,
tinklers, turquoise and shell pendants, inlays, bone tubes, frog forms, circular pendants, and turquoise production debris. One cluster is comprised of rare and possible inalienable items primarily found in ritual deposits—bilobe beads, copper, bifurcated forms, and foot/shoe forms. A third group includes items that are all found in mortuary contexts, in addition to other contexts such as domestic rooms, including truncated *Olivella* sp. beads, buttons, ornaments produced from jet and shell, and azurite and malachite mineral specimens. The ornaments included in the other two clusters are not strongly associated with any particular context, with the exception of shell bracelets, which appear in both burial (Grave 16) and ritual (Kiva R and S) contexts.

The clusters defined in a five-model LCA are significantly associated with context (p=<0.01). Burials, domestic rooms, and kivas are each strongly associated with a particular cluster, although as depicted in a profile plot of the resulting conditional probabilities, the other clusters also contribute to the latent distribution of the assemblage (Figure 15). Interestingly, different interments are associated with separate clusters. Grave 16 is associated with Cluster 5, which includes disc beads (turquoise, shell, and shale), spire-lopped *Olivella* sp. beads, tinklers, inlays, shell pendants, shell bracelets, frog forms, pendants of various shapes, reflective materials like *Haliotis* sp. shell and galena, and turquoise. Burial 14 is differentially associated with Cluster 4, comprised of shell and shale disc beads, spire-lopped *Olivella* sp. beads, bone tubes, hematite, and jet. Other burials are associated with Cluster 3, including turquoise disc beads, shell pendants, ovoid pendants, azurite and malachite, jet, and *Haliotis* sp. shell. Kiva contexts are clearly associated with Cluster 2, comprised of turquoise production debris, quartz crystals, selenite, argillite, and inlays. Domestic/unspecialized room contexts, in addition
Figure 14. Dendrogram of clustered variables for Aztec West Ruin ornament type, form, shape, and material.
Figure 15. Profile plot of conditional response probabilities associated with each depositional context (top) and latent class cluster (bottom), Aztec West Ruin.
to room offerings, are associated with both Clusters 1 and 2; Cluster 1 is composed of argillite pendants, sunburst pendants, bone tubes, and selenite.

Discussion

This contextual study reveals several intriguing patterns in the social use and potential meaning of ornaments at two major centers in the San Juan Basin and sheds light on the continued importance of Chaco Canyon as an important place into the twelfth and thirteenth centuries. There appear to be both similarities and differences in the meanings and values attributed to ornaments at Pueblo Bonito during the Chaco florescence and at post-Chaco Aztec Ruin. More differences than similarities are identified in ornaments with low levels of inalienability, particularly those associated with small-scale and horizontal aspects of social identity (age, gender, social group membership). However, there are numerous parallels in the attributes of ornaments associated with structured deposits in kivas and rooms, in addition to those associated with vertical social status. These correspondences suggest a historical and ideological “harkening back,” perhaps through a revitalization movement, and a continued participation in the Chacoan ritual-ideological complex, at least to some degree, into the post-Chaco period (Bradley 1996; Lekson and Cameron 1995; Kantner 2004; Kintigh 1994; Kintigh et al. 1996; Stein and Fowler 1996; Fowler and Stein 1992; Van Dyke 2004, 2009). As Van Dyke (2004, 2009) emphasizes in her work on discursive social memory within Chaco Canyon during the Late Bonito period and outside of the canyon during the Pueblo III period, the past may be continually and selectively recalled and reconstructed based on current needs, such as the legitimization of authority.
A relatively uniform suite of ornamental objects and materials appear in ritual contexts at both Pueblo Bonito and Aztec Ruin. Bilobe beads, side-drilled frog beads, foot/shoe forms, bifurcated forms, shell disc beads, and spire-lopped *Olivella* sp. beads, along with turquoise production debris, are found in kiva offerings at both sites. However, the specific distribution, relative frequency, and specific form of these items vary between the two sites. While bilobe beads are numerous at Pueblo Bonito, for example, they are few at Aztec West. Likewise, the majority of the frog beads at Pueblo Bonito are associated with structured ritual contexts, while most at Aztec West are found within two high-energy burials (Grave 16 and Burial 14). Conversely, foot/shoe forms appear in both kiva offerings and Burial 14 at Pueblo Bonito, but are restricted to ritual contexts at Aztec West. Bifurcated forms, which are primarily shell or turquoise pendant beads (including bifurcated bilobe beads) in kiva offerings and Burial 14 at Pueblo Bonito, appear as arcuate pendants made from reworked shell bracelets in association with a kiva at Aztec West. Similarly, turquoise disc beads, inlays, and circular *Haliotis* sp. shell pendants are associated with high-energy burials at both sites.

Although trade relationships in both raw materials and finished ornaments likely shifted over the course of the twelfth century, particularly with changes taking place in the Hohokam area, this cannot entirely account for the differences between the Pueblo Bonito and Aztec assemblages. Based on their source areas (Gulf of California) and the lack of evidence for local manufacture, the items that appear to have been imported as finished items from the Hohokam area include *Glycymeris* sp. bracelets, *Olivella* sp. beads, and shell bilobe beads (likely produced from *Glycymeris* sp.). While bilobe beads are scarce at Aztec and abundant at Pueblo Bonito, *Glycymeris* sp. bracelets and *Olivella*
sp. beads are common at both sites. *Haliotis* sp., found on the Pacific Coast, is also present in both assemblages; although there is no direct evidence of the production of *Haliotis* sp. ornaments at either site, whole shells were found at Pueblo Bonito. Disc beads and pendants of shale, argillite, jet, turquoise, and ceramic were made locally at each site, evidenced by the presence of production debris and/or unfinished pieces (or those broken in the process of manufacture). In addition, both assemblages include copper bells and other copper items. Thus, while a larger range of local materials is represented in the Aztec Ruin ornament assemblage, the same general types of ornaments appear to be either locally made or imported at each site.

At Aztec Ruin during the post-Chaco period, the placement of specific ornament forms and materials in burials and ritual deposits may have served as citations or connections to the former Chacoan ceremonial order. These material references may have been used by local leaders and/or ritual practitioners to authenticate a link to the powerful individuals or “apical ancestors” (Plog and Heitman 2010) buried at Pueblo Bonito, and specifically to the kin group or house society represented by the northern burial crypt. If the items placed in offerings within architectural spaces derived their social value from their use as commemorative objects of memory, as argued by Mills (2008), then their inclusion in post-Chacoan ceremonial structures and burials suggests an intentional association with these memories, perhaps to legitimize ancestral connection with the past. The association of some of these same symbols of authority and social memory in a mass infant and child burial at Aztec, which also contains an abundance of other high-value items, suggests that this legitimation may have been extended to descendants of specific lineages as well.
In a recent publication, Mills (2015:263) refers to Pueblo Bonito depositional practices as an “archive” of a “particular memory regime.” Knowledge of the specific contents of this record, even in a referential manner, implies some degree of firsthand experience or familiarity. Given the incorporation of these powerful Chacon ritual symbols in both a Chaco-era kiva (Kiva L) and terminal Chaco/early post-Chaco Late Bonito phase kivas at Aztec, along with increasing evidence that the site was occupied continuously (Brown et al. 2008), I propose that these practices represent a conscious continuation of Chacoan ritual practice and identity. Van Dyke (2009:230) makes a similar argument for the architecture of Aztec, suggesting that it served as a material citation to Chaco and an attempt to “replicate specific meanings.”

Importantly, the social practices involving ornaments took on an increasingly altered or citational form over the course of two centuries with the shifting composition of the residential population of the site. As the Middle San Juan region became a more multicultural landscape, reflecting a combination of influences derived from local populations and both the Northern San Juan and Chuska areas, the link to Chaco became more tenuous. This may have created a renewed need to affirm historical ties to Chaco, either real or reinvented by the thirteenth century, in order to maintain existing leadership or prestige structures.

**Conclusion**

In the Chacoan and post-Chacoan worlds, ornaments appear to have played a vital role in negotiating various aspects of personal and social identification through practices of bodily adornment and ritual deposition. Within contemporary archaeological
approaches, which draw heavily on social theory, material culture is construed as the primary means through which identity is constructed and reproduced; social relations are constituted through people’s association and interaction with the material world (Hull 1997; Hodder 2012). Recent research on the materialization of practices has also focused on the identification of socially valuable objects and inalienable possessions, items that are vital to social transactions, ritual performance, and the creation of social memories (Heitman 2007; Lesure 1999; Mills 2000, 2002, 2004, 2008, 2015; Walker et al. 1996; Walker and Lucero 2000; Weiner 1992, 1994; Crown and Wills 2003). Specific practices involving these items, which are part of the active construction of identity, may be studied through examination of their use-lives or biographies, including deposition within certain contexts.

At both Pueblo Bonito and Aztec West Ruin, it appears that the social uses and values of ornaments were intimately linked to their partible or fragmented nature. Ornamental items, such as beads, could be gathered together within larger composite pieces (i.e., necklaces) and displayed on the body, or disassembled and placed with collections of other ornaments or other meaningful objects in burials and structured deposits (Figure 16). Conferring social value on fragmented and reassembled objects is cross-culturally consistent with dividual or aggregate concepts of personhood (Fowler 2004). In these formulations, people are thought to be comprised of parts of other people or social groups (e.g., clans, kin groups, families), places, and substances/essences (Alvi 2001; Busby 1997; Strathern 1999). Fractal objects may serve as representations or actual embodiments of various social relationships and obligations to both living and inanimate entities. In the Ancestral Pueblo world, the separating out of these various essential parts
Figure 16. Examples of ornaments and related items in Pueblo Bonito structured deposits. Clockwise from upper left: Kiva P, Kiva I, Kiva L, Kiva R, Room 186, Kiva Q. NMNH Catalog Nos. 336000, 335968, 335981, 335752, 336027, and 336001. Courtesy of the Department of Anthropology, Smithsonian Institution. Photos by Hannah Mattson.
or elements within ritual structures and apical ancestral burial crypts may have served to reaffirm a shared cosmological perspective, perhaps within practices of ritual renewal, commemoration, and dedication.

Pertinent to this discussion is the conception of both ritual structures and house societies at Pueblo Bonito as “persons” (Borić 2007; Heitman 2007; Lévi-Straus 1982; Mills 2008, 2015). At Pueblo Bonito and Aztec Ruin, mundane or ordinary ornaments (as defined by their association with unstructured refuse and domestic contexts) are included in kiva and room offerings. Despite their placement in highly structured contexts, however, these items do not appear to have had a high degree of inalienability. Rather than emphasizing the singularity of objects of social value, it may be more appropriate to focus on groups of objects deliberately placed together that create a combined, collective effect. As suggested by Pollard (2001, 2008) in his work on British Neolithic votive offerings, otherwise ordinary items may be arranged in certain ways, and combined with more extraordinary objects, in order to define and fulfill obligations towards non-human things. Mills (2008) makes a similar argument for Chacoan termination and dedication offerings, where ritual structures may have been animated through reference to proper bodily adornment. Perhaps the inclusion of common ornaments in kiva offerings (that is, those that referenced large-scale group membership and were widely available), relates to adorning the structure as a typical member of that group would self-identify themselves through ornamentation. Interestingly, Mills (2015:255) also notes that in the house society model, the house “is often viewed as a living being, embodied by the architecture of the house.” As discussed by Heitman (2007:256), the house may be construed as “a microcosm of the cosmological order.” In their re-examination of the Room 33 burials,
the core or anchor of the northern house or kin/lineage group, Plog and Heitman (2010) suggest that the configuration of offerings and architectural elements serve as representations of important cosmological associations.

I would argue that at Pueblo Bonito, ornamentation was used to actively construct various aspects of social identity through the adornment of living people, ancestors, and architectural spaces. In addition, ornaments were necessary in renewing the existing ritual-ceremonial order through the gathering together and sanctification of essential parts/relationships/substances. These social values and uses were directly cited at Aztec West Ruin immediately after the decline of the Chaco Canyon as a central place in the San Juan Basin and were more broadly referenced at the site during the Pueblo III period, particularly in order to legitimize the authority of local leaders in the increasingly diverse social milieu of the Middle San Juan region.
Chapter 4
Gray Ware from the Pueblo Bonito Mounds

The re-excavation of three trenches in front of Pueblo Bonito, two of which were placed directly through the large mounds just south of the structure, produced over 97,000 gray ware ceramic sherds. This chapter presents the results of the analyses of these artifacts, focusing on the main issues outlined in the project research design—production, exchange, use, and discard. These general research topics encompass more specific and interrelated interpretive issues at Pueblo Bonito such as site function, population estimates, feasting, and trade.

Discarded utilitarian ceramics, although typically not the focus of much scholarly attention, provide valuable information on the types and scales of activities in which people engaged—from everyday cooking for the household to communal feasting, from local production of ceramics to large-scale importation, and from occasional occupation to more permanent habitation. Utility wares are thus fundamental to archaeological interpretations of great house function. A significant portion of the debate surrounding this issue has centered on the ceramics recovered from the Pueblo Alto Trash Mound, the only great house midden excavated since 1931. The results of analyses presented in this chapter represent a comparative data set to that of Pueblo Alto, allowing for an expanded discussion of the role played by core canyon great houses.

After a brief summary of previous research on utility wares from Chaco Canyon, this chapter first describes the methods of analysis, including the specific attributes recorded and the type definitions utilized. The results of analysis are then presented with
a focus on the distribution of various technological and functional attributes across the
trenches. These results are next examined in the context of the core research issues of
production, exchange, use, and discard at Pueblo Bonito. Finally, they are compared to
materials from other sites in the canyon with an emphasis on Pueblo Alto. Whenever
possible, comparisons with the Chaco Project results utilize the original raw data from the
rough sort analysis (conducted for approximately 20,000 gray ware sherds) rather than
published results of the detailed analysis sample, which is based primarily on rim sherds
with the intent of representing vessels.

**Previous Research**

While many different ceramic wares from various traditions were imported into
the canyon, one of the unique aspects of the ceramics from Chaco is the large-scale
importation of utilitarian vessels from the Chuska area, located 70 km west of the canyon.
Because archaeologists generally assume that everyday cooking vessels would be
produced locally, much of the previous research on gray wares has focused on
characterizing and explaining this massive movement of Chuska vessels into the canyon.
The presence of trachyte, initially identified simply as basalt, in ceramics from Chaco
Canyon was first observed in sherds from Chetro Ketl by Florence Hawley (1934). She
noted that utility ware sherds with basalt temper were twice as numerous as those
tempered with sand. Since the nearest potential source of this basalt was located well
outside of the canyon, she concluded that the tempering material, rather than the vessels
themselves, must have been imported. In her work with La Plata ceramics, Anna Shepard
(1939) identified the temper in sherds from the Chuska area specifically as sanidine
basalt, or trachyte. Shepard (1954) later conducted a petrographic study of ceramics from Pueblo Bonito recovered by Neil Judd and reported that gray ware sherds with sanidine basalt temper comprised 75 percent of the total utility ware in upper levels and 25 percent in lower levels. She suggested Washington (or Narbona) Pass as a probable source for the tempering material and concluded that culinary vessels were imported from the Chuska area into Chaco Canyon. Judd (1954) initially discounted this explanation as unlikely given the lack of a known analogue among modern Pueblo peoples.

During the Navajo Nation Irrigation Project, Peckham and Wilson (1967) conducted a large survey of the Chuska valley and slope. Warren (1967) performed a petrographic analysis of a sample of ceramics from the project, identifying the drainages and lava flows of Narbona Pass and Beautiful Mountain as the most likely sources of trachyte temper. In subsequent studies of ceramics from Chaco Canyon, Warren (1967, 1977, 1980) also found that trachyte-tempered ceramics dominated the Chaco utility ware assemblages and concurred with Shepard’s (1954) original explanation that most gray ware was produced non-locally. Likewise, in their investigation of Kin Kletso, Vivian and Mathews (1965) reported that almost half of the utility ware ceramic assemblage was tempered with trachyte.

The excavations conducted by the Chaco Project, including ten small-house sites in addition to Pueblo Alto, generated a veritable mountain of ceramic data (McKenna 1980, 1981, 1984; McKenna and Toll 1984, 1991; Toll 1981, 1985; Toll and McKenna 1987, 1992, 1993, 1997). Over half of the 240,000 sherds collected during the project were utility wares, the majority of which were tempered with trachyte. Based on these frequencies, analysts estimated that tens of thousands of Chuska utility vessels were
consumed at Chacoan sites from AD 700 to 1200 (Toll 1985). They also noted that while Chuska Gray Ware comprises the majority of the combined utility ware assemblage, they appear to occur at significantly lower percentages at small sites (Toll and McKenna 1997).

Within the last decade, data recovery projects within various regions of the Chuska Valley have produced large ceramic assemblages and compositional studies of both clays and tempers, forming a valuable data set from which the temporal and spatial distribution of trachyte-tempered ceramics can be traced (Carpenter 2000; Hays-Gilpin et al. 1999; Hensler 1999; Hensler and Goff 2002; Hensler, Reed and Carpenter 2005; Mills et al. 1993; Reed et al. 1998; Reed and Goff 2000). Compositional studies of Chuska ceramics from Chacoan sites indicate that the Skunk Spring Community was the most likely source of the volumes of Chuska Gray Ware imported into the canyon (King 2003). The trachyte itself, however, appears derive from Beautiful Mountain (Mills et al. 1997). King (2003) suggests that there may have been some degree of residential mobility between the Chuskan and Chacoan areas.

Other major research issues involving utility wares include the identification of locally produced pottery and the sourcing of Cibola Gray Ware ceramics. Cibola utility wares are primarily tempered with sand/sandstone, often co-occurring with some combination of crushed sherd temper, and thus are assumed to have been produced locally. However, direct evidence for pottery production in the canyon is sparse. Although fuel shortages possibly constrained local ceramic production, necessitating importation, agricultural groups worldwide are known to use farming waste for fuel (Toll and McKenna 1997: 162-163; Warren 1967a: 55; Rice 1987: 154). The Chaco Project
attempted to differentiate Cibola tempers based on various attributes, suggesting a few possible distinctions, but no production groups could be isolated (Toll and McKenna 1997).

The importation of gray ware vessels has also figured prominently in researchers’ formulations of the economic organization and nature of leadership within Chacoan society. Although a large volume of gray ware was imported into the canyon along with other nonlocal goods, little material appears to have flowed outward. This “centripetal” movement of mundane goods produced in relatively unspecialized contexts into the canyon core is cited as evidence that Chaco was a corporate chiefdom supported by a system of staple finance (Earle 2001; Peregrine 2001; Toll 2001). The production and transport of Chuska Gray Ware is thought to have been tied to large-scale ceremonial events, controlled by leaders only to the degree to which they had influence over the ritual calendar (Toll 2006).

Important to these interpretations of Chaco as a ritual pilgrimage center is the ceramic assemblage recovered from the Pueblo Alto midden. Chaco Project analysts estimated the number of vessels represented by sherds in the Alto mound to be over 150,000 (based primarily on rim sherds), an extraordinarily high number compared to an estimated small residential population (Toll and McKenna 1987:209). Along with the interpretation that the mound formed through regular and massive depositional episodes, the accumulation of material in the Alto mound was thought to be the result of feasting activities and ritual breakage of vessels during periodic gatherings of non-residents at the site (Lekson et al. 1988; Toll 1985; Windes 1984, 1987). The Pueblo Alto ceramic assemblage contains a particularly high percentage of Chuska Gray Ware jar sherds,
particularly within “event” layers (Toll 2001). By extension, it has been suggested that Pueblo Bonito, and other large canyon great houses as well, may have also served as centers of communal feasting and ceremony. Wills (2001, 2010) provides an alternative interpretation to mound formation in the canyon, suggesting that the duration and intensity of occupation and construction activities at Pueblo Alto and Pueblo Bonito adequately account for the configuration and contents of the midden deposits associated with each of those structures.

A recent re-evaluation of the ceramic and faunal assemblages from Pueblo Alto by Plog and Watson (2012) also does not support a ritual pilgrimage model in which large-scale feasting was an important component. Rather, the ceramics from the Pueblo Alto mound are consistent with those from other sites in Chaco Canyon and across the northern Southwest in both frequency (both relative and absolute) and estimated numbers of discarded vessels represented (ranging from 5,737 to 22,561) relative to estimated population (Plog and Watson 2012:462). Similar to Wills (2001), Plog and Watson (2012) conclude that the midden materials from Pueblo Alto were deposited as the result of domestic consumption, small-scale feasting, construction, and ritual events at a scale consistent with that of other sites.

**Attributes Recorded and Methods of Analysis**

For the current study, four university research assistants analyzed nearly 100,000 gray ware sherds from 2007 to 2009. Of the gray ware sherds collected and included in bulk analysis, 68 percent (or 66,277 sherds) were subjected to additional analysis that included the identification of tempering material through microscopic examination,
classification into wares and types, determination of vessel form, and weight. A total of 16,302 of these sherds were also included in a detailed and comprehensive analysis, which entailed the recording of a minimum of 30 additional attributes for each artifact (see below). All rim sherds in the assemblage were subjected to full analysis.

**Ware**

Ware categories for gray ware were determined primarily on the basis of tempering material (see ware and type descriptions). Five main gray ware traditions were recognized in the assemblage, including Cibola, Chuska, Mesa Verde, Tusayan, and Little Colorado Gray Wares.

**Type**

Types within each gray ware tradition were identified largely on the basis of surface treatment (i.e. presence and configuration of corrugations) and rim form, following the classifications of Goetze and Mills (1993) and Toll and McKenna (1997).

**Temper**

Aplastic material within each sherd was identified by examination through a binocular microscope. The main temper categories recorded include sand (mixed) and/or sherd, quartz sand, trachyte, andesite/diorite, and crushed rock. If more than one tempering material was identified, then the most abundant type was listed under *Predominant Temper*, followed by *Secondary Temper* and *Additional Temper*. 
Form

Vessel forms include jars, bowls, ollas, canteens, pitchers, mugs, effigy jars, seed jars, ladles, scoops, and pipes (Shepard 1965; Toll and McKenna 1997). The overwhelming majority of gray wares are closed forms, particularly jars.

Vessel Part

Identified vessel portions include rims, body fragments, necks, bases, handles, and unknown pieces (Shepard 1965; Toll and McKenna 1997).

Rim Characteristics

Orifice Diameter

This is an estimate of the diameter of the orifice, the smallest constriction of the vessel opening, based on the curvature of an individual sherd. For direct and inverted rims, the rim and vessel orifice are one and the same, and analysts used a rim diameter chart to record the interior of the rim curvature. For flared-rim vessels, on the other hand, the orifice is smaller than the rim diameter. Concentric semi-circular templates cut from sheets of balsa wood and created in 2 cm intervals, were fit into the interior orifice of each rim sherd to determine the orifice diameter. For jars with everted rims, if a rim sherd did not also retain a portion of the neck, no orifice diameter measurement was collected.

% Rim Represented

This is an estimate of the proportion of the entire rim represented by an individual rim sherd, and was measured using the same rim diameter templates described above. Rims were compared against 10-degree segments marked on the templates.
**Rim Angle/Eversion**

The orientation of the rim in relation to the neck or body of the vessel was recorded as straight (or direct), medium (10-30 degrees), or flared (greater than 30 degrees).

**Rim Angle Degree**

A more exact angle of rim eversion was measured using a goniometer. Using this simple tool, eversion was measured in 5 degree increments.

**Forming Techniques**

Only two forming techniques, coiling/scraping and pinching, were observed in the assemblage, and these were easily distinguished by surface irregularities and evenness of wall thickness.

**Corrugation Characteristics**

**Corrugation Type**

The appearance of unobliterated coils was recorded as flattened (coils have little relief in profile and do not overlap), clapboard (coils show relief in profile and overlap), or indented (coils are impressed at intervals, creating a wavy and textured appearance). If more than one corrugation type was observed on an individual sherd, additional types were recorded in *Corrugation Type 2* and *Corrugation Type 3*.

**Indentation Pattern**

Indentation pattern is the manner in which indentations are placed on the vessel exterior in relation one another. Three patterns were observed—diagonal (indentations on superjacent and subjacent coils are opposing, creating diagonal or “pinwheel-like” lines that traverse the vessel surface), vertical (indentations on superjacent and subjacent coils
are placed at the same intervals, creating vertical lines on the vessel exterior), and random (no particular pattern is evident). If more than one type or pattern of indentation was present, such as is the case with zoned vessels, then additional patterns were recorded in *Indentation Pattern 2 and Indentation Pattern 3.*

*Angle of Indentation*

We measured the angle of the outside of an indentation (the edge at which concave and convex portions meet) against the vertical axis of the center of the indentation using a goniometer and recording in degrees. More slanted indentations produce larger angle measurements and more vertical indentations produce smaller angle measurements.

*Distance Between Indentations*

This measurement includes the distance from the middle of one indentation to the middle of the adjacent indentation on the same coil. If the sherd was large enough, three separate measurements were taken from different parts of the exterior surface, with the mean of these three measurements comprising the overall indentation distance for an individual sherd. If a sherd exhibited indentation zoning, where different patterns of indentations appeared on the same piece, then three indentation distance measurements were recorded for each identified zone.

*Elaborations in Surface Manipulation*

This category includes additional treatments to the surface of corrugated vessels, such as patterning, zoning, and incising. In some wares, these treatments are the basis for separate type definitions. Patterning refers to variation in indentation or coil attributes that crosscut horizontal coils, zoning refers to horizontally oriented variation in
indentation or coil attributes, and incising refers to utilization of an instrument to create designs on the vessel exterior or define coil junctures.

*Direction of Indentation*

The direction of indentation refers to the orientation of pinching along a coil, which is thought to directly reflect the hand used for adhering one coil to the one below it through pinching. This category was recorded as the direction—right-to-left, left-to-right, or vertical—of the indentation, starting at the bottom and moving upwards. Therefore, as discussed in more detail below (see Production), pinching with the right thumb creates a right-to-left indentation and pinching with the left thumb creates a left-to-right indentation.

*Breakage Pattern*

This category records the angle of coil junctures, which is related to the specific manner in which coils are joined together. Corrugated pottery typically breaks on coil intersections, which constitute planes of weakness within vessel bodies. At least one of these breaks, and usually two, was usually visible on sherds in cross-section, and was recorded as straight, angled, or both.

*Direction of Coiling*

Coiling direction, either clockwise or counterclockwise—was only observable on the central portions of vessel bases. As described below (Production), direction of indentation may serve as an indirect indicator of coiling direction.

*Mending Holes*

The presence of holes drilled through vessel walls typically denotes an attempt to stabilize and prevent propagation of cracks, thereby extending vessel uselife.
Degree of Usewear

Evidence for usewear was recorded for both interior and exterior surfaces as none, slight, moderate, and heavy. Since slip is absent on gray ware, usewear was generally visible only through coil/indentation attrition, and thus was most discernible on the exterior surfaces of vessels. Slight wear was defined by slight rounding of coils/indentations, moderate wear was defined by the presence of shallow pitting and attrition, and heavy wear was defined by complete flattening of coils/indentations or abrasion exposing the underlying paste.

Residue/Use Alteration

The presence of any deposits related to the use of the vessel was recorded for both interior and exterior surfaces, including residue, sooting (exterior only), smudging (interior only), burning, or carbon deposits (interior only).

Maximum Length, Width, Thickness, Weight

We recorded basic metrics for each sherd, including maximum length (mm), maximum width (mm), thickness (mm), and weight (g). On corrugated sherds, wall thickness was measured between coils. Three separate thickness measurements were taken on sherds 3 cm or more in size, two on sherds 2-3 cm in size, and one on sherds less than 2 cm in size. These three measurements were averaged to arrive at a mean sherd thickness.

Type Definitions

Gray ware ceramics have paste colors ranging from white to light gray and lack slip, polish, or paint. The classification of gray ware types primarily followed the
descriptions provided by Goetze and Mills (1993), in addition to those outlined by Toll and McKenna (1997). In accordance with these ceramic classifications, utility ware types were distinguished largely on the basis of temper, followed by paste and surface treatment. Based on these three main attributes, five gray ware traditions were identified in the assemblage: Cibola, Chuska, Mesa Verde, Tusayan, and Little Colorado.

**Cibola Gray Ware**

Gray ware of the Cibola tradition (Dittert 1949, 1959; Marshall 1991; Ruppe 1966) is found over much of the southern Ancestral Pueblo area. It is characterized by generally light paste (light gray to white) resulting from the use of clay with low iron content and a neutral or reducing firing atmosphere, as well as the presence of sand and/or crushed sherd temper. Early gray ware types are dominated by coarse sand temper. Although sherd temper increases in frequency over time, combinations of sand and sherd comprise the bulk of the sequence. Cibola Gray Ware types are also distinguished by the style and location of corrugation. The earliest types generally lack corrugation and occasionally exhibit traces of red pigment (fugitive) applied to plain vessel exteriors following firing. Corrugation first appears in the form of wide, flattened coils confined to the neck; over time these bands narrow in width. Slightly overlapping “clapboard” corrugations appear next in the sequence, usually on the neck and upper body of ceramic vessels. Indented corrugation characterizes later types, first appearing on the neck and shoulder as with clapboard corrugations, and then eventually covering the entire vessel exterior. Occasionally both clapboard and indented corrugations occur on the same vessel in alternating “zones” or patterns.
A major departure from the Goetze and Mills (1993) Cibola Wray ware classification for rim sherds should be noted—the current analysis omitted the “PII Rim” and “PIII Rim” categories. These types are based on the general observation that the rims of gray ware vessels become more everted or flared (oriented outward with respect to the vessel neck) over time. In their analysis of rim flare for gray ware sherds from Chaco Canyon, Toll and McKenna (1997:177-181) report largely overlapping distributions in eversion angles for their PII Rim, PII-PIII Rim, and PIII Rim types. While they confirm the overall trend in flaring over time, the degree of overlap is such that the use of eversion angle alone to temporally classify sherds is suspect. In this analysis, corrugated Cibola Gray Ware rim sherds were classified by corrugation type, as described above. Although rim eversion angle was recorded, no temporal assignment was made during the primary stages of analysis.

*Plain Gray*

Plain Gray includes all body sherds that lack corrugation or other surface treatment. This category encompasses sherds from entirely plain gray vessels, Lino Gray body sherds, and the lower portions of neck corrugated vessels.

*Lino Gray*

The earliest Cibola Gray Ware type, Lino Gray includes only rim and neck sherds without surface treatment other than scraping and smoothing. Body sherds are excluded, as these could derive from other, later types such as those with neck corrugations (see above). Lino Gray is also sometimes defined as having abundant coarse sand temper, resulting in obvious protrusion of the temper through the surfaces of the vessel walls (Toll and McKenna 1997). This last criterion was not found to be useful in identifying
this type, as the temper of later corrugated types matched this description as well. Bowls and seed jars are more common in Lino Gray than in other gray ware types (Toll and McKenna 1997:218). Lino Gray is often associated with Basketmaker III to Pueblo I period white wares, including White Mound and La Plata Black-on-whites.

*Kana-a Neckbanded*

Kana-a Neckbanded (or Wide Neckbanded) is the earliest corrugated gray ware type in the Cibola tradition. It is defined by wide (usually 10 mm or more; Goetze and Mills 1993: 56), flattened bands around the neck and shoulder area of the vessel. In profile, these bands do not overlap and protrude very little from the vessel wall. Only rim and neck sherds may be included in this category. Sherds from the lower, uncorrugated portions of these vessels would be identified as Plain Gray. As noted by Toll and McKenna (1997:230), the production of Kana-a Neckbanded appears to be restricted to A.D. 800 to 950, making it a good temporal marker. It is most commonly associated with White Mound and Kiatuthlanna/Early Red Mesa Black-on-whites.

*Narrow Neckbanded*

This type is similar to Kana-a Neckbanded, except that the flattened bands are more narrow (less than 10mm). For the same reasons discussed above, only rim and neck sherds may be identified as Narrow Neckbanded. This gray ware type is associated with Red Mesa Black-on-white.

*Neck Corrugated*

Neck Corrugated sherds clearly derive from neck corrugated vessels, but cannot be placed in a neckbanded category. This may be the result of coil overlap (as with clapboard corrugations; see below), unflattened coils, or indented corrugations. Sherds of
this type are fairly rare, as they must be from the confluence of the corrugated (neck) and plain (shoulder) portions of a vessel. Like Narrow Neckbanded, this type is associated with Red Mesa Black-on-white. This definition of Neck Corrugated differs from that of Goetze and Mills (1993:56), in which only clapboard corrugations are included; it also departs from the Toll and McKenna (1997) classification, which includes only indented corrugations.

**Clapboard Corrugated**

Clapboard corrugations are also flattened coils, although they partially overlap one another and usually exhibit more relief in profile than those of neckbanded types. Coils are generally less than 10 mm wide. This type may include both rim and body sherds. Sherds from the clapboard corrugated portions of zoned vessels could be included in this type, as well as neck corrugated sherds for which vessel portion could not be determined.

**Indented Corrugated**

Indented Corrugated dominates Cibola utility ware from the Pueblo II and III periods. It is characterized by thin coils with evenly spaced, angled indentations. Fingerprints are often preserved within these indentations. Both body and rim sherds may be placed in this category, including the upper portions of neck indented corrugated vessels. Indented Corrugated has a long temporal span, occurring in association with a variety of Pueblo II and Pueblo III period whiteware types, including Gallup, Chaco, Puerco, Reserve, Escavada, and McElmo Black-on-whites.

**Zoned Corrugated**

Zoned Corrugated is defined by the presence of more than one type of corrugation, each of which is arranged in a horizontal band or zone around the vessel.
In the Cibola tradition, clapboard and indented corrugations usually co-occur on the same vessel in this manner. In terms of temporal assignment, this type can be considered a subset of Indented Corrugated.

*Patterned Corrugated* Likewise, Patterned Corrugated only occurs on Indented Corrugated vessels. This subtype is characterized by the presence of coils oriented in some manner other than horizontal, particularly wavy lines and spirals that crosscut pre-existing horizontal coils. In most cases, these appear to be placed onto the vessel exterior appliqué-style.

*Indeterminate Cibola Gray* This category includes sherds for which a specific type cannot be discerned, usually as a result of small size or lack of surface(s).

**Chuska Gray Ware**

Chuska Gray Ware is defined by the presence of trachyte temper, originally recorded by Hawley (1934) and Shepard (1939). Trachyte, also known as sanidine trachybasalt or alkali feldspar trachyte, is a dark volcanic rock comprised of “vitreous sanidine crystals, light green stubby diopside prisms and gold brown biotite” (Warren 1967:63). These various crystals give trachyte a distinctive greenish-black color and a sparkling appearance, such that it is often visible without the aid of magnification. Chuska Gray Ware is of particular importance in this analysis, as it comprises nearly half of the total gray ware assemblage from the Pueblo Bonito mounds.

The Chuska Gray Ware classification utilized here follows that of Goetze and Mills (1993), which incorporates types originally defined by Peckham and Wilson (1967). Types are primarily defined by vessel portion; while only three undifferentiated
types (plain, clapboard, and indented corrugated) are defined for body sherds, seven types are defined for rim and neck sherds. Like Cibola Gray Ware, early vessels lack corrugation and have direct or uneverted rims. Neck corrugation appears subsequently, beginning with wide-flattened bands around the rim, neck and shoulder area and becoming narrow and less flattened over time. Clapboard corrugations appear next, followed by indented corrugations and increasingly flared rims. The types defined for rim and neck sherds are distinguished by band width and rim angle.

*Bennett Gray*

Bennett Gray, the counterpart to Lino Gray, is the earliest ceramic type in the Chuska sequence. It is defined by completely plain vessel exteriors. In order to avoid overlap with the plain lower portions of neck corrugated vessels, only rim and neck sherds lacking surface treatment are included. Associated white ware types include Crozier, Drolet, Theodore, Pena, Tunicha, Newcomb, La Plata, and White Mound Black-on-whites; these also co-occur with Sheep Springs and Tocito Gray.

*Undifferentiated Chuska Plain Gray Ware*

This type includes all gray ware body sherds that lack banding and corrugation. This includes body sherds of Bennett Gray and the lower portions of neck corrugated vessels.

*Sheep Springs Gray*

Sheep Springs Gray is defined by wide, flattened coils restricted to the vessel neck and shoulder. Bands range in width from 11 to 30 mm (Peckham and Wilson 1967) and exhibit little-to-no relief in profile. Only rim and neck sherds may be confidently
placed in this type. Sheep Springs Gray is associated with the same white ware types as Bennett and Tocito Gray.

*Tocito Gray*

Tocito Gray also has completely flattened coils located only on the vessel neck and shoulder, although they are narrower (6-13 mm) than those exhibited in Sheep Springs Gray. See Bennett Gray for associated white ware types.

*Gray Hills Banded*

This neckbanded type is characterized by coils that have not been completely flattened, and hence show relief in a clapboard-like fashion. Coils are slightly narrower than those of either Sheep Springs or Tocito Gray, typically ranging from 5 to 13 mm in width. Only rim and neck sherds are assigned to this type. Gray Hills Banded is associated with a variety of Pueblo II Chuska white ware types, including Drolet, Newcomb, Theodore, Pena, Tunicha, Naschitti, Burnham, Brimhall, and Taylor Black-on-whites.

*Captain Tom Corrugated*

Captain Tom Corrugated, which also exhibits neck corrugations, is distinguished by narrow (3-9 mm), slightly overlapping coils that have been incised. The incisions may follow along coil junctures or cross-cut coils, creating various patterns. Only rim and neck sherds may be placed in this type. Like Gray Hills Banded, Captain Tom Corrugated is associated with Drolet, Newcomb, Naschitti, Burnham, Brimhall, and Taylor Black-on-whites.
Blue Shale Corrugated

Blue Shale Corrugated, representing the first Chuska Gray Ware type to exhibit overall corrugations, is defined by the presence of clapboard or indented corrugations and rims with a direct or moderate flare. In addition, the corrugations on these vessels are often zoned and patterned. Only rims sherds may be assigned to this type. Blue Shale Corrugated body sherds are placed in the Undifferentiated Chuska Clapboard or Indented Corrugated Gray Ware categories. Associated white ware types include Chuska, Toadlena, Nava, and Crumbled House Black-on-whites.

Hunter Corrugated

Hunter Corrugated is defined by a flaring rim and overall clapboard or indented corrugations similar to Blue Shale Corrugated. Associated white ware types include Chuska, Toadlena, Nava, and Crumbled House Black-on-whites.

Undifferentiated Clapboard/Indented Corrugated

Since the majority of the Chuska Gray Ware types are defined on the basis of characteristics of the rim and neck portions of vessels, all body sherds with corrugations are placed into undifferentiated clapboard or indented categories.

Undifferentiated Zoned Corrugated

Body sherds that include at least two types of corrugation arranged in horizontal bands are placed within the subtype of Undifferentiated Zoned Corrugated. These zones may be comprised of indented and clapboard corrugations or different styles of indented corrugations (defined by various indentation angles or tooled indentations).

Undifferentiated Patterned Corrugated

Undifferentiated Patterned Corrugated is defined by corrugations that are not oriented horizontally, such as spirals and wavy lines.
These coils may be part of the original construction of the vessel wall itself, or may be applied after the vessel was formed. These two types are not mutually exclusive; a vessel may be both zoned and patterned.

**Mesa Verde/San Juan Gray Ware**

Mesa Verde Gray Ware was produced and distributed in the northern San Juan region, north of the San Juan River. It is characterized by the presence of crushed igneous rock temper, particularly andesite/diorite, often mixed with small quantities of sandstone. The classificatory scheme utilized follows the type definitions of Breternitz et al. (1974), Blinman and Wilson (1991), and Oppelt (2007). Seven types are generally distinguished based on both surface manipulations and/or rim eversion. Temporal trends follow those of other wares, with plain vessels common early in the sequence, followed by neck corrugated types, and then fully corrugated types.

**Chapin Gray**

Chapin Gray (also known as Twin Trees Plain) is defined by a plain, scraped exterior that may sometimes be polished or even incised. The temper is usually coarse and is visible through the surface. Occasionally a red wash was applied to vessel exteriors after firing. Associated white ware types include Chapin and Piedra Black-on-whites.

**Moccasin Gray**

This type is distinguished by the presence of wide, flattened coils greater than 10 mm in width around the vessel neck. Only vessel necks, rims, and upper bodies may be placed in this category. Chapin and Piedra Black-on-whites are associated with Moccasin Gray.
**Mancos Gray**

Mancos Gray is also a neck corrugated type, but coils are clapboarded and often tooled/incised. Associated white ware types include Piedra and Cortez Black-on-whites.

**Mummy Lake Gray**

Mummy Lake Gray is a late plain ware type with a rough surface and a single flattened band/fillet below the rim. This fillet was applied after the exterior surface was scraped. Since it dates to the Pueblo II/PIII period, the rim is flared. Mummy Lake Gray is associated with Mancos, McElmo, and Mesa Verde Black-on-whites.

**Mancos Corrugated**

Mancos Corrugated is defined by corrugations that are indented and cover the entire vessel body, and direct rims. Patterning in the corrugations is common in this type, and sometimes the interior of the rim is painted. Only rims may be confidently placed in this type. Associated white ware types include Cortez, Mancos, McElmo, and Mesa Verde Black-on-whites.

**Dolores Corrugated**

Dolores Corrugated is a fully indented corrugated type with a moderately everted rim. Only rim sherds can be placed in this type. White ware types associated with Dolores Corrugated include Mancos, McElmo, and Mesa Verde Black-on-whites.

**Mesa Verde Corrugated**

Mesa Verde Corrugated is also defined by corrugations that cover the entire vessel surface, but rims are fully flared. Patterning is common, including appliqué designs, and the interior rim is sometimes painted. This type can only be identified from rim sherds and is associated with McElmo and Mesa Verde Black-on-whites.
Undifferentiated Mesa Verde Plain Gray

This type includes the undifferentiated lower portions of Mancos, Moccasin, or Mancos Gray vessels.

Undifferentiated Mesa Verde Corrugated

This type encompasses corrugated body sherds that could not be placed within more specific types, including the lower portions of Mancos, Dolores, and Mesa Verde Gray Corrugated vessels.

Little Colorado Gray Ware

The gray ware of the Little Colorado River Valley is the least defined of any of the traditions identified in the analysis. The temper consists of either quartz and augite sand or sherd (which co-occurs with very dark paste). Augite sand is distinct to the Hopi Buttes area of northern Arizona. Colton (1955) only recognized a single gray ware type within the Little Colorado tradition. This analysis followed the classificatory scheme of Goetze and Mills (1993), in which four types similar to those found in Tusayan Gray Ware are defined.

Undifferentiated Plain Gray

Gray ware sherds lacking corrugations, regardless of the part of the vessel they represent, are included in this type.

Clapboard Corrugated

Clapboard Corrugated is characterized by all sherds exhibiting flattened, slightly overlapping coils.
**Indented Corrugated**

Indented Corrugated includes all sherds with indented corrugations, regardless of vessel portion. Associated white ware types include Holbrook, Chevelon, and Walnut Black-on-whites.

**Moenkopi Style Corrugated**

Similar to the corresponding Tusayan Gray Ware type (see below), Moenkopi Style Corrugated is characterized by indented or clapboard corrugations showing partial obliteration or flattening. This type is associated with Walnut Black-on-white.

**Tusayan Gray Ware**

Tusayan Gray Ware is found across the northern Southwest, including northern Arizona, southeastern Utah, and parts of northwest New Mexico (Colton 1955); while widely distributed early in the sequence, Tusayan Gray Ware became increasingly restricted over time, and was eventually replaced by sherd-tempered Cibola Gray Ware (Hays-Gilpin and Hartesveldt 1998:120). Production appears to be centered on the Black Mesa area of northeastern Arizona. This ware is defined by the presence of abundant pure quartz temper, which decreases in coarseness over time. Ceramic pastes range from light gray to very dark gray in color and vessel surfaces are typically unsmoothed. Temporal shifts in surface treatments follow those of other areas.

**Obelisk Gray**

Obelisk Gray is the earliest plain ware in the sequence, and is defined by a polished surface that can range from buff to pink to tan in color. This type resembles early Mogollon plain ware types.
**Lino Gray**

Lino Gray in the Tusayan area is similar to that of the Cibola area; temper is coarse, surfaces are rough and frequently pitted, and rims are direct. Vessels were also occasionally covered with a fugitive red wash. Only rims sherds can be identified as Lino Gray. This type is associated with Lino Black-on-white.

**Kana-a Neckbanded**

Kana-a Neckbanded is defined by the presence of wide (>10 mm), flattened coils around the neck and upper shoulder of otherwise plain ware vessels. Only sherds from the upper portions of vessels can be placed in this type. The type is often associated with Kana-a Black-on-white.

**Medicine Gray**

Medicine Gray is characterized by indented corrugations located on the neck and shoulder of the vessel. Since the lower portion of the vessel is plain, body sherds cannot be included in this type.

**Tusayan Corrugated**

Tusayan Corrugated (also known as Deadmans Corrugated), the primary ware of the Kayenta region, has unobliterated indented corrugations covering the entire vessel. Indented corrugated coils are frequently alternated with plain or clapboard coils to create patterns and/or zoning. Tusayan Corrugated is associated with a wide variety of Pueblo II and Pueblo III period white ware types, including Black Mesa, Dogoszhi, Sosi, and Tusayan Black-on-whites.
Moenkopi Corrugated

Moenkopi Corrugated is characterized by either indented or clapboard corrugations that have been flattened or otherwise nearly obliterated. This type is associated with the same white ware types as Tusayan Corrugated (see above).

Kiet Siel Gray

Kiet Siel Gray is a late plain ware type with an everted rim. Only rim sherds can be assigned to this type. Associated white ware types include Tusayan and Kayenta Black-on-whites.

Undifferentiated Plain Gray

This type includes body sherds with plain surfaces, including the lower portions of Lino Gray, Kana-a Neckbanded, and Medicine Gray vessels.

Undifferentiated Clapboard Corrugated

This type includes body sherds with slightly flattened and overlapping coils.

Undifferentiated Incised/Tooled Corrugated

After Goetze and Mills (1993:60), this type includes any corrugated sherd that displays embellishment with a tool, including incising and punctuating. The two contemporaneous types of Honani and O’Leary Tooled are subsumed by this category. Corrugation may be either clapboard or indented.

Assemblage Summary

Of the 66,277 gray ware sherds analyzed beyond the initial sort, 46.3 percent (n=30,693) are from the East Trench, 46.7 percent (n=30,984) are from the West Trench, and 7 percent (n=4,600) are from the Middle Trench. As described elsewhere, the Middle
Trench is located between, rather than within, the mounds. Although it is likely that material recovered from the Middle Trench derives from slumping of the East Mound, contribution of material from the West Mound cannot be ruled out. As a result, while the following summary includes the Middle Trench, it primarily focuses on the assemblages from the East and West Trenches. This section summarizes the Pueblo Bonito mounds gray ware assemblage in terms of general attributes, including ware, type, rim eversion, vessel form, and vessel size (orifice diameter). Attributes related to finer-scale variation in surface treatment (i.e., corrugation characteristics) are summarized and interpreted within the discussion of gray ware production (see Production).

**Distribution of Wares**

The utilitarian ceramic assemblage from the mounds is dominated by Cibola and Chuska Gray Wares—they comprise 51 percent and 45 percent of the assemblage, respectively (Figure 17). All other gray wares—including Mesa Verde, Tusayan, and Little Colorado—comprise minor percentages of the total. Of these, gray wares from the northern San Juan region are most numerous (representing 2.4% of the total). While this general pattern is evident in both mounds, there are some important differences in wares between the two; the East and Middle Trenches contain higher percentages of Cibola Gray Ware (52.9% each) and the West Trench contains a higher percentage of Chuska Gray Ware (47.8% versus 43% in the East Trench) (Table 3, Figure 18). In addition, the East and Middle Trenches contain slightly higher percentages of Mesa Verde Gray Ware (2.7% and 2.9%, respectively) than the West Trench (2.1%). A Chi-Square test revealed that these differences are statistically significantly [$\chi^2(8, n=66274)=193.05, p<0.001$].
Figure 17. Distribution of wares, entire assemblage.

Figure 18. Distribution of gray wares, divided by trench.
Table 3. Occurrence of wares by trench.

<table>
<thead>
<tr>
<th></th>
<th>West Trench</th>
<th>Middle Trench</th>
<th>East Trench</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chuska Gray Ware</strong></td>
<td>47.8%</td>
<td>43.6%</td>
<td>43.0%</td>
<td>45.3%</td>
</tr>
<tr>
<td></td>
<td>n=14810</td>
<td>n=2004</td>
<td>n=13205</td>
<td>n=30019</td>
</tr>
<tr>
<td><strong>Cibola Gray Ware</strong></td>
<td>49.2%</td>
<td>52.9%</td>
<td>52.9%</td>
<td>51.2%</td>
</tr>
<tr>
<td></td>
<td>n=15248</td>
<td>n=2435</td>
<td>n=16244</td>
<td>n=33927</td>
</tr>
<tr>
<td><strong>Little Colorado</strong></td>
<td>0.1%</td>
<td>0.1%</td>
<td>0.1%</td>
<td>0.1%</td>
</tr>
<tr>
<td><strong>Gray Ware</strong></td>
<td>n=27</td>
<td>n=4</td>
<td>n=23</td>
<td>n=54</td>
</tr>
<tr>
<td><strong>Mesa Verde</strong></td>
<td>2.1%</td>
<td>2.9%</td>
<td>2.7%</td>
<td>2.4%</td>
</tr>
<tr>
<td><strong>Gray Ware</strong></td>
<td>n=634</td>
<td>n=132</td>
<td>n=840</td>
<td>n=1606</td>
</tr>
<tr>
<td><strong>Prescott Gray</strong></td>
<td>--</td>
<td>--</td>
<td>0.01%</td>
<td>&lt;0.01%</td>
</tr>
<tr>
<td><strong>Ware</strong></td>
<td>--</td>
<td>--</td>
<td>n=2</td>
<td>n=2</td>
</tr>
<tr>
<td><strong>Tusayan Gray</strong></td>
<td>0.9%</td>
<td>0.5%</td>
<td>1.2%</td>
<td>1.0%</td>
</tr>
<tr>
<td><strong>Ware</strong></td>
<td>n=264</td>
<td>n=25</td>
<td>n=379</td>
<td>n=668</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>30984</td>
<td>4600</td>
<td>30693</td>
<td>66277</td>
</tr>
</tbody>
</table>

These differences likely relate to an inferred temporal distinction between the mounds; the accumulation of the majority of the material comprising the West Mound appears to correlate with the height of Chuska importation, which occurred around AD 1040-1100 (Toll and McKenna 1997:111), while accumulation in the East Mound continued into the AD 1100s as Chuska importation of gray wares into the canyon began to decline slightly and imports from the northern San Juan increased (Toll 2006:128).

The distribution of wares in the Pueblo Alto trash mound is generally comparable to the Pueblo Bonito mounds, with the exception that Chuska Gray Ware represents a higher percentage and Cibola Gray Ware a lower percentage of the total gray ware, at 52 percent and 47 percent, respectively (Figure 19). These differences are statistically significant [$\chi^2 (2, n=85819) = 460.8, p<0.001$]. In addition, the relative percentage of
Mesa Verde Gray Ware is four times higher in the Pueblo Bonito mounds (2.4%) compared to the Alto mound (0.60%).

Figure 19. Distribution of gray wares from midden contexts, Pueblo Bonito and Pueblo Alto.

Distribution of Types

In terms of types, the Pueblo Bonito gray ware assemblage is dominated by Indented Corrugated, regardless of ware (Tables 4 and 5; Figure 20). However, there is a higher percentage of Chuska Indented Corrugated (86.8%) compared to Cibola Indented Corrugated (77.4%). In addition, there is a significantly higher percentage of Cibola Plain Gray (15.1%) compared to Chuska Plain Gray (5.1%). When the distribution of types is
compared between the mounds, it becomes obvious that the East Mound is later, both in
its initiation and continued deposition (Table 6). A similar pattern emerges for each
ware—a significantly higher percentage of early and plain gray types are represented in
the West Mound, and a higher percentage of indented corrugated is represented in the
East Mound (p<0.01).

Table 4. Summary of ceramic types by ware.

<table>
<thead>
<tr>
<th>Ceramic Type</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cibola Gray Ware</strong></td>
<td></td>
</tr>
<tr>
<td>Indeterminate</td>
<td>600</td>
</tr>
<tr>
<td>Kana-a Neckbanded</td>
<td>54</td>
</tr>
<tr>
<td>Lino Gray</td>
<td>5</td>
</tr>
<tr>
<td>Narrow Neckbanded</td>
<td>60</td>
</tr>
<tr>
<td>Neck Corrugated</td>
<td>5</td>
</tr>
<tr>
<td>Patterned Corrugated</td>
<td>6</td>
</tr>
<tr>
<td>Plain Gray</td>
<td>5110</td>
</tr>
<tr>
<td>Undifferentiated Clapboard Corrugated</td>
<td>1232</td>
</tr>
<tr>
<td>Undifferentiated Gray Ware Handle</td>
<td>3</td>
</tr>
<tr>
<td>Undifferentiated Indented Corrugated</td>
<td>25780</td>
</tr>
<tr>
<td>Unidentified Handle</td>
<td>76</td>
</tr>
<tr>
<td>Unidentified Rim</td>
<td>595</td>
</tr>
<tr>
<td>Zoned Corrugated</td>
<td>490</td>
</tr>
<tr>
<td>Total</td>
<td>33927</td>
</tr>
<tr>
<td><strong>Chuska Gray Ware</strong></td>
<td></td>
</tr>
<tr>
<td>Indeterminate</td>
<td>340</td>
</tr>
<tr>
<td>Bennett Gray</td>
<td>1</td>
</tr>
<tr>
<td>Blue Shale Corrugated</td>
<td>28</td>
</tr>
<tr>
<td>Captain Tom Corrugated</td>
<td>2</td>
</tr>
<tr>
<td>Gray Hills Banded</td>
<td>10</td>
</tr>
<tr>
<td>Hunter Corrugated</td>
<td>51</td>
</tr>
<tr>
<td>Patterned Corrugated</td>
<td>35</td>
</tr>
<tr>
<td>Sheep Springs Gray</td>
<td>9</td>
</tr>
<tr>
<td>Tocito Gray</td>
<td>4</td>
</tr>
<tr>
<td>Undifferentiated Clapboard Corrugated</td>
<td>1502</td>
</tr>
<tr>
<td>Undifferentiated Indented Corrugated</td>
<td>24829</td>
</tr>
<tr>
<td>Undifferentiated Plain Gray</td>
<td>1537</td>
</tr>
<tr>
<td>Unidentified Handle</td>
<td>18</td>
</tr>
<tr>
<td>Unidentified Rim</td>
<td>500</td>
</tr>
<tr>
<td>Zoned Corrugated</td>
<td>1153</td>
</tr>
<tr>
<td>Total</td>
<td>30019</td>
</tr>
<tr>
<td><strong>Mesa Verde Gray Ware</strong></td>
<td></td>
</tr>
<tr>
<td>Indeterminate</td>
<td>21</td>
</tr>
<tr>
<td>Chapin Gray</td>
<td>1</td>
</tr>
<tr>
<td>Dolores Gray</td>
<td>4</td>
</tr>
<tr>
<td>Mancos Gray</td>
<td>2</td>
</tr>
</tbody>
</table>
Table 5. Distribution of general surface treatment by ware.

<table>
<thead>
<tr>
<th>Ware Type</th>
<th>Cibola Gray Ware</th>
<th>Chuska Gray Ware</th>
<th>Mesa Verde Gray Ware</th>
<th>Tusayan Gray Ware</th>
<th>Little Colorado Gray Ware</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plain Gray</td>
<td>15.1%</td>
<td>5.1%</td>
<td>7.0%</td>
<td>8.0%</td>
<td>13.0%</td>
<td>n=6,826</td>
</tr>
<tr>
<td></td>
<td>n=5,115</td>
<td>n=1,538</td>
<td>n=112</td>
<td>n=54</td>
<td>n=7</td>
<td></td>
</tr>
<tr>
<td>Neckbanded</td>
<td>0.4%</td>
<td>0.1%</td>
<td>0.4%</td>
<td>1.0%</td>
<td>--</td>
<td>n=157</td>
</tr>
<tr>
<td></td>
<td>n=119</td>
<td>n=25</td>
<td>n=6</td>
<td>n=7</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>Clapboard Corrugated</td>
<td>3.6%</td>
<td>5.1%</td>
<td>--</td>
<td>6.3%</td>
<td>1.9%</td>
<td>n=2,805</td>
</tr>
<tr>
<td></td>
<td>n=1,232</td>
<td>n=1,530</td>
<td>n=42</td>
<td>n=1</td>
<td>n=43</td>
<td></td>
</tr>
<tr>
<td>Indented Corrugated</td>
<td>77.4%</td>
<td>86.8%</td>
<td>90.0%</td>
<td>76.3%</td>
<td>79.6%</td>
<td>n=54,341</td>
</tr>
<tr>
<td></td>
<td>n=26,276</td>
<td>n=26,066</td>
<td>n=1,446</td>
<td>n=510</td>
<td>n=43</td>
<td></td>
</tr>
</tbody>
</table>

| Tusayan Gray Ware                |                  |                  |                      |                   |                          |         |
|                                  |                  |                  |                      |                   |                          |         |
| Indeterminate                    | 3                |                  |                      |                   |                          |         |
| Kana-a Neckbanded                | 7                |                  |                      |                   |                          |         |
| Moenkopi Corrugated              | 12               |                  |                      |                   |                          |         |
| Tusayan Corrugated               | 483              |                  |                      |                   |                          |         |
| Undifferentiated Clapboard Corrugated | 42          |                  |                      |                   |                          |         |
| Undifferentiated Incised/Tooled Gray | 2           |                  |                      |                   |                          |         |
| Undifferentiated Plain Gray      | 54               |                  |                      |                   |                          |         |
| Unidentified Rim                 | 50               |                  |                      |                   |                          |         |
| Zoned Corrugated                 | 15               |                  |                      |                   |                          |         |
| Total                            | 1606             |                  |                      |                   |                          |         |

| Little Colorado Gray Ware        |                  |                  |                      |                   |                          |         |
|                                  |                  |                  |                      |                   |                          |         |
| Indeterminate                    | 3                |                  |                      |                   |                          |         |
| Clapboard Corrugated             | 1                |                  |                      |                   |                          |         |
| Indented Corrugated              | 42               |                  |                      |                   |                          |         |
| Moenkopi Style                   | 1                |                  |                      |                   |                          |         |
| Undifferentiated Plain Gray      | 7                |                  |                      |                   |                          |         |
| Total                            | 54               |                  |                      |                   |                          |         |

| Grand Total                      | 66277            |                  |                      |                   |                          |         |
Figure 20. Distribution of gray ware surface treatment by trench.

Table 6. Occurrence of general surface treatment of gray wares by trench.

<table>
<thead>
<tr>
<th></th>
<th>West Trench</th>
<th>Middle Trench</th>
<th>East Trench</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plain Gray</td>
<td>11.6%</td>
<td>16.1%</td>
<td>8.2%</td>
</tr>
<tr>
<td></td>
<td><em>n</em>=3,582</td>
<td><em>n</em>=741</td>
<td><em>n</em>=2,503</td>
</tr>
<tr>
<td>Neck Corrugated</td>
<td>0.3%</td>
<td>0.1%</td>
<td>0.2%</td>
</tr>
<tr>
<td></td>
<td><em>n</em>=99</td>
<td><em>n</em>=6</td>
<td><em>n</em>=52</td>
</tr>
<tr>
<td>Clapboard Corrugated</td>
<td>4.8%</td>
<td>5.7%</td>
<td>3.4%</td>
</tr>
<tr>
<td></td>
<td><em>n</em>=1,495</td>
<td><em>n</em>=260</td>
<td><em>n</em>=1,050</td>
</tr>
<tr>
<td>Indented Corrugated</td>
<td>79.4%</td>
<td>75.6%</td>
<td>84.9%</td>
</tr>
<tr>
<td></td>
<td><em>n</em>=24,590</td>
<td><em>n</em>=3,479</td>
<td><em>n</em>=26,050</td>
</tr>
</tbody>
</table>
This temporal difference is also supported by rim eversion. Rim flare of gray ware jars generally increases through time, from direct or unflared before AD 1020 to fully flared (greater than 30 degrees) around AD 1100-1120. The East Mound contains a significantly higher percentage of fully flared rims (65%), and the West Mound contains both more direct rims (7.5%) and a significantly higher percentage of moderately flared rims (40%) (Table 7; Figure 21).

**Table 7. Rim eversion by trench, detailed sample.**

<table>
<thead>
<tr>
<th></th>
<th>West Trench</th>
<th>Middle Trench</th>
<th>East Trench</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straight</td>
<td>23</td>
<td>9</td>
<td>20</td>
<td>52</td>
</tr>
<tr>
<td>Flared</td>
<td>161</td>
<td>35</td>
<td>286</td>
<td>482</td>
</tr>
<tr>
<td>Medium</td>
<td>121</td>
<td>27</td>
<td>131</td>
<td>279</td>
</tr>
<tr>
<td></td>
<td>305</td>
<td>71</td>
<td>437</td>
<td>813</td>
</tr>
</tbody>
</table>

**Figure 21. Rim eversion of gray ware sherds by trench, detailed sample.**
**Vessel Form and Size**

In general, utility ware assemblages are dominated by closed vessel forms, which are more conducive to cooking and storage than open forms. Jars represent the large majority (99.9%) of forms in the Pueblo Bonito gray ware assemblage, followed distantly by bowls (<0.1%) and ladles (<0.1%). This pattern is evident in all three trenches, and there are no significant differences in form by provenience (Table 8). Overall, gray ware jars comprise 53.9 percent of the entire ceramic assemblage from the mounds, including white wares and exotics.

**Table 8. Gray ware vessel form occurrence by trench.**

<table>
<thead>
<tr>
<th>Vessel Portion</th>
<th>West Trench</th>
<th>Middle Trench</th>
<th>East Trench</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base (indet.)</td>
<td>3</td>
<td>7</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Bowl</td>
<td>15</td>
<td>1</td>
<td>17</td>
<td>33</td>
</tr>
<tr>
<td>Cylinder Jar</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Handle (indet.)</td>
<td>10</td>
<td>12</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>Indeterminate</td>
<td>6</td>
<td>2</td>
<td>6</td>
<td>14</td>
</tr>
<tr>
<td>Jar</td>
<td>30,948</td>
<td>4,597</td>
<td>30,646</td>
<td>66,191</td>
</tr>
<tr>
<td>Ladle</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Mug/Cup</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Seed Jar</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Grand Total</td>
<td>30,984</td>
<td>4,600</td>
<td>30,693</td>
<td>66,277</td>
</tr>
</tbody>
</table>

These results are similar to those reported for Pueblo Alto, in which 99.8 percent of the gray wares are identified as jars and 0.2 percent are identified as ollas (Toll and McKenna 1980:43). Of the entire rough sort ceramic sample, including decorated wares, a total of 53.9 percent are gray ware jars. This is also similar to the composition of the combined ceramic assemblages reported by the Chaco Project—88.3 percent jars, 6.9 percent tecomates, 0.9 percent ollas, 0.8 percent pitchers, and 0.7 percent bowls (Toll and McKenna 1997:53). Although jars dominate the combined Chaco Project gray ware assemblage, a greater diversity of forms is represented as a result of the inclusion of early
sites. In general, diversity in gray ware vessel form varies inversely with time in Chacoan sites. For example, gray ware tecomates, which resemble large seed jars, appear to be restricted to early contexts—83 percent of the tecomates included in the Chaco Project analysis were found in early contexts, and the remaining 17 percent found in later contexts were either white wares or red wares (Toll and McKenna 1997:69). Gray ware pitchers and bowls are also more common in early contexts. The lack of diversity in gray ware forms in the Pueblo Bonito midden assemblage supports the interpretation that the majority of the material in the mounds accumulated during the Classic Bonito phase or later.

Since no complete or reconstructible vessels were recovered, orifice diameter as estimated from rim and/or neck sherds (including only rim sherds that retained a portion of the neck, as described previously) is the only proxy for gray ware vessel size or volume in the Pueblo Bonito mound assemblage. Some have questioned the relationship between jar orifice diameter and vessel size, since the maximum width of the jar often differs from the restricted opening of the vessel, and propose the use of vessel height instead. Unfortunately, this dimension is not measurable on sherds. Several studies report strong correlations between orifice diameter and vessel volume of both bowls and cooking jars; for example, an examination of whole vessels from Chacoan sites conducted as part of the Chaco Project ceramic analysis found a strong correlation between volume and orifice diameter for both gray ware jars and white ware bowls (Toll and McKenna 1997:73; see also Blinman 1989). Therefore, orifice diameter is considered to be a valid measure of the relative size of cooking vessels and changes therein.
The average orifice diameter for gray ware jars in the Pueblo Bonito mounds assemblage is 21.8 cm. The average for the East Mound is slightly higher at 22.15 cm and the average for the West Mound is slightly lower at 21.05 cm. This is similar to the average of 21.30 cm reported for the Chaco Project sites combined (Toll and McKenna 1997:171), and the average of 21.50 cm reported for all proveniences from Pueblo Alto (Toll and McKenna 1987:89). The distribution of the Pueblo Bonito gray ware orifice diameters is slightly bimodal, exhibiting a large peak from 22-24 cm, and a much smaller peak from 34-36 cm (Figure 22). Based on the published data for Pueblo Alto, it appears that gray ware jar orifice diameter may also be slightly bimodal, although the graph cuts off at 35 cm (Toll and McKenna 1987:91).

Figure 22. Distribution of orifice diameters of gray ware jars.
The multimodality in diameters is preserved when the assemblage is divided by provenience. The largest peak occurs at 20-22 cm in the West Mound and 22-24 cm in the East Mound (Figure 23). Interestingly, peaks in the larger range of diameters, at 34 cm and 40 cm, are more pronounced in the West Mound than in the East Mound. This is likely a function of the distribution of wares between the mounds, as gray ware jar orifice diameters vary significantly by ware.

Figure 23. Distribution of gray ware jar orifice diameters by trench.

Chuska jars generally have larger orifice diameters than Cibola jars, as observed for both Chaco Project assemblages and the Pueblo Bonito mounds assemblage (Figure 24; Toll and McKenna 1987). Chuska jars from the Pueblo Bonito assemblage have a
significantly larger mean orifice diameter (23.4 cm) than Cibola jars (20.5), as well as a larger maximum diameter (44 cm compared to 40 cm). A chi-square test revealed significantly less small Chuska Gray Ware jars (less than 20 cm) than expected and more large (more than 30 cm) and very large (more than 40 cm) Chuska jars than expected (p<0.01). Likewise, there are significantly more small Cibola Gray Ware jars than expected, and fewer very large Cibola jars than expected. The distribution of Chuska jar orifice diameters is thus more bimodally or even trimodally distributed, displaying a large peak at 22-24 cm and smaller peaks at 34 cm and 40 cm. The distribution of Cibola jar orifices, on the other hand, is skewed towards the left and displays a single peak from 18-20 cm. The fact that the West Mound contains a higher percentage of Chuska Gray Ware than the East Mound thus likely accounts for the more pronounced multimodality in the West Mound orifice distribution.

Figure 24. Distribution of Chuska and Cibola Gray Ware jar orifice diameters, Pueblo Bonito
Production and Exchange

One of the major project research questions concerns the organization of crafts production, an issue intimately tied to the nature of leadership in the Chaco system and the function of canyon communities. There is general agreement among researchers that the production and movement of staple, or mundane, goods, such as utilitarian ceramics, supported the Chaco system (Earle 2001; Toll 2001). Evidence does not suggest that leaders directly controlled or sponsored the production of such goods, but rather that production was decentralized, occurring within households in a low-level and independent manner (Hagstrum 2001; Peregrine 2001; Toll 2001). If leaders did influence production, it was likely indirectly through the control of the ceremonial calendar and the scheduling of ritual events during which large quantities of goods may have been consumed and/or laborers for great house construction were assembled.

Identifying which households were producers, and how concentrated those producers were in specific communities within the region, has been the focus of much previous archaeological research. Recent studies involving Chuska ceramics (Hays-Gilpin et al. 1999; Hensler and Goff 2002; Hensler et al. 2002; King 2003; Mills et al. 1997; Reed et al. 1998) have suggested specific communities in the Chuska area that may have been gray ware production loci, namely Skunk Springs, Newcomb, Crumbled House, and Naschitti. King (2003) identified the Skunk Springs area as the most likely source based on compositional analysis of ceramics from both the canyon and the Chuska area. Narbona Pass chert and construction timbers originate in this area as well. Given the volume of material moving into the canyon from this area in conjunction with a lack of evidence for either coercive control or goods that were exchanged in return, King (2003) suggests a model of residential mobility between the two areas (see also Toll 1981, 1991;
Windes and McKenna 2001), during which, “at various times of the yearly cycle, kin
groups may have produced pottery, harvested timber, grown maize, collected chert,
prepared dried meat, and moved all to Chaco Canyon for use in small residential

Since Cibola wares are tempered with less geologically distinct materials (sand
and sherd), the identification of specific production loci has proved to be difficult. Chaco
Project ceramic analysts were unable to confidently assign the Cibola tempers to specific
sources, including those within or in close proximity to the canyon, despite considerable
effort at recording minor and potentially valuable variation within the sand/sandstone
temper category. Warren (1977) suggested that Chacra Mesa, located east of the canyon,
may have been one of the production locations for sandstone-tempered ceramics. She
also proposed that Cibola ceramics with coarse quartz sand temper were produced outside
of the canyon; outcrops of this material were identified less than 25 km north of the
central canyon (Toll and McKenna 1997:87).

In addition to the temper itself, various oxidation (or refiring) studies conducted
on sherds from Chacoan sites examine basic paste composition. Toll and McKenna
(1987:96; 1997:117) found that Cibola White Ware and Gray Ware generally fire to buff
colors (their Color Groups 1-3) although they display considerable variation within this
range (see also Bubemyre and Mills 1993). Based on these data, it has been suggested
that Cibola wares were imported into the canyon from multiple production loci (Toll
2001; Toll and McKenna 1997:117).

Studies of pottery from various areas within the Cibola region have had greater
success at isolating production loci. Duff (1993) used compositional analysis of
corrugated ceramics to define production areas in the Cibola area during the Pueblo III period. In addition, Peeples (2010) has tied specific groups of Pueblo III communities to suites of gray ware attributes and then verified these same clusters through compositional analysis. Although these data are not yet available for assemblages contemporaneous with the height of Chaco, such research may hold the key to identifying where the Cibola Gray Ware recovered from Chaco Canyon was produced.

Based on the relative simplicity in manufacturing techniques and the large variation in skill level displayed in Chacoan goods, Hagstrum (2001) and others (e.g., Peregrine 2001; Toll 2001) suggest that household specialists produced pottery and other craft items. Ceramic production within the domestic sphere would have been carried out in conjunction with other household tasks, and thus would have been both part-time and seasonal (Hagstrum 2001:47-50).

Specialization occurs when there are fewer producers than consumers, so that they produce above the needs of their own households (Costin 2001:276). In general, specialists produce pottery that displays less variability than pottery made by non-specialists—efficiency and repetition, which increase with production intensity, result in greater standardization (Costin 1991:33; Rice 1992:268). While this relationship between intensity and standardization is generally supported by ethoarchaeological studies (Arnold and Nieves 1992; Bowser 2000; Roux 2003; Stark 1995), it is more variable in archaeological studies (Schleher 2010).

Standardization is typically quantified using the Coefficient of Variation (CV), the standard deviation expressed as a percentage of the mean (Longacre et al. 1988:103); the smaller the CV, the less relative variation, and thus greater degree of standardization,
there is in a sample. Previous studies indicate that the CVs of items produced manually generally range from 1.7 percent (the highest degree of standardization possible) to 57.7 percent (completely random, unstandardized production) (Eerkens and Bettinger 2001). Ethnographically, specialist potters produce vessels with CVs of less than 10 percent (Crown 1995:148-149). As demonstrated by Schleher (2010), pottery assemblages from archaeological contexts in the Southwest often display a greater degree of variation (10-30%), even when specialization is indicated by other evidence. This is likely the result of the pooling of items produced by multiple potters, in many different production episodes, and over longer temporal spans (Schleher 2010:84). Thus, while CVs of less than 10 percent do indicate specialist production in archaeological assemblages, CVs of greater than 10 percent are not necessarily indicative of non-specialist production. Schleher (2010) also notes that utility wares may be expected to display more variation than decorated wares, as styles generally cover longer temporal spans and potentially discrete types are often lumped into larger typological categories (i.e., “corrugated gray ware”). In addition, ethnographic research suggests that culinary wares generally exhibit more variation than decorated wares.

Previous studies report CVs of 15 to 45 percent for gray ware ceramics from Chaco Canyon (King 2003; Toll 1981:105, 1990:284; Toll and McKenna 1997: Appendix 2A). In the Chaco Project analysis, Chuska Gray Ware was found to have less metric variability than Cibola Gray Ware in several attributes, including sherd thickness, rim diameter, rim fillet width, and rim flare (Toll and McKenna 1997:200-203). In attributes related to surface manipulation (patterning, coil width), Chuska Gray Ware examples were found to have more variation than Cibola Gray Ware. Even though the
CVs for all attributes examined were above 10 percent, based on the overall relative technological uniformity of Chuska wares and the sheer volume of trachyte-tempered vessels entering the canyon, it was concluded that Chuska Gray Ware production must have been specialized to some degree, perhaps at the level of the community (Toll 1981, 1985; Toll and McKenna 1997).

Ceramics produced by the same social units are expected to display similarities in technological style—that is, similarities in the specific technical choices made during production (Lechtman 1977; Lemonnier 1992). Technological style encompasses information that is transmitted from one potter to another within a group, requiring close interaction and physical proximity. Ethnoarchaeological research indicates that conformity to proper technological method, rather than to a specific decorative style, is emphasized during the learning process (Lathrap 1983; Stanislawski and Stanislawski 1978). These technological elements are “low-visibility” traits and are thus not easily emulated; decorative elements, on the other hand, are “high-visibility” traits and may copied over wide areas and across social boundaries (see also Carr 1995b; Wobst 1977). In addition, technological style tends to be resistant to change, as it constitutes habitual practices or “ways of doing” (habitus) (Dietler and Herbich 1998; Hegmon 1998). In general, ceramics with similar technological attributes are thought to represent smaller interacting cultural units than ceramics with similar decorative attributes.

The distinctions between low and high visibility traits, and technological versus decorative attributes, are more ambiguous in utility ware ceramics than in decorated wares—the methods of vessel construction, which would normally be considered low-visibility, are clearly visible and unobscured on corrugated vessel surfaces. In their study
of pottery and population movement in the eastern Mimbres area, Hegmon et al. (2000) considered the variables of rim thickness, body thickness, number of coils, coil width, corrugation pattern, distance from rim to first/last coil, rim shape, smudging, and polishing as representative of the technological style of production of corrugated wares. Schleher and Ruth (2005) also examined various attributes of corrugated pottery in their study of ceramics from Pinnacle Ruin; they considered wall thickness, breakage pattern, and coil width to be low-visibility attributes; traits related to firing methods as medium-visibility attributes; and attributes related to surface finish (smudging, polishing) as higher visibility. In his study of utility ware ceramics from the Cibola region, Peeples (2010) found that compositional groups correlated with various technological variables, including wall thickness, coil width, indentation characteristics (type, direction, alignment, dimensions, density), and surface treatment (elaborations, obliteration, smudging).

In the following section, certain attributes of Indented Corrugated gray wares are examined within and across wares. Of all of the gray ware types identified in the Pueblo Bonito mounds assemblage, Indented Corrugated was chosen because it comprises the overwhelming majority of all wares (n=15,500, detailed analysis) and a greater number of attributes were recorded than for either plain or clapboard corrugated types. As described above (Methods), corrugation characteristics were only recorded for the detailed sample. Thus, the sample utilized in the following discussion consists of 15,500 indented corrugated gray ware sherds. Seven morphological attributes are considered—sherd thickness, coil width, indentation width, indentation angle, coil/indentation direction, indentation pattern, and breakage pattern. While previous studies (e.g., Hegmon et al.
2000; Neuzil 2001; Peeples 2010; Schleher and Ruth 2005) indicate that these attributes are likely tied to production units, the visibility of these traits is difficult to assess. Sherd thickness and breakage pattern are the only attributes that are not visible in the final product, and may thus be considered low-visibility; the other attributes likely lie along a continuum of visibility, depending upon the context of vessel use and the composition of the “audience”. Since all of these attributes are related to ceramic forming methods, however, they are all considered to be elements of technological style. It is therefore assumed that similarities in these variables represent interacting production groups. In addition, the relative degree of standardization (as measured by the CV) exhibited in these attributes will be compared across wares to examine relative intensity and specialization of production.

**Coil Width, Indentation Width, Sherd Thickness, and Indentation Angle**

The metric technological attributes of coil width, indentation width, sherd thickness, and angle of indentation are summarized in Table 9. Mean coil width is largest among Tusayan indented (5.55 mm) and Mesa Verde indented (5.51 mm), followed by Cibola indented (5.47 mm) and Chuska indented (5.14 mm). Chuska wares thus have significantly narrower coils than all other wares (One-Way ANOVA, p<0.001). Coil width CVs are largest for Mesa Verde (21.45), followed by Cibola (20.61), Chuska (19.93), and Tusayan (19.18). By far, the largest mean distance between consecutive indentations is displayed by Mesa Verde wares (10.46 mm), followed by Cibola (9.74 mm), Tusayan (9.51 mm), and Chuska (9.38 mm). Although Chuska wares display the shortest mean indentation width, this is not significantly lower than that of Cibola or Tusayan wares. However, Mesa Verde indentation width is significantly larger than all
other wares (ANOVA, p<0.001). Mesa Verde wares also have the highest CV for indentation width (20.49), followed by Cibola (20.42), Chuska (19.28), and Tusayan (17.86). Sherd thickness is the least variable metric attribute examined; all of the wares have mean thicknesses within 0.10 mm of one another. Chuska wares have the lowest CV (12.73), and Tusayan (14.94) and Cibola (14.39) have the highest CVs.

Table 9. Summary of surface treatment metric variables by ware.

<table>
<thead>
<tr>
<th>Ware</th>
<th>Coil Width</th>
<th>Indentation Distance</th>
<th>Sherd Thickness</th>
<th>Indentation Angle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cibola Indented</td>
<td>5.47</td>
<td>9.74</td>
<td>4.46</td>
<td>36.14</td>
</tr>
<tr>
<td>Corrugated</td>
<td>1.13</td>
<td>1.99</td>
<td>0.64</td>
<td>10.11</td>
</tr>
<tr>
<td>mean (mm)</td>
<td>20.61</td>
<td>20.42</td>
<td>14.39</td>
<td>27.98</td>
</tr>
<tr>
<td>St. Dev.</td>
<td>5490</td>
<td>4246</td>
<td>4978</td>
<td>5306</td>
</tr>
<tr>
<td>CV</td>
<td>20.42</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chuska Indented</td>
<td>5.14</td>
<td>9.38</td>
<td>4.43</td>
<td>34.68</td>
</tr>
<tr>
<td>Corrugated</td>
<td>1.03</td>
<td>1.81</td>
<td>0.56</td>
<td>10.65</td>
</tr>
<tr>
<td>mean (mm)</td>
<td>19.93</td>
<td>19.28</td>
<td>12.73</td>
<td>30.71</td>
</tr>
<tr>
<td>St. Dev.</td>
<td>5533</td>
<td>4521</td>
<td>4978</td>
<td>5306</td>
</tr>
<tr>
<td>CV</td>
<td>19.28</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>n</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mesa Verde Indented</td>
<td>5.51</td>
<td>10.46</td>
<td>4.38</td>
<td>37.84</td>
</tr>
<tr>
<td>Corrugated</td>
<td>1.18</td>
<td>2.14</td>
<td>0.60</td>
<td>9.19</td>
</tr>
<tr>
<td>mean (mm)</td>
<td>21.45</td>
<td>20.49</td>
<td>13.78</td>
<td>24.30</td>
</tr>
<tr>
<td>St. Dev.</td>
<td>322</td>
<td>237</td>
<td>255</td>
<td>277</td>
</tr>
<tr>
<td>CV</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>n</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tusayan Indented</td>
<td>5.55</td>
<td>9.51</td>
<td>4.39</td>
<td>36.27</td>
</tr>
<tr>
<td>Corrugated</td>
<td>1.06</td>
<td>1.70</td>
<td>0.66</td>
<td>8.39</td>
</tr>
<tr>
<td>mean (mm)</td>
<td>19.18</td>
<td>17.86</td>
<td>14.94</td>
<td>23.14</td>
</tr>
<tr>
<td>St. Dev.</td>
<td>275</td>
<td>212</td>
<td>255</td>
<td>300</td>
</tr>
<tr>
<td>CV</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Taken together, the above results indicate that Chuska indented corrugated wares are relatively more standardized and have the most indentations and coils per unit of vessel. This high “corrugation density” is likely related to the subjective observation of
analysts that Chuska wares generally display finer workmanship than other wares. Conversely, Mesa Verde indented corrugated wares have the fewest indentations and coils per unit of vessel. As noted by Toll (2001:58), corrugations have functional advantages in hindering the propagation of cracks during thermal expansion and contraction. Thus, a greater density of corrugations was likely preferred for culinary wares.

Chuska wares also display significantly smaller indentation angles (resulting in less slanting indentations along the coil) than other wares (ANOVA, p<0.01), with the exception of Little Colorado ware (which has a small sample size) (Table 9). However, the CV is relatively large, indicating that Chuska wares do not exhibit consistent uniformity in surface treatment. The indentation angle distributions of Mesa Verde (n=277), Cibola (n=5306), and Chuska (n=5479) indented corrugated wares all display two obvious peaks, one at 31-35 degrees and another at 41-45 degrees, while Tusayan (n=300) and Little Colorado (n=17) are unimodal, with peaks at 31-35 degrees and 21-25 degrees, respectively (Figure 25).

Cibola and Chuska wares also display a third smaller peak at 10-15 degrees; again, with the exception of Little Colorado (n=17), Chuska wares exhibit the highest proportion of very acute indentations. Overall, the Cibola and Chuska ware distributions are fairly similar, while the Mesa Verde distribution is noticeably skewed towards the right (towards less acute angles) and both Tusayan and Little Colorado distributions are clearly skewed towards the left (towards more acute angles).
These results generally corroborate the Chaco Project findings that Chuska wares exhibit relatively low metric variation in certain technological traits (rim diameter, rim fillet width, and rim flare), but more variation in surface manipulation (Toll and McKenna 1997:200-203). It may be that indentation angle is more decorative than technological, and thus is not necessarily tied to specific production units. Given the multimodal distribution of indentation angles, particularly for Chuska wares, other possibilities are that our current corrugated ware classification combines different emic vessel categories, or that multiple production units are represented.
**Indentation Direction**

There has been some debate whether coiling direction and indentation/pinching direction are related to handedness of the potter or intercultural differences. Hall (1932) first noted differences between indentation angles on corrugated sherds, and proposed that this was a function of the hand used for pinching. He also suggested that the angle or direction of indentation is inversely related to the direction of coiling; specifically, he proposed that rotating the vessel with the left hand while coiling results in a clockwise/right-moving coiling pattern and pinching with the left thumb results in a counterclockwise/left-moving indentation pattern, and vice versa.

Thus, one should be able to ascertain the direction of vessel construction (coiling) by observing the orientation of indentations. Hall (1932) reported significant differences in the occurrence of right versus left-handed coiling on corrugated vessels between geographic areas using this method (Table 10). Although his sample sizes were small, Hall (1932) reported a preponderance of right-handed coiling and pinching in the Western Ancestral Pueblo area, and a prevalence of left-handed coiling and pinching in the Mesa Verde, Mimbres, and Rio Grande areas. A sample of 117 sherds from Chaco Canyon was also incorporated into this study, 16 percent of which displayed left-handed coiling.

Snow (1983) examined the relationships proposed by Hall (1932) and concluded that the correlation between coiling and indentation direction was not solely the result of genetic differences related to handedness. Because the occurrence of left-handedness in normal populations is generally 10 to 11 percent, handedness alone cannot account for the proportion of sherds displaying left-handed coiling and pinching in the Mesa Verde.
(47%), Mimbres (68%), SE New Mexico and Lower Rio Grande (35%), and Rio Grande and Eastern Peripheral (30%) areas. Snow (1983) proposed that the correlation between the direction of coiling and indentation may instead be related to directional symbolism in Pueblo ritual circuitry. Clockwise or “antisunwise” appears to be the primary direction of ritual movement among the Tanoan Pueblos, whereas counterclockwise or “sunwise” is most common among the Western and Keresan Pueblo sacred circuits. Using ethnographic data, Snow (1983) discussed how vessels intended for ritual use are intentionally manufactured following this ceremonial movement, and vessels intended for tourist trade are intentionally manufactured in the opposite direction of this ritual movement.

Table 10. Distribution of clockwise/left-hand coiling and counterclockwise/right-hand coiling in utility wares based on direction of pinching from Hall’s (1932) study, as revised by Snow (1983:Table 1).

<table>
<thead>
<tr>
<th>Geographic Area</th>
<th>Clockwise Coil (Left Hand)</th>
<th>Counterclockwise Coil (Right Hand)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mimbres</td>
<td>68%, n=141</td>
<td>32%, n=67</td>
</tr>
<tr>
<td>Mesa Verde</td>
<td>47%, n=42</td>
<td>53%, n=48</td>
</tr>
<tr>
<td>SE New Mexico and Lower Rio Grande</td>
<td>35%, n=97</td>
<td>65%, n=184</td>
</tr>
<tr>
<td>Rio Grande and East Peripheries</td>
<td>30%, n=588</td>
<td>70%, n=1352</td>
</tr>
<tr>
<td>Chaco Canyon</td>
<td>16%, n=19</td>
<td>84%, n=98</td>
</tr>
<tr>
<td>Acoma, Laguna, and Grants area</td>
<td>10%, n=60</td>
<td>90%, n=565</td>
</tr>
<tr>
<td>Northeastern Arizona</td>
<td>6%, n=43</td>
<td>94%, n=738</td>
</tr>
<tr>
<td>West Puerco and Upper Little Colorado</td>
<td>5%, n=37</td>
<td>95%, n=658</td>
</tr>
<tr>
<td>Zuni and El Morro Valley</td>
<td>5%, n=41</td>
<td>95%, n=823</td>
</tr>
<tr>
<td>Lower Little Colorado</td>
<td>4%, n=83</td>
<td>96%, n=2014</td>
</tr>
</tbody>
</table>
Of the 11,288 indented corrugated sherds included in the Pueblo Bonito mounds detailed analysis for which indentation direction could be determined, the large majority exhibit right-handed/clockwise pinching (90.9%) (Table 11). The highest incidence of left-handed/counterclockwise pinching is represented in the Mesa Verde Gray Ware (40%), and low incidences are represented in the other wares from the San Juan Basin and Western Anasazi areas, similar to Hall’s (1932) findings. Cibola Gray Ware vessels, which are most likely to be representative of locally manufactured pottery from Chaco, display 7.9 percent left-handed pinching. This is similar to Pueblo III Cibola area gray ware assemblages, which exhibit about 10 percent left-handed pinching (Matthew Peebles, personal communication 2010), but is significantly lower than the incidence reported for Hall’s Chaco sample (16%), perhaps as a result of his small sample size and mixing of wares.

**Table 11. Coiling/pinching direction by ware for the Pueblo Bonito mounds assemblage.**

<table>
<thead>
<tr>
<th>Ware</th>
<th>Left-handed/Counterclockwise Pinching (Clockwise Coil)</th>
<th>Right-handed/Clockwise Pinching (Counterclockwise coil)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chuska Gray Ware</td>
<td>8.9% (n=480)</td>
<td>91.1% (n=4931)</td>
<td>n=5411</td>
</tr>
<tr>
<td>Cibola Gray Ware</td>
<td>7.9% (n=419)</td>
<td>92.1% (n=4864)</td>
<td>n=5283</td>
</tr>
<tr>
<td>Little Colorado Gray Ware</td>
<td>17.6% (n=3)</td>
<td>82.4% (n=14)</td>
<td>n=17</td>
</tr>
<tr>
<td>Mesa Verde Gray Ware</td>
<td>40.0% (n=111)</td>
<td>60.0% (n=166)</td>
<td>n=277</td>
</tr>
<tr>
<td>Tusayan Gray Ware</td>
<td>6.0% (n=18)</td>
<td>94.0% (n=282)</td>
<td>n=300</td>
</tr>
<tr>
<td>Total</td>
<td>9.1% (n=1031)</td>
<td>90.9% (n=10257)</td>
<td>n=11288</td>
</tr>
</tbody>
</table>
Significant differences revealed by Chi-square analysis include less left-handed/clockwise-coiled Cibola and Tusayan sherds than expected, many more left-handed/clockwise-coiled Mesa Verde sherds than expected, and fewer right-handed/counterclockwise-coiled Mesa Verde sherds than expected (p<0.001, $\chi^2=334.16$). The pattern of counterclockwise coiling observed on gray ware sherds from the mounds is also verified by larger vessels/vessel portions from Pueblo Bonito; Judd (1954:188) reports that 28 of the 29 gray ware jars recovered from his excavations of Pueblo Bonito are coiled counterclockwise/right-handed.

The distribution of coiling/indentation direction across wares indicates that this technological attribute is neither randomly distributed nor tied to specific production units; rather, directionality in vessel manufacture appears to cross the boundaries of different ceramic traditions in the Ancestral Pueblo/Anasazi area. There is little difference in the ratio of left-handed-to-right-handed pinching between Cibola and Chuska sherds. This may relate to cultural similarity between the two areas, both in ceramic technological style and/or ideas of ritual circuitry. If populations from the Cibola and Chuska areas participated most heavily in ceremonial activities in the canyon, as has been proposed by various researchers, then similarity in esoteric symbolism may be expected. Furthermore, the continued predominance of right-handed pinching in corrugated wares in the Cibola area from the Pueblo III period and later may indicate some degree of continuity in cultural identity, at least on a large scale, despite significant population reorganization. The differences apparent in Mesa Verde wares may indicate less intense contact with the potters of other regions and/or differences in ideology and
ritual practice, as indicated by divergences in other aspects of material culture such as ritual architecture.

**Indentation Pattern**

Because indentation pattern involves the entire vessel surface, it would seem to be the most highly visible and decorative attribute in the analysis. Indentation pattern was recorded in two different ways—first, by the effect created by the placement of indentations in relation to one another, including diagonal, vertical, or random; and second, by the presence or absence of zoning/patterning, or incising/tooling (see Methods: Attributes Recorded). Overall, the assemblage is dominated by diagonal (48.7%) and random (44.2%) indentation patterns (Table 12).

Some significant differences exist between wares; Chuska and Mesa Verde wares include many more diagonally patterned sherds and fewer randomly patterned sherds than expected, while Tusayan and Cibola wares include fewer diagonally patterned sherds and more randomly patterned sherds than expected (p<0.001, $\chi^2=121.76$). Mesa Verde and Tusayan wares also include fewer vertically patterned sherds than expected, and Cibola wares contain more vertically-patterned sherds than expected.

In addition to the overall pattern of indentation, variation in the appearance of corrugated vessels may also be created by the utilization of different corrugation types arranged in either horizontal bands (zoning) or in patterns such as zig-zags or spirals. Although zoned and/or patterned vessels comprise very minor percentages of each ware, they are relatively more common among Chuska Gray Ware examples (4.0%, n=1188), followed by Tusayan Gray Ware (2.2%, n=17), Cibola Gray Ware (1.5%, n=496), and Mesa Verde Gray Ware (0.4%, n=6). The association of patterning/zoning and Chuska
Gray Ware was also noted by Chaco Project analysts (Toll and McKenna 1997:197-200). Creating such elaborations and embellishments in surface appearance, while maintaining vessel integrity, would have necessitated great skill and familiarity in corrugated ware production.

**Table 12. Distribution of indentation patterns across wares.**

<table>
<thead>
<tr>
<th>Ware</th>
<th>Diagonal Indentation Pattern</th>
<th>Random Indentation Pattern</th>
<th>Vertical Indentation Pattern</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chuska Gray Ware</td>
<td>2471</td>
<td>1814</td>
<td>209</td>
<td>4494</td>
</tr>
<tr>
<td></td>
<td>55%</td>
<td>40%</td>
<td>5%</td>
<td></td>
</tr>
<tr>
<td>Cibola Gray Ware</td>
<td>1875</td>
<td>1961</td>
<td>223</td>
<td>4059</td>
</tr>
<tr>
<td></td>
<td>46%</td>
<td>48%</td>
<td>6%</td>
<td></td>
</tr>
<tr>
<td>Little Colorado Gray Ware</td>
<td>10</td>
<td>3</td>
<td>--</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>77%</td>
<td>23%</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>Mesa Verde Gray Ware</td>
<td>154</td>
<td>70</td>
<td>4</td>
<td>228</td>
</tr>
<tr>
<td></td>
<td>68%</td>
<td>30%</td>
<td>2%</td>
<td></td>
</tr>
<tr>
<td>Tusayan Gray Ware</td>
<td>87</td>
<td>149</td>
<td>7</td>
<td>243</td>
</tr>
<tr>
<td></td>
<td>36%</td>
<td>61%</td>
<td>3%</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>4398</td>
<td>3997</td>
<td>443</td>
<td>9037</td>
</tr>
</tbody>
</table>

**Breakage Pattern**

The way that coils are joined together determines the morphology of breaks that occur along coil junctures (Rice 1987; Schleher and Ruth 2005:5). Breakage pattern was classified as slanted, straight, or both (if two breaks with different morphologies were observed on the same sherd). Slanted breaks are the most common (44.6%) in the assemblage, followed by both slanted and straight (31.3%) and straight (24.3%) (Table 13). Although sherds displaying slanted breaks are most numerous within each ware,
there are some significant differences between wares. Chi-square analysis reveals that Mesa Verde Gray Ware examples depart most significantly from the others; namely, there are many more sherds with straight breaks than expected, and fewer sherds with both angled and straight breaks than expected (p<0.001, $\chi^2=35.1$). In addition, Cibola Gray Ware vessels contain less straight and more slanted breaks than expected, as do Tusayan Gray Ware. Interestingly, Chuska Gray Ware displays less slanted breaks than expected.

Coil joining techniques, as seen through breakage patterns, are not randomly distributed across wares in this assemblage. While Mesa Verde Gray Ware departs the most dramatically from the other wares, there is significant variation in breakage patterns within each ware, suggesting that the utility wares in the Pueblo Bonito mounds are the product of multiple production loci.

Table 13. Distribution of breakage patterns across wares.

<table>
<thead>
<tr>
<th>Ware</th>
<th>Slanted</th>
<th>Straight</th>
<th>Both</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chuska Gray Ware</td>
<td>43.2%</td>
<td>24.9%</td>
<td>31.9%</td>
<td>4921</td>
</tr>
<tr>
<td></td>
<td>n=2125</td>
<td>n=1224</td>
<td>n=1572</td>
<td></td>
</tr>
<tr>
<td>Cibola Gray Ware</td>
<td>46.1%</td>
<td>23.0%</td>
<td>30.9%</td>
<td>4315</td>
</tr>
<tr>
<td></td>
<td>n=1989</td>
<td>n=991</td>
<td>n=1335</td>
<td></td>
</tr>
<tr>
<td>Little Colorado Gray</td>
<td>40.0%</td>
<td>30.0%</td>
<td>30.0%</td>
<td>10</td>
</tr>
<tr>
<td>Ware</td>
<td>n=4</td>
<td>n=3</td>
<td>n=3</td>
<td></td>
</tr>
<tr>
<td>Mesa Verde Gray Ware</td>
<td>41.1%</td>
<td>36.4%</td>
<td>22.5%</td>
<td>236</td>
</tr>
<tr>
<td></td>
<td>n=97</td>
<td>n=86</td>
<td>n=53</td>
<td></td>
</tr>
<tr>
<td>Tusayan Gray Ware</td>
<td>51.1%</td>
<td>20.1%</td>
<td>28.8%</td>
<td>264</td>
</tr>
<tr>
<td></td>
<td>n=135</td>
<td>n=53</td>
<td>n=76</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>4350</td>
<td>2357</td>
<td>3039</td>
<td>9746</td>
</tr>
</tbody>
</table>
**Discussion**

This examination of technological attributes indicates that Indented Corrugated sherds from the Pueblo Bonito mounds vary both between and within wares. Indentation angle, coil width, indentation width, and indentation pattern vary most significantly by ware, indicating that these attributes were important aspects of technological style. Direction of vessel construction is similar across wares, but varies dramatically between spatially disparate regions. As proposed by Snow (1983), it is possible that indentation/coiling direction is related to widely shared ideas of ritual circuitry.

The CVs of the metric attributes examined in this analysis are all above 10 percent, ranging from 12.73 percent to 30.71 percent. Thus, the variation exhibited in the assemblage is within the range recorded for other archaeological contexts in the Southwest (Schleher 2010). In general, Chuska and Tusayan Indented Corrugated gray wares display the least variation in technological attributes, indicating production within smaller/more concentrated production areas and/or by fewer potting groups. Cibola and Mesa Verde Indented Corrugated gray wares, on the other hand, display relatively more variation in traits related to vessel construction and thus were likely produced within fairly large/diffuse production areas and/or by multiple potting groups.

Chuska Gray Ware examples exhibit a greater degree of standardization in certain technological traits—including sherd thickness, coil width, indentation distance, and coiling direction—compared to other wares. Although the CVs of these attributes are low relative to other wares, they are not dramatically lower. Ceramic production likely involved multiple household-level production units and, based on similarities in technological attributes, these units were likely interacting relatively closely.
Interestingly, less standardization is displayed in indentation angle, indentation pattern (particularly zoning/patterning), and breakage pattern.

It may be that the traits containing less variation constitute part of a shared technological style, while those exhibiting more variation, particularly those related to surface manipulation, were not emphasized during the learning process. Adherence to this technological style may also represent temporal consistency in learning/teaching frameworks in the Chuska area, resulting in intergenerational standardization (Schleher 2010). As noted by Toll (2006:114) “it seems clear that gray ware also had to ‘look right’, and its appearance conformed to standards over hundreds of years, just as did white ware.” Perhaps the relatively more standardized attributes noted above were more essential to how a “proper” cooking vessel should look than certain aspects of surface decoration. It is possible that Chuska Gray Ware vessels, in addition to having functional advantages due to the presence of trachyte temper, were desirable in the degree to which they more consistently displayed ideal utilitarian vessel characteristics than other wares. Another possibility is that manipulations, including patterning and zoning, identified the work of individual potters or production units/communities in the Chuska area.

Tusayan Gray Ware, which comprises just one percent of the total gray ware recovered from the trenches, exhibits relatively low degrees of variation in most technological attributes, particularly coil width, indentation distance, and indentation angle. Tusayan Gray Ware is most similar to Cibola Gray Ware in indentation direction, indentation pattern (including presence of zoning/patterning), and breakage pattern. However, it departs significantly from all other wares in coil width and indentation angle (with the exception of Little Colorado Gray Ware). Tusayan utility wares imported into
the canyon thus appear to have been made by fewer production units than Cibola or Mesa Verde Gray Wares. Given the similarity between Cibola and Tusayan Gray Wares in certain technological attributes, production units in these two regions likely had shared standards and/or some degree of contact.

In addition to displaying the highest degree of variation, Mesa Verde Gray Ware departs the most significantly from other gray wares in almost every aspect of technological style considered—coil width, indentation distance, indentation/coiling direction, indentation angle, and coil joining techniques (breakage pattern). This suggests that the gray ware production units in the Northern San Juan region that made the pots imported into Chaco Canyon may have had limited contact/interaction with production groups to the south.

Cibola Gray Ware also contains a significant amount of intraware variation in the attributes examined, particularly in coil width, indentation distance, sherd thickness, indentation angle, and indentation patterning. Even if Cibola wares were produced locally in the canyon, these results indicate that they were produced elsewhere as well. Like Tusayan and Chuska Gray Wares, indentation/coiling direction is predominantly right-handed and coils tend to be joined in such a way that breakage is slanted.

In order to further examine the variation within the Cibola Gray Wares from the mounds, two K-Means Cluster analyses were performed on a random sample of 500 Indented Corrugated sherds—the first utilizing a five-cluster solution for the attributes of indentation distance, sherd thickness, and coil width; and the second utilizing a four-cluster solution for the attributes of indentation angle, coil width, and indentation distance. The relative frequency of these clusters in the mounds was then examined.
through Chi-Square analyses. These analyses indicate that there are statistically significant differences between the East and West mounds in the frequency of various groups or clusters. Specifically, the frequencies of different clusters vary inversely between the two mounds. In the first case, which includes indentation angle, the East Mound contains significantly fewer Group 1 sherds, more Group 2 sherds, and more Group 3 sherds than expected, while the West Mound contains the inverse $\chi^2(4, n=500)=18.21$, $p=0.001$. In the second analysis, which includes sherd thickness, the East Mound contains more Group 2, fewer Group 3, and fewer Group 4 sherds than expected, while the West Mound contains fewer Group 2, more Group 3, and more Group 4 sherds than expected $\chi^2(3, n=500)=185.82$, $p=<0.001$.

These results suggest that portions of the Cibola Gray Ware assemblages in the East and West Mounds were made by different production units. Given the temporal difference noted between the mounds based on multiple material classes, this may be related to shifts/reconfigurations in trade relationships within the Cibola area over time. Evidence also suggests that at least two social groups or house societies may have resided in Pueblo Bonito (Akins 1986; Heitman and Plog 2005; Mills 2008; 2015; Schillaci and Stojanowski 2002:348-349; Schillachi 2003). If discard is correlated with location of residence within the structure, or with construction and use of different great kivas (Mills 2015), then the differences in utility wares between the mounds may indicate that each group had distinct relationships within the larger Cibola region. Although only a few technological traits were included in this analysis, and the inclusion of other attributes may have resulted in delineation of different clusters, similar attributes have been found to correlate with distinct compositional groups of gray ware within the Cibola area (e.g.,
Peeples 2010). While the number of different production units represented in the Cibola Gray Ware from the mounds is not necessarily approximated by the number of clusters defined here, this analysis demonstrates that the variation present is not randomly distributed.

**Consumption and Discard**

The manner in which utilitarian ceramic vessels were utilized at Pueblo Bonito is closely tied to the function of the great house, both in relation to other great houses and to small houses. It has been proposed that the large great houses in the canyon core, such as Pueblo Bonito and Pueblo Alto, were locations of periodic and large-scale ceremonial gatherings that involved the preparation and consumption of food (Lekson et al. 1988; Toll 1984). On the other hand, it has also been suggested that Pueblo Bonito served a primarily residential function (e.g., Wills 2001). These two interpretations have different implications for the use and discard of cooking and storage vessels. The following discussion examines how gray ware vessels were utilized at Pueblo Bonito, including the material evidence for both normal domestic use and possible feasting. In addition, given that at least half of the gray ware in the mounds is clearly imported, potential functional differentiation between wares is also considered.

Previous studies (e.g., Blinman 1989; Mills 2007; Wills and Crown 2004; Potter 2000; Spielmann 1998; Van Keuren 2001) have primarily utilized two lines of ceramic evidence to identify the presence of potential feasting in the archaeological record—the ratio of cooking vessels to serving vessels and the distribution of the sizes of these vessels. A high jar-to-bowl ratio implies an excess breakage of cooking jars related to
food preparation, while a low ratio implies an excess breakage of serving bowls related to food consumption (Blinman 1989:118). In addition, multimodal size distributions are thought to indicate the existence of separate size classes of vessels; smaller cooking vessels are interpreted as related to normal domestic food preparation while larger cooking vessels are thought to be used for food preparation related to suprahousehold feasting (e.g., Hayden 2001; Potter 2000).

**Whole Vessels: Context**

Judd (1954) reports the recovery of 29 “cooking pots” from Pueblo Bonito. Handles are noted on six of the pots, with lugs more common on larger pots and loop handles more common on smaller pitcher-like forms. These vessels/vessel portions were found in varying contexts, including both kivas and rooms (Judd 1954:188). Four large corrugated gray ware vessels with flared rims were found partially buried within the floor of Room 128, apparently for storage purposes; two of these vessels had patterned corrugations, the base of one was missing and had been reformed utilizing adobe, and grass seeds were found within another. It appears that these pots were cracked and/or otherwise exhausted for cooking activities, and were then repurposed as storage vessels. From the photo provided by Judd (1954: Plate 52), the vessels appear to be sooted, which supports this interpretation. One vessel was found in Room 309, described by Judd (1954:188) as “a ceremonial chamber built of second-type masonry abutting an older wall.” Five restorable neck-corrugated vessels were found beneath the floor of Room 323, which was constructed in AD 925. From Judd’s photo (1954: Plate 50), one appears to be Kana’a or Wide Neckbanded and two have patterned corrugations. In addition, one vessel was recovered embedded within the floor of Room 348; three vessels were found
in Kivas H, U, and W; and 15 additional vessels were found in apparently domestic rooms with “third-type” and “fourth-type” masonry styles. Of the 29 pots, Judd (1954:188) notes that only five are from “Old Bonitian” contexts.

A total of 20 corrugated gray ware jars were recovered from the Hyde excavations of Pueblo Bonito, as reported by Pepper (1920: Table 2): one each from Rooms 20 (a miniature vessel), 39b, 60, 64, 80, 82, 86, 109, 130, 140, 141, and 160; two each from Rooms 39 and 105; and three from Room 38 (which may actually be corrugated bowls according to the narrative description). Unfortunately, neither descriptions (form and/or specific context of recovery) nor measurements are provided for the majority of these vessels, with the exception of the miniature jar from Room 20, the jar from the floor of Room 60 described as containing seeds and red paint (1920:221), and the restorable tooled neck corrugated jar found on the floor of Room 85 (1920:Fig. 121).

A total of four restorable gray ware jars are reported from Pueblo Alto, including one each from Floor 1 and 2 of Room 145, two from Floor 2 of Room 103, and one from the fire pit of Room 110 (Toll and McKenna 1987:178). Thomas Windes (cited in Toll and McKenna 1987:178) noted that there was a general tendency for “short, squat culinary jars to be found on room floors”

No whole or restorable gray ware vessels were found in either the Pueblo Bonito mounds or the Pueblo Alto mound (Toll and McKenna 1987). Taken together, these vessels found in situ indicate that gray ware vessels were used in rooms and kivas, for cooking and storage, but not generally associated with burials.
**Vessel Form: Cooking vs. Serving**

The Pueblo Bonito mounds ceramic assemblage is comprised of 53.9 percent gray ware jars, 16.0 percent white ware bowls, and 4.4 percent red ware/brown ware bowls, resulting in a cooking jar-to-serving bowl ratio of 2.64 (Table 14; Figure 26). The mounds differ somewhat from one another, in that the West Mound has a slightly lower percentage of gray ware jars, a slightly higher percentage of white ware bowls, and a slightly lower percentage of red ware/brown ware bowls, resulting in a lower ratio of 2.54 compared to 2.76 for the East Mound. The proportion of gray ware jar sherds recovered from trash contexts within Pueblo Bonito itself appears to be similar to that of the mounds, at least based on Judd’s (1954:187) account of the material recovered from Room 323 (dated to AD 935), which was used as a dump; out of 24,587 sherds within the trash fill, 53.6 percent were reported to be utility wares.

**Table 14. Occurrence of utility jars and non-utility bowls by provenience.**

<table>
<thead>
<tr>
<th></th>
<th>Gray ware jars</th>
<th>White ware bowls</th>
<th>Red ware, Brown ware, and Exotic ware bowls</th>
<th>Gray ware jars: serving bowls</th>
<th>Total (all forms)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>West Trench</td>
<td>53.1% n=30950</td>
<td>16.7% n=9712</td>
<td>4.2% n=2449</td>
<td>2.54</td>
<td>58,319</td>
</tr>
<tr>
<td>Middle Trench</td>
<td>51.0% n=4597</td>
<td>16.2% n=1458</td>
<td>3.8% n=341</td>
<td>2.56</td>
<td>9,020</td>
</tr>
<tr>
<td>East Trench</td>
<td>55.1% n=30648</td>
<td>15.2% n=8462</td>
<td>4.7% n=2635</td>
<td>2.76</td>
<td>55,576</td>
</tr>
<tr>
<td>Total Pueblo Bonito Mounds</td>
<td>53.9% n=66195</td>
<td>16.0% n=19632</td>
<td>4.4% n=5425</td>
<td>2.64</td>
<td>122,915</td>
</tr>
</tbody>
</table>

*counts include all samples for exotic wares and both full and simple sort samples for gray ware and white wares
Figure 26. Proportions of gray ware jars and serving bowls from the Pueblo Bonito mound assemblage by provenience.

The proportions of gray ware jars (35.6%) and white ware/red ware/brown ware bowls (41.9%) reported for the Pueblo Alto trash mound detailed sample (n=5367) equate with a cooking jar-to-serving bowl ratio of 0.85; this departs significantly from the ratio calculated for the Pueblo Bonito mounds. However, based on the Chaco Project ceramic rough sort database, the Alto trash mound assemblage (n=38,036 sherds) contains 53.5 percent gray ware jars and 18.4 percent white ware and red ware/brown ware bowls, resulting in a much higher cooking jar-to-serving bowl ratio of 2.9 (Figure 27). Of the entire rough sort sample from all proveniences (n=90,145 sherds), gray ware jars and white ware/red ware/brown ware bowls comprise 53.2 and 17.1 percent, respectively, yielding an even higher ratio of 3.1. It appears that the Pueblo Alto detailed
sample, which was comprised almost entirely of rims, overrepresented bowls, as they produce more rim sherds, and underrepresented jars, as they produce significantly fewer rim sherds (see also Plog and Watson 2012).

Perhaps somewhat unexpectedly, the ceramic assemblages of the small sites of 29SJ629 and 29SJ627 have slightly lower cooking jar-to-serving bowl ratios than the assemblages of both Pueblo Bonito and Pueblo Alto (Figure 27). A ratio of 2.1 was calculated for the Chaco Project rough sort ceramic assemblage (n=84477) from 29SJ627, including 57.5 percent gray ware jars and 27.5 percent white ware/red ware/brown ware bowls. Similarly, the rough sort assemblage from 29SJ629 (n=32724) contains 62.2 percent gray ware jars and 32.5 percent serving bowls, which equates with a cooking-to-serving vessel ratio of 2.5.

Figure 27. Relative proportions of gray ware jars and serving bowls by site.
Powers et al. (1983: Appendix D, Table 2) provide ceramic ware and type frequencies for sample assemblages from several Chacoan great houses, both within and outside of the canyon. Although vessel form is not included in the published data, based on the observation that virtually all of the utility wares from Chacoan sites are jars, and in conjunction with evidence indicating that white ware (rather than utility ware) jars were mostly used for storage and water transport purposes, gray ware ceramics are interpreted as primarily cooking vessels; thus, the relative percentage of gray ware ceramics is used here as a proxy for the general proportion of cooking vessels in an assemblage for the purposes of comparison across sites. The Pueblo Bonito, Pueblo Alto (Toll and McKenna 1987, 1997), and Salmon Ruin excavated assemblages are compared with sample assemblages from five canyon great houses (Chetro Ketl, Pueblo del Arroyo, Una Vida, Penasco Blanco, and Tsin Kletsin) and ten outlying great houses (Andrews, Bis’sa ani, Casamero, Guadalupe, Kin Bineola, Kin Klizhin, San Mateo, Kin Ya’a, Twin Angels, and Pueblo Pintado). Only sites with recorded assemblages totaling more than 100 sherds were included. In addition, sites with no reported gray ware and those with conflicting ceramic data (particularly between Marshall et al. 1979 and Powers et al. 1983) were not included. Among the seven canyon great houses considered, gray ware comprises between 33.5 and 64.2 percent (mean = 50.3%) of the total ceramic assemblage (Figure 28); this range is significantly lower than that of the ten outlying great houses included in this comparison, which vary from 48 to 80.9 percent (mean=63.2%).

Interestingly, of the “downtown” great houses included in this comparison, the Pueblo Bonito ceramic assemblage has the highest proportion of utility ware. This may indicate that food preparation was emphasized over food consumption at the site, and/or
it may simply be a product of the sheer size of the pueblo (eating out of common pots, for example). Perhaps, as noted by Wills (2001:442) concerning the high sherd density in the Pueblo Alto midden, the elevated quantity of utility ware in the Pueblo Bonito mounds is the result of “a larger and more intensive occupation generating a larger amount of household debris.” Alternatively, distance from the canyon may be the underlying cause of this variation. If higher proportions of non-utility ceramics associated with canyon sites are related to differences in the activities associated with these locations, and if direct Chacoan influence decreased with distance from the canyon, then it might be expected that great houses located closer to the canyon would have ceramic assemblages more similar to canyon sites than would outliers.

Figure 28. Relative percentages of gray ware ceramics from various Chacoan great house sites. Gray denotes great house sites located in Chaco Canyon.
Pearson product-moment correlation coefficients were computed to assess the relationship between gray ware proportion and great house (both excavated and unexcavated) size, as approximated by the estimated number of rooms (ranging from 12 to 695); the scale of ritual/integrative activity, as approximated by the frequency of kivas (including both Great Kivas and smaller roomblock kivas) at each site (ranging from 1 to 35); and distance from the Chaco Canyon core area (ranging from 0 to 60 miles). There is not a significant correlation between gray ware percent and site size \(r= -0.390, n=17, p=0.110\); however, the results do suggest a slight tendency for smaller sites to contain larger proportions of utility ware (or smaller proportions of decorated ceramics) than larger sites (Figure 29). There is an even weaker link between gray ware percent and the number of kivas associated with each site \(r=-0.321, n=17, p=0.194\) (Figure 30).

![Figure 29. Scatterplot of estimated number rooms and proportion of gray ware ceramics (with regression line).](image)

\[ R^2 = 0.1518 \]
On the other hand, there is a significant, if somewhat weak, positive correlation between gray ware percentage and distance from the canyon \([r=0.495, n=17, p=0.037]\). In general, as distance from downtown Chaco increases, so does the proportion of utility ware; or, to reverse this, the consumption of decorated ceramics is higher at downtown great houses (Figure 31). Overall, the relative proportions of culinary jars associated with Chacoan great house sites, as approximated by the percentage of utility ware comprising their respective ceramic assemblages, appears to be related to proximity to the core area, rather than to structure size or the number of integrative/ritual facilities present.
Figure 31. Scatterplot of distance from the canyon core area and proportion of gray ware ceramics (with regression line).

Other Ancestral Pueblo sites appear to have higher cooking: serving vessel ratios than even outlying Chacoan great houses. In her study of site typology along the Lower Chaco River, Sebastian (1983) concludes that sites with evidence for long-term residential occupation—including residential structures, internal hearths, middens, and storage features—typically had ceramic assemblages comprised of 70 percent utility ware and 30 percent decorated ware. Sebastian (1983) also notes that about half of the decorated ware assemblage (or 12 to 15 percent) was comprised of bowls. Based on these proportions, the cooking-to-serving vessel ratio at residential sites in the Lower Chaco River area ranged from 4.5 to 5.8. In his examination of the ceramics from McPhee Village in the Dolores area, Blinman (1989: Table 2) reports jar:bowl ratios from nine roomblocks as ranging from 6.17 to 14.62. The roomblocks associated with high-ranking
ritual structures had jar: bowl ratios on the lower end of this spectrum and were interpreted as locales of potluck-style feasting.

In summary, the cooking:serving vessel ratio (or gray ware jar: non-utility ware bowl ratio) of the Pueblo Bonito mounds, while comparable to that of Pueblo Alto and to the small sites of 29SJ627 and 29SJ629, appears to be significantly lower than that of other Ancestral Pueblo sites. The overall proportion of the assemblage comprised of utility ware, which is argued to primarily represent culinary jars, is higher at Pueblo Bonito than at the other great house sites in the downtown/core area, but is generally lower than at outlying great houses. There is clearly a large amount of variation in ceramic assemblage composition that is not accounted for by the three variables (site size, kiva frequency, and proximity to the canyon core) considered here; incorporating other factors such as the size, occupation span, and nature of the community associated with each great house and the intensity of local ceramic production and/or trade, while outside the scope of this report, would likely yield interesting results. However, based on the preliminary assessments made here, the cooking: serving vessel ratio of the Pueblo Bonito mounds assemblage, and its similarity to that of other great house sites in the canyon, is interpreted as the result of the nature, rather than just the scale, of occupation and use of the site and the downtown Chaco area.

**Vessel Size Distribution**

The whole gray ware vessels from Pueblo Bonito reported by Judd (1954) are described as varying in diameter from 11.75 cm to 34.93 cm (with a mean of 23.01 cm) and in height from 12.07 cm to 40.01 cm (with a mean of 25.73 cm) (Table 15). In his comparison with 25 gray ware vessels recovered from Pueblo del Arroyo, Judd
(1954:189) notes that those from Pueblo Bonito average 7.6 cm smaller in both diameter and height, and those from Pueblo Arroyo exhibit more rim flare. No whole or restorable vessels were found from the Pueblo Bonito mounds during the current investigation.

Table 15. Reported measurements of whole gray ware vessels from sites in Chaco Canyon.

<table>
<thead>
<tr>
<th>Site Description</th>
<th>Mean Orifice Diameter (cm)</th>
<th>Orifice Diameter Range (cm)</th>
<th>Height (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pueblo Bonito Mounds</td>
<td>21.75</td>
<td>3 - 44</td>
<td>-</td>
</tr>
<tr>
<td>Pueblo Bonito Whole Vessels (Judd 1954; Pepper 1920)</td>
<td>23.01</td>
<td>11.75 – 34.93</td>
<td>25.73</td>
</tr>
<tr>
<td>Pueblo Alto, all proveniences (Toll and McKenna 1987)</td>
<td>21.50</td>
<td>8 – 35</td>
<td>-</td>
</tr>
<tr>
<td>Whole Vessels from Pueblo Alto and various small house sites (Toll and McKenna 1997)</td>
<td>17.95</td>
<td>5.6 – 26.0</td>
<td>26.74</td>
</tr>
<tr>
<td>Chaco Project Analysis (Toll and McKenna 1997)</td>
<td>21.3</td>
<td>7 - 42</td>
<td>-</td>
</tr>
<tr>
<td>Whole Vessels from 29SJ629</td>
<td>19.8</td>
<td>16 - 26</td>
<td>-</td>
</tr>
<tr>
<td>Whole Vessels from 29SJ627</td>
<td>21.4</td>
<td>6 - 32 (21-32)</td>
<td>-</td>
</tr>
<tr>
<td>Whole Vessels from 29SJ1360</td>
<td>19.8</td>
<td>14.5-24.3</td>
<td>-</td>
</tr>
</tbody>
</table>

The Chaco Project ceramic analysis included the examination of 282 whole vessels from Pueblo Alto and small sites in the canyon, including the “Bc” sites and unprovenienced pots donated to the Maxwell Museum, many of which were collected by Earl Morris and likely originated in the Chuska Valley. Of these, 37 were gray ware jars and 14 were gray ware pitchers (Toll and McKenna 1997:74). The gray ware jars had a mean orifice diameter of 17.95 cm, a range of 5.6-26 cm, and an average height of 26.74 cm.
Out of 63 whole vessels recovered from 29SJ627, 14 were gray ware jars (Toll and McKenna 1992:210). Four of these vessels were found in association with kivas, four in residential rooms, two in storage rooms, and four in ramada areas. Excluding two miniature vessels, the orifice of diameters of the jars averaged 21.4 cm and ranged from 20.5 cm to 32 cm. A total of 23 whole gray ware vessels were documented from 29SJ629 from a variety of contexts. The average orifice diameter of the 15 vessels for which measurements could be obtained ranged from 16 cm to 26 cm, with a mean of 19.8 cm (Toll and McKenna 1993:104). Similarly, 13 whole gray ware vessels recovered from 29SJ 1360 yielded orifice diameter measurements ranging from 12 cm to 23.5 cm, with a mean of 19.8 cm (1993:105).

Although the average orifice diameter of gray ware jars from the Pueblo Bonito mounds (21.8 cm; see Assemblage Summary: Vessel Size) is lower than that reported for the structure itself by Judd (1954), it is comparable to that documented for Pueblo Alto (Toll and McKenna 1987) and for all of the Chaco Project sites combined (Toll and McKenna 1997). Interestingly, the maximum orifice diameter recorded for the Pueblo Bonito mound assemblage (44 cm) exceeds that of all other reported assemblages in the canyon. However, it should be noted that 35 cm may be an artificial maximum for the Pueblo Alto assemblage, as noted previously.

The orifice diameters of Chuska and Cibola Gray Ware jars were found to be multimodally and unimodally distributed, respectively. Chuska Gray Ware jars have both the largest mean (23.4 cm) and the largest maximum (44 cm) orifice diameter, whereas Cibola Gray Ware jars had a lower mean (20.5 cm) and maximum (40 cm) orifice diameter. The multimodality of the orifice diameter distribution is also more pronounced.
in the West Mound than in the East Mound; this is likely a product of the higher proportion of Chuska Gray Ware in the West Mound. Mesa Verde, Tusayan, and Little Colorado gray ware jars were all found to have smaller mean orifice diameters than Chuska and Cibola Gray Ware in the Pueblo Bonito assemblage (18.3 cm, 18.7 cm, and 20 cm, respectively).

Differences between the size distributions of the various wares are most clearly depicted in cumulative frequency curves (Figure 32). These curves indicate the breakage of relatively small Tusayan and Mesa Verde Gray Ware jars, small-to-medium Cibola Gray Ware jars, and medium-to-large Chuska Gray Ware jars.

![Cumulative frequency curves for gray ware jar orifice diameters by ware.](image)
While generally similar patterns in the distribution of Chuska and Cibola Gray Ware orifice diameters are apparent in the Chaco Project data (Figure 33), there are some notable differences. Cibola Gray Ware vessels are more broadly distributed in the Pueblo Bonito assemblage, displaying many more small diameters as well as a larger maximum diameter. Chuska Gray Ware examples from the Pueblo Bonito assemblage also have a higher maximum orifice diameter and include more larger-sized vessels than in the Chaco project assemblages. In addition, the multimodal distribution of Chuska Gray Ware orifice diameters is more pronounced in the Pueblo Bonito assemblage.

Figure 33. Distribution of gray ware jar orifice diameters for Cibola and Chuska Gray Ware jars, Pueblo Bonito assemblage and combined Chaco Project assemblages.
The gray ware orifice diameter data from the Pueblo Bonito mounds thus supports the existence of separate size classes of culinary jars. When all utility jars are combined regardless of ware, these classes correspond with vessel sizes with average diameters of 22 to 24 cm (medium) and 34 to 36 cm (large). Chuska Gray Ware appears to have had an additional size class with an average diameter of 40 cm (very large). Although the distribution peaks in the larger size ranges may appear relatively small compared to those in the smaller size ranges, their significance should not be underestimated given the difference in the use-lives of small vs. large vessels. Ethnographic data indicate that small- and medium-sized culinary pots may outlast large ones by as much as five times (e.g., DeBoer and Lathrap 1979; Rice 1987:298-299).

In a study of whole vessels from Chaco Canyon, Trowbridge (2009) concludes that feasting practices at Chacoan great houses, including Pueblo Bonito, are reflected in distributions of both cooking vessel and decorated bowl sizes. In addition, she proposes an increased emphasis on feasting at the end of the Pueblo II and into the Pueblo III period, exhibited by a shift to larger vessel sizes and a unimodal, rather than bimodal, distribution. The temporal differences between the West and East Mounds, which arguably correspond to Pueblo II and late Pueblo II to Pueblo III periods, respectively, allow for a comparison with Trowbridge’s (2009) cooking vessel size distributions. The bimodality in the West Mound assemblage does support the presence of suprahousehold food preparation at Pueblo Bonito during the Classic Bonito phase, though the second peak in size is less prominent than that shown in Trowbridge’s (2009: Figure 3) data; this is likely a function of the small sample size of whole vessels (n=17 vessels for Pueblo Bonito, Pueblo del Arroyo, and Penasco Blanco). The distribution of gray ware jar
diameters in the East Mound is more normal than that in the West Mound, although some bimodality still exists. In addition, although the mean jar diameter increases slightly, the peak of the distribution remains within the size range of normal domestic use. Therefore, there does not appear to be a significant increase in the proportion of large (30-39 cm) and very large (>40 cm) culinary vessels in the Pueblo Bonito mounds over time. While multiple lines of evidence indicate a general temporal difference between the mounds, given both the temporal overlap between the two middens during the Pueblo II period and the inability to control for time stratigraphically in backfill deposits, this conclusion should be considered tentative.

**Usewear and Functional Differentiation**

Unfortunately, there is no consistent data on the degree of usewear present on whole gray ware vessels from Pueblo Bonito or Chaco Canyon in general. Although sooting on some of the vessels is apparent in published photographs (Judd 1954; Pepper 1920; Toll and McKenna 1987, 1992, 1997), sooting on whole vessels was systematically documented only for the small site of 29SJ629. Out of 20 whole gray ware vessels, 11 (55%) are recorded as sooted (Toll and McKenna 1993:104).

Toll and McKenna (1987: Table 1.42) note that sooting is present on 50.4 percent of the gray ware sherds from Pueblo Alto. They also identify a temporal trend towards increased sooting, in that “less than half of the grayware from all contexts assigned to time periods before AD 1040 is sooted, and more than half of those from almost all later contexts is sooted” (1987:172). Interestingly, less than ten percent of the gray ware sherds from the Pueblo Bonito mounds were recorded as sooted (Table 16). Given the photographs showing sooting on whole vessels from the structure and the large
proportion of the gray ware assemblage with mechanical usewear, the low incidence of sooting is likely related to postdepositional processes within the mounds. Based on the mound stratigraphy exposed in the trench walls, it appears that the midden deposits were subject to severe reworking through water activity (Wills 2010). Alluvial channels, some of them quite large, periodically traversed the mounds, and sherds of late ceramic types have been found within strata underlying those containing earlier types. Toll and McKenna (1987: 172) note that sherds exposed on the surface (such as at 29SJ629 and 29SJ627) exhibit far less sooting than sherds from buried contexts; for example, none of the 30 gray ware sherds from surface contexts included in the Pueblo Alto detailed sample were sooted.

### Table 16. Occurrence of Usewear and Sooting in the Gray Ware Assemblage.

<table>
<thead>
<tr>
<th>Ware Type</th>
<th>Heavy Usewear</th>
<th>Moderate Usewear</th>
<th>Heavy – Moderate Usewear</th>
<th>Sooting</th>
</tr>
</thead>
<tbody>
<tr>
<td>West Mound</td>
<td>11.0% n=730</td>
<td>79.6% n=5250</td>
<td>90.6% n=5980</td>
<td>10.3% n=684</td>
</tr>
<tr>
<td>Middle Trench</td>
<td>15.6% n=88</td>
<td>73.7% n=415</td>
<td>89.3% n=503</td>
<td>23.8% n=134</td>
</tr>
<tr>
<td>East Mound</td>
<td>12.4% n=1136</td>
<td>77.7% n=7100</td>
<td>90.1% n=8236</td>
<td>7.7% n=708</td>
</tr>
<tr>
<td>Chuska Gray Ware</td>
<td>12.2% n=918</td>
<td>76.7% n=5759</td>
<td>88.9% n=6677</td>
<td>9.9% n=743</td>
</tr>
<tr>
<td>Cibola Gray Ware</td>
<td>11.8% n=940</td>
<td>79.8% n=6347</td>
<td>91.6% n=7287</td>
<td>8.8% n=701</td>
</tr>
<tr>
<td>Mesa Verde Gray ware</td>
<td>13.1% n=52</td>
<td>77.3% n=307</td>
<td>90.4% n=359</td>
<td>10.1% n=40</td>
</tr>
<tr>
<td>Tusayan Gray ware</td>
<td>9.0% n=38</td>
<td>85.7% n=360</td>
<td>94.8% n=398</td>
<td>7.4% n=31</td>
</tr>
<tr>
<td>Total</td>
<td>12% n=1954</td>
<td>78.4% n=12785</td>
<td>90.4% n=14739</td>
<td>9.6% n=1564</td>
</tr>
</tbody>
</table>

Over 90 percent of the gray ware sherds from them Pueblo Bonito mounds have moderate-to-heavy mechanical usewear (Table 16); a total of 78.4 percent are recorded as having moderate usewear, and 12 percent show evidence for heavy usewear. The
incidence of usewear differs only slightly between the mounds and is not statistically significant. Similar to the findings for both white wares and exotics, Tusayan Gray Ware displays the highest percentage of moderate-to-heavy usewear (94.8%), followed by Cibola Gray Wares (91.6%), Mesa Verde gray wares (90.4%), and Chuska Gray Wares (88.9%) (Figure 34).

![Figure 34. Degree of usewear by ware.](image)

It has been suggested that there may have been a functional difference between Cibola and Chuska Gray Ware jars, with Chuska vessels perhaps preferred for cooking purposes. Quartz, the main tempering material in Cibola Gray Wares, expands when it is heated beyond a certain temperature; over time, repeated heatings cause damage to the
vessel (Rice 1987). Trachyte does not expand when heated, and therefore Chuska vessels have relatively greater thermal shock resistance (Hensler 1999; Hensler et al. 2002). In addition, as discussed previously, corrugated Chuska vessels have more coils and indentations per unit surface area than do other corrugated wares; by hindering crack propagation, this higher corrugation density would have also contributed to longer vessel use-life (Pierce 1999, 2005).

If Cibola and Chuska Gray Ware jars were utilized for different purposes, then distinctions in size, sooting, and usewear would be expected. Chuska jars do display a slightly higher percentage of sooting and burning (9.9%) compared to Cibola jars (8.8%), but this difference is not significant. For both wares, sooting and burning is more common on small jars than on larger jars. While 25 percent of Chuska and Cibola Gray Ware jars with orifice diameters less than 30 cm have evidence for sooting and burning, only 14 percent of the Chuska jars and 8 percent of Cibola jars with diameters greater than 30 cm are sooted. This pattern is similar for exterior usewear—a significantly lower percentage of large jars, both Cibola and Chuska, have evidence for heavy wear compared to smaller jars. In addition, average wall thickness for indented corrugated jar sherds is virtually identical between Chuska and Cibola wares, regardless of orifice diameter. Therefore, while there does not appear to be a functional difference between Chuska and Cibola wares in the small-to-medium size range, it appears that large Chuska vessels were used less intensively.

**Quantification of Ceramic Consumption: Rim Sherds**

Based on the number of rims recovered from the excavated portion of the Pueblo Alto Trash Mound (2.2% of the total mound), Chaco Project analysts estimated that the
midden contained the remains of over 150,000 ceramic vessels. Unmatched rim sherds were assumed to represent individual vessels and the density of rims was assumed to be relatively constant throughout the mound. Given low residential population estimates for the site, the rate of per capita domestic vessel consumption necessary to produce such deposits is virtually unprecedented in the archaeological and ethnographic record. As a result, it has been suggested that Pueblo Alto was a locale for large-scale feasting events that may have involved the ritual breakage of vessels.

The methodology involved in the Pueblo Alto vessel quantity projections has been questioned, even by the Chaco Project Analysts themselves: “estimating the ceramic population at any site and then arriving at per-annum and per-family use rates is a procedure fraught with guessing, assuming, fudging, and leaping” (Toll and Mckenna 1987:203; also see Plog and Watson 2012). Based on the disturbed nature of the excavated mound deposits within Judd’s trenches, such a projection for Pueblo Bonito would prove to be exceedingly tenuous. Consequently, no attempt will be made here to estimate the actual number of utility ware vessels present within the mounds. However, the average density of both total gray ware sherds and gray ware rim sherds per excavated midden volume is likely correlated with the intensity of utility vessel consumption, and may thus be compared both between the two Pueblo Bonito mounds and between the Pueblo Alto and Pueblo Bonito trash mounds.

Of the 10,590 rims included in the total Pueblo Bonito mounds ceramic assemblage, 3,367 or 31.8 percent are gray ware (Table 17). The East Mound contains a higher percentage of utility ware rims than does the West Mound, but the difference is slight. However, the mounds do differ significantly from one another in the density of
gray ware sherds; the West Mound contains more gray ware sherds, and more gray ware rim sherds, per cubic meter. A possible explanation for this lies in the fact that a higher percentage of the gray ware rims in the West Mound are Chuska wares (50%) compared to the East Mound (44%). As discussed previously, Chuska vessels have significantly larger orifice diameters than Cibola vessels. Although orifice diameter is strongly correlated with vessel volume, this relationship is not linear; small increases in diameter are associated with large increases in vessel volume. Therefore, jars with larger orifices will generate many more body sherds when broken than those with smaller orifices.

While the average gray ware jar orifice diameter is lower in the West Mound than the East Mound, the breakage of significantly larger jars would contribute exponentially more body sherds to the deposits.

Table 17. Summary of gray ware density in midden contexts.

<table>
<thead>
<tr>
<th></th>
<th>Gray ware Rims (%) of total rims, all wares</th>
<th>Gray ware rims/ m$^3$</th>
<th>Gray ware sherds (all)/ m$^3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pueblo Bonito Mounds</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>East Mound</td>
<td>31.8%</td>
<td>15</td>
<td>432*</td>
</tr>
<tr>
<td></td>
<td>$n=3367$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>West Mound</td>
<td>33.4%</td>
<td>13</td>
<td>370</td>
</tr>
<tr>
<td></td>
<td>$n=1656$</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>30.7%</td>
<td>17</td>
<td>495</td>
</tr>
<tr>
<td></td>
<td>$n=1506$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pueblo Alto Trash Mound</td>
<td>38.8%</td>
<td>26.3</td>
<td>374</td>
</tr>
<tr>
<td></td>
<td>$n=1429$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>29SJ629</td>
<td>19%</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>$n=212$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>29SJ1360</td>
<td>24%</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>$n=351$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>29SJ627</td>
<td>22%</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>$n=1247$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chaco Project, all sites</td>
<td>30.7%</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>$n=6178$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*excludes gray ware from the Middle Trench

While the density of gray ware sherds per excavated cubic meter in the Pueblo Alto Trash Mound is actually lower than that of the West Mound, and comparable to that
of the East Mound, the density of gray ware rim sherds is much higher. In addition, gray ware comprises a significantly larger percentage of the total Pueblo Alto Trash Mound rim assemblage. Including both rim and body sherds, the Pueblo Alto Trash Mound contains a surprisingly high proportion of gray ware jars (Plog and Watson 2012; Toll 2001; Toll and McKenna 1987, 1997). As discussed previously, Pueblo Alto has a higher cooking jar: serving bowl ratio than Pueblo Bonito. This cannot be accounted for by differences in ware alone, as the Pueblo Alto Trash Mound contains a significantly higher percentage of Chuska wares, and significantly lower percentage of Cibola wares, than the Bonito mounds. As noted above (see Vessel Size), Chuska Gray Ware jars from Pueblo Alto have a smaller maximum orifice diameter and display a more unimodal distribution in orifice size than those from Pueblo Bonito. It appears that while a relatively higher quantity of utility vessels was consumed at Pueblo Alto, larger sized jars were utilized at Pueblo Bonito.

It was not possible to calculate sherd and rim density for the excavated portions of the 29SJ627, 29SJ629, and 29SJ1360 small sites; however, significantly lower percentages of gray ware rims are reported by Chaco Project analysts (Toll and McKenna 1987, 1992, 1993). The average utility vessel size, as approximated by orifice diameter, is also lower in these assemblages compared to those of Pueblo Alto and Pueblo Bonito. Not surprisingly, it appears likely that relatively fewer, and smaller, utility vessels were consumed at small sites. In conclusion, the relative quantity of utility vessels consumed differs between Pueblo Bonito and Pueblo Alto, as well as between these two great houses and excavated small house sites.
Summary

In summary, a total of 97,461 gray ware sherds were recovered from excavated deposits in the Pueblo Bonito trash mounds. Almost 70 percent of these artifacts were individually analyzed, and 17 percent were subjected to intensive or detailed analysis. In terms of raw frequencies, the gray ware ceramic assemblage is derived equally from the East and West Mounds. Virtually all (99.9%) of the gray ware sherds were classified as jars, and Indented Corrugated is the dominant utility ware type (82%). The East Mound contains a higher proportion of Cibola, whereas the West Mound contains a higher proportion of Chuska Gray Ware. The distribution of gray ware types indicate a temporal difference between the East and West Mounds; the West Mound contains a higher percentage of early gray ware types (Plain, Neckbanded, and Clapboard Corrugated Gray), while the East Mound contains a higher proportion of Indented Corrugated Gray, everted/flared rims, and gray ware from the northern San Juan region.

The orifice diameters of gray ware jars average 21.5 cm and are distributed slightly bimodally, with peaks at 22 to 24 cm and 34 to 36 cm. Chuska Gray Ware jars have significantly higher mean and maximum orifice diameters (23.4 cm and 44 cm, respectively) than those of Cibola Gray Ware jars (20.5 cm and 40 cm, respectively). In addition, the orifice diameters of Chuska Gray Ware are more multimodally distributed (with 2-3 peaks) than those of Cibola Gray Ware (with a single peak). The West Mound has a lower mean gray ware orifice diameter than the East Mound; however, since the West mound contains a higher percentage of Chuska Gray Ware, it likewise displays a higher maximum orifice diameter and a more multimodal diameter distribution.

An examination of metric attributes recorded from indented corrugated sherds in the detailed sample indicates that Chuska Gray Ware, and to a lesser extent Tusayan Gray
Ware, is relatively more standardized than other gray wares. Chuska utility wares have narrower coils, more indentations per unit area, and generally display finer workmanship than the other gray wares in the assemblage. Cibola and Mesa Verde Gray Wares, on the other hand, exhibit the most metric variation; these data suggest that these wares were derived from larger production areas, likely encompassing disparate production units. A preliminary examination of the co-occurrence of technological attributes also suggests differences in the Cibola Gray Ware production units represented in each the East and West Mounds. Interestingly, Mesa Verde Gray Ware differs the most significantly from the other wares in the various technological attributes examined, suggesting that production units in the northern San Juan may have had little direct interaction with those in the Cibola and Tusayan areas at this time.

The cooking jar: serving bowl ratio of the Pueblo Bonito ceramic assemblage is slightly lower than that of Pueblo Alto, and slightly higher than that of the 29SJ627 and 29SJ629 small sites. The relative proportion of the Pueblo Bonito mound assemblage comprised of gray ware, used as a proxy for cooking vessel proportion for the sake of comparison with other sites, does not differ significantly from that of the Pueblo Alto assemblage. In addition, both Pueblo Alto and Pueblo Bonito have the highest proportions of gray ware of the large great houses in the canyon bottom, which in turn have generally lower proportions than outlying great houses. Variation in the prevalence of utility ware appears to be associated with proximity to the canyon, rather than site size. In terms of gray ware vessel size, the Pueblo Bonito mound assemblage contains the largest maximum orifice diameter, and one of the highest mean orifice diameters, of those documented from canyon sites thus far.
The majority of the gray ware assemblage exhibits evidence of usewear, particularly small-to-medium vessels. While it appears that large Cibola and Chuska jars were used less intensively than smaller vessels based on sooting and usewear, the multimodal distribution of Chuska Gray Ware orifice diameters, particularly within the larger size range, suggests that large Chuska jars were used differently than either smaller Chuska and Cibola jars or larger Cibola jars. The relatively low level of usewear evident on large (and very large) Chuska cooking pots is consistent with the interpretation that they were utilized less frequently; alternatively, the materials comprising Chuska vessels may be more resistant to wear than those used for Cibola vessels.

Compared to the Pueblo Alto Trash Mound, the excavated portion of the Pueblo Bonito mounds has a significantly higher gray ware sherd density, but a significantly lower gray ware rim sherd density. Since vessel surface area increases geometrically (rather than linearly) with increases in orifice diameter, significantly more body sherds will be produced from the breakage of larger vessels. Therefore, a greater density of gray ware rim sherds at Pueblo Alto may represent the breakage of more individual vessels, while the greater density of non-rim sherds at Pueblo Bonito may indicate the breakage of relatively fewer and larger gray ware pots.

Conclusions

In conclusion, the majority of the gray ware ceramic assemblage from the Pueblo Bonito mounds is comprised of small-to-medium-sized Cibola and Chuska jars with moderate-to-heavy usewear. In conjunction with other material and stratigraphic evidence (Crown 2008, 2010, 2016; Driver 2008; Wills 2010; Wills et al. 2015), most of the gray ware assemblage is considered to be indicative of household-level food preparation.
activities. This conclusion is also supported by the relatively high proportion of cooking vessels represented in the Pueblo Bonito assemblage compared to other canyon core great houses.

The data presented here also provide evidence for suprahousehold food preparation at Pueblo Bonito during the Classic Bonito phase. There is clear evidence for the existence of separate size classes of cooking pots, the largest of which were imported from the Chuska area and are of extraordinary size compared to what has been documented at other Chacoan sites thus far. The large-scale importation of utility wares, even smaller vessels, into Chaco Canyon is quite unusual, as both ethnographic and archaeological data indicate that cooking vessels are almost always produced locally. Researchers have suggested both economic and ideological explanations for this phenomenon—the lack of adequate fuel in the canyon may have necessitated production elsewhere, Chuska vessels may have been functionally superior to locally produced cooking vessels because of the heat-resistance imparted by trachyte temper and particularly well-executed surface manipulations, and/or Chuska vessels were symbolically charged “pieces of places” (Spielmann 2002; Toll 2001) and were critical in the preparation of feasts. Perhaps, as Toll (2001) and Spielmann (2002) suggest, Chuska vessels were tied to feasting activities through their symbolic link to a meaningful place as much as they were by economic necessity.

As a result of the difficulties in sourcing widely available tempering materials (i.e., sand), the nature and scale of the importation of Cibola Gray Wares into the canyon remains relatively unknown. The data presented here and by Chaco Project analysts suggest that the Cibola wares in the canyon may have been produced by many different
potters/potting groups within the Cibola region. Interestingly, various technological style characteristics of Cibola Indented Corrugated are clustered, and these clusters are differentially represented in the East and West Mounds. This may indicate differences in regional social ties between two segments of the Pueblo Bonito population. A careful study of the variation in often-ignored corrugation characteristics on utility wares from sites in Chaco canyon and in other areas in the Cibola region may help elucidate the nature of these social ties.

\[i\] The total detailed sample is reported as 5380 in Table 1.4 in Toll and McKenna (1997:42), but only 5367 sherds are included in Table 1.5, a summary of vessel form by type (1997:43). It should be noted that the caption of Table 1.5 ("Vessel forms of all rough sort types, Pueblo Alto") is somewhat misleading in that it does not specify that the table only includes the detailed sample.
Chapter 5
Conclusions

The three studies in this dissertation highlight the role of material practice in identity construction. The production, use, and discard of material objects create, reproduce, and transform the contours of the social world, defining relationships between individuals, social segments of various scales, and both the natural and cultural landscapes. Coiling a utility ware pot in a certain direction, depositing turquoise and specific types of shell beads in kiva offerings, wearing pendants of particular shapes and sizes, and using special cooking pots to prepare communal feasts are all ways of doing; they are “bodily and mental routines,” involving a multitude of conscious and unconscious decisions made in specific sociohistorical and environmental contexts (Reckwitz 2002:256). Two of the papers (Chapters 3 and 4) focus on large artifact assemblages from Pueblo Bonito and Aztec Ruin that have never before been systematically analyzed. The results of these contextual analyses contribute to our understanding of social organization, ritual practice, domestic activity, and trade at these preeminent sites. Finally, these studies have methodological implications for future analyses of ornaments and utility ware pottery in the U.S. Southwest, particularly those examining attributes related to identity and social value.

Social Identity and Material Practice: Adornment, Ritual Deposition, and Pottery Production

In my examination of the geographic and temporal distribution of ornaments of different styles and materials across the Southwest, I found that several ornament forms are widespread and common, including stone disc beads and spire-opped *Olivella* sp.
beads. However, the way that these items were used varies extensively over time and space. Practices of personal adornment—that is, the manner in which specific jewelry items are combined and displayed on the bodies of both the living and the dead—and deposition involving ornaments appear to be fairly specific to archaeological regions. For example, at Grasshopper Pueblo, only men wore *Glycymeris* sp. shell pendants, while only women wore shell and bone rings (Whittlesey 1978); in the Sinagua area during the thirteenth century, painted armbands and shell bracelets were worn on the left side (Whittaker and Kamp 1992); in the Mimbres area, men adorned themselves with anklets of disc beads, while women were associated with stone and shell bead necklaces (Munson 2000); and in the Hohokam region, *Glycymeris* sp. bracelets were not differentially distributed and appear to represent large-scale group identity (e.g., Bayman 2002; Haury 1976). As revealed through a diachronic review of ornament use in the Ancestral Pueblo area, certain practices persisted over centuries within regions (such as the placement of shell beads in kiva offerings and the wearing of ear strands of stone disc beads, bracelets of turquoise disc beads, and necklaces of *Olivella* sp. shell), while others changed along with demographic shifts (Crotty 1995; Jernigan 1978; Judd 1954; Mathien 1997; Morris 1919, 1924).

In my comparative analyses of ornaments from Pueblo Bonito and Aztec Ruin, I argue that similarities in the uses of ornaments indicate continuity in some aspects of social identity within the San Juan Basin during the post-Chaco period, particularly those related to ancestral connections (real or created), vertical social status, and ritual practice. However, differences in practices of adornment associated with horizontal aspects of social identity—such as age, gender, and large-scale group identity—suggest that the
residents of the two sites likely identified themselves in distinct ways. This is not surprising given that periods of population movement and reorganization, such as that coinciding with the decline of Chaco Canyon as a central place, are generally associated with social disruption and structural change (e.g., Aldenderfer 1993; Nelson and Schachner 2002; Schachner 2001).

For example, based on their unrestricted distributions, indicators of large-scale, horizontal aspects of social identity at Pueblo Bonito include shell and shale disc beads and Glycymeris sp. bracelets. At Aztec Ruin, these indicators include bone tube beads, spire-lopped and truncated Olivella sp. beads, and disc beads of both stone and shell. Likewise, at Pueblo Bonito, children are associated with shell bilobe beads and shell pendants, whereas at Aztec Ruin, they are associated with shell disc beads, bone tube beads, and truncated Olivella sp. beads. However, turquoise disc beads, inlays, and circular Haliotis sp. pendants appear to be associated with high-energy burial contexts at both sites. A similar suite of ornaments also appears in ritual contexts at the two sites, including shell bilobe beads, turquoise frog beads, foot/shoe forms, bifurcated forms, shell disc beads, spire-lopped Olivella sp. beads, and turquoise production debris. I propose that the post-Chaco residents of Aztec Ruin, while possessing a self-ascribed identity significantly different from that of the inhabitants of Chaco Canyon during its florescence, continued to participate in practices associated with Chacoan cosmology and intentionally associated themselves with the ancestors tied to the northern burial cluster at Pueblo Bonito (see also Mills 2015; Van Dyke 2009).

Similar to adornment and ritual deposition, practices of pottery production are also tied to social identity at various scales. While decorative styles are highly visible and
may be emulated without specific production knowledge, other aspects of production are less visible and must be learned. These more conservative elements of ceramic manufacture are thought to represent interacting social units, as physical proximity is required to learn specific technological methods (Lathrap 1983; Lechtman 1977; Lemonnier 1992; Stanislawski and Stanislawski 1978). In my analysis of gray ware pottery from the Pueblo Bonito mounds, I examine several attributes of indented corrugated ceramics related to technological style, including wall thickness, coil width, indentation width, indentation angle, coil/indentation direction, indentation pattern, and breakage pattern (Hegmon et al. 2000; Peeples 2010; Schleher and Ruth 2005). Based on this analysis, it appears that Chuska vessels are more standardized than the other gray wares in all attributes except those related to surface manipulations. It is possible that zoning and patterning of indentations on Chuska vessels represent different potting groups/communities, while other attributes are related to learned potting techniques associated with a larger shared social identity. The analysis also revealed the presence of groups of correlated technological attributes within the Cibola Indented Corrugated Gray Ware assemblage from the mounds, which may represent different production areas. Interestingly, these groups or clusters were differentially discarded in the East versus the West mounds. It has been proposed that at least two major house societies are represented by the architecture and distribution of material remains at Pueblo Bonito (Heitman 2007). Within a house society model, houses are social formations based on kinship or descent, but they are not limited to predefined social categories such as clans (Gillespie 2007; Lévi-Strauss 1982). These social units share important ancestors, ritual practices, and values that are anchored or embedded within specific architectural spaces, such as the
northern and western burial crypts at Pueblo Bonito (Beck 2007; Heitman 2007, 2015; Mills 2015). If the mounds are associated with different houses at Pueblo Bonito, my analyses of gray ware ceramics suggest that each segment may have had different social ties within the larger Cibola region. This is also generally supported by biological data (Akins 1986; Schillaci et al. 2001; Schillaci and Stojanowski 2003; Snow and LeBlanc 2015).

One aspect of technological style associated with utility pottery, coiling/indentation direction, is particularly interesting, as it may be related to large-scale aspects of social identity encompassing widely shared elements of cosmology. The direction of coiling, which is inversely related to the angle or direction of indentation, appears to be a conservative element of technological style and is typically consistent within regions (Hall 1932; Snow 1983). For example, there is a predominance of counterclockwise coiling in the prehispanic Western Pueblo area, while clockwise coiling is relatively more common in the Mesa Verde, Mimbres, and Rio Grande areas. As handedness alone cannot account for the differences between regions, Snow (1983) proposed that the correlation between the direction of coiling and indentation may instead be related to directional symbolism in ritual circuitry. For example, clockwise or “antisunwise” appears to be the primary direction of ritual movement among the Tanoan Pueblos, whereas counterclockwise or “sunwise” is most common among the Keresan Pueblo sacred circuits. I found that both Cibola and Chuska Indented Corrugated Gray Ware from the Pueblo Bonito mounds predominantly display counterclockwise coiling/right-handed pinching, while Mesa Verde Indented Corrugated Gray Ware exhibits clockwise coiling/left-handed pinching. Thus, the similarities in practices of
directional vessel construction between the Cibola and Chuska areas may indicate elements of shared social identity, both in ceramic technological style and ideas of ritual circuitry. A shared cosmology and ritual practice would be expected if populations from both of these areas participated in ceremonial events in the canyon, or at least had strong social ties represented by intensive ceramic trade. Social relationships with the Northern San Juan region appear to be weaker based on the relatively low proportion of Mesa Verde ceramics present. Differences in ideology and ritual practice may also be indicated by divergences in other aspects of material practice, including ceramic production techniques such as directional coiling and construction of ritual architecture.

In examining the relationship between material culture, social identity, and practice, these studies also underscore the lack of a clear dichotomy between sacred and mundane objects. Just as utilitarian ceramic vessels may have been constructed according to ceremonial directionality, commonplace ornaments and materials are found in structured ritual deposits at Pueblo Bonito. In the context of kiva offerings at Pueblo Bonito, deposits were found to contain stone of different materials (turquoise, argillite, shale, jet, azurite, malachite, ochre, selenite, obsidian, chert), marine shell of various species (particularly *Olivella, Glycymeris, Haliotis,* and *Spondylus/Chama*), reflective materials (abalone, galena, iron pyrite, and quartz crystals), both whole and broken ornaments of special/rare and common forms (e.g., shell bilobe beads, frog beads, bifurcated forms, disc beads of all materials, *Olivella* sp. beads, inlays, shell bracelets, and pendants of various forms), and turquoise matrix and production debris. Although not formally included in these studies, these offerings also contain objects such as lithicdebitage, small tools (especially projectile points and awls), animal parts (feathers, claws,
teeth, and even duck bills), fossils, uniquely shaped stone manuports, and vegetal material (e.g., piñon nuts, seeds, stems). These gatherings or collections of objects—special and ordinary, whole and broken, exotic and local—within structured spaces may represent fundamental components of, and relationships in, the physical and spiritual worlds (Heitman 2007; Mills 2008, 2015; Zedeño 2009). According to Plog and Heitman (2010), both the content and configuration of such ritual deposits at Pueblo Bonito may serve as microcosms of the larger Chacoan cosmological order. Thus, in the context of assemblies of other objects and placement within certain architectural spaces, otherwise commonplace artifacts may be conferred with social value. In a similar vein, it appears that “ordinary” Chuska cooking pots (based on the large volume of them entering the canyon and their discard in middens along with other household refuse) may have been used in the preparation of suprahousehold feasts at Pueblo Bonito. They may have been preferred for this purpose over their Cibola counterparts for their connections to a meaningful place on the landscape (the Chuska Mountains) and for the valuable social ties they materialized. This association may also account for the presence of ornaments of Chuska chert in pilaster offerings in one kiva (Kiva K), although no other ornaments of this material were identified in any other portion of the site. In addition, Chuska chertdebitage was found in a pilaster offering in Kiva G. Thus, in addition to their economic value, ceramics and lithic raw material from the Chuska area may have served as directional, topographic, or cosmological referents in certain contexts (Heitman 2007; Plog and Heitman 2010).
The analyses of ornaments and utility ware from Pueblo Bonito contribute to our knowledge of Chacoan ritual practice, social organization, and site function. Based on their contextual associations, ornaments were clearly items of social value at Pueblo Bonito, as they are included in large numbers in probable ancestral burial crypts, kiva offerings, ceremonial rooms, and structured deposits in domestic rooms. The recurrence of similar types of objects in these deposits has a liturgical and reiterative quality, suggesting formality of practice and continuity over time (Mills 2008, 2015; Plog and Heitman 2010). These material associations and practices may have been so closely bound to Chaco Canyon as a central place, and to the shared ideology and social identity that it represented, that they continued to reverberate throughout the San Juan Basin for generations despite significant demographic reorganization. This appears to be the case at Aztec Ruin, where the association of specific ornament forms and materials with ritual structures is analogous to that at Pueblo Bonito.

The ornament analysis also supports the idea that the two burial clusters at Pueblo Bonito represent separate social segments. Although both groups of interments contain ornaments that are interpreted as referencing large-scale aspects of group identity and vertical social status, each cluster is also significantly associated with distinct groups of ornament types and materials. These differences appear to be mirrored in other types of goods included in these burial crypts, as well as in differences between the contents of the two mounds (Crown 2016; Neitzel 2003). However, only the northern burial crypt is associated with unique ornament forms otherwise restricted to structured deposits in kivas. As pointed out by Mills (2015: 259, citing Chesson 2007 and Gillespie 2007), in
ethnographic examples of house societies, one house may be dominant over another. The association of the northern burial cluster, and particularly Burial 14, with a suite of ornamental ritual motifs, which may represent inalienable objects (bifurcated, frog/tadpole, and foot/shoe forms) and are also found in kiva offerings, suggest that this house or lineage may have had a stronger tie to the dedicatory ritual practices associated with kivas. This is particularly the case with smaller kivas, such as court kivas, as great kiva offerings contain a different suite of objects that are individually more “ordinary” (though of great significance when they are aggregated) (Mills 2015:260). This connection may represent an association with certain ancestors (real or mythological), deities, and/or obligations or duties related to specific ritual performances and ceremonial events (Heitman 2007, 2015; Plog and Heitman 2010). Based on the differential presence of ceramic trade wares in the mounds, these two segments may have also had different social ties outside of the canyon; this also appears to be supported by biological evidence (Akins 1986; Schillaci 2003; Schillaci and Stojanowski 2003; Snow and Leblanc 2013).

Based on the analysis of utility ware ceramics from the middens, it appears that a significant amount of food preparation occurred at Pueblo Bonito during its occupation and that vessels were likely fragmented during use, rather than intentionally broken through ritual termination. The characteristics of the ceramic assemblage, in addition to those of other artifacts recovered from the mounds, are largely consistent with household-level domestic refuse (Crown 2016; Wills 2010). This includes a predominance of small and medium cooking jar fragments with mechanical wear and sooting indicating moderate-to-heavy use before breakage and disposal. Along with the Pueblo Alto trash
mound, the Pueblo Bonito middens contain the highest proportion of cooking vessels to other ceramic vessels of any great house in the canyon.

In terms of vessel size, the gray ware assemblage from Pueblo Bonito also exhibits the largest maximum orifice diameter, and one of the highest mean orifice diameters, compared to other assemblages from the canyon. Furthermore, the distribution of orifice diameters in the Pueblo Bonito mounds suggests the existence of separate size classes of culinary jars. While two size classes are represented among all of the utility wares, a third class of very large jars is apparent in the Chuska Gray Wares. Based on size, wall thickness, and usewear, there does not appear to be a functional difference between Chuska and Cibola gray wares in the small-to-medium size range. However, large Chuska jars appear to have been used less intensively than either smaller Chuska and Cibola jars or large Cibola jars, indicating that they may represent a separate functional category. I suggest that some amount of food preparation for communal feasts was likely occurring at Pueblo Bonito, particularly during the Classic Bonito phase, and that large Chuska Gray Ware jars may have been preferred for this purpose (Blinman 1989; Potter 2000; Spielmann 1998; Van Keuren 2001; Wills and Crown 2004). Both the production and long-distance transport of large cooking pots entailed a high level of energy and labor expenditure, and these vessels would have been highly valued. As discussed above, their social value may have also been linked to their directional and/or geographic associations.
These studies entailed the recording of attributes that are not commonly included in analyses of ornaments or pottery. In her discussion of the production of goods used for ritual activities, Spielmann (2002) argues that socially valued goods, such as those used in ritual contexts, tend to possess certain physical qualities that distinguish them from other, less-valued goods. These characteristics are generally related to aesthetic appeal or the “enchantment” of the viewer, and typically include raw material types from relatively inaccessible and/or symbolic sources, brightness (degree of polishing, burnishing, or use of reflective raw materials), color, and size. These qualities are often expressed as gradients within artifact classes. For example, larger and thinner Melanesian axes made of certain types and colors of stone are used for ceremonial purposes, while axes used in domestic contexts are typically smaller and thicker (Spielmann 2002: 200; Strathern 1969). In addition, the degree to which these axes are used for ritual purposes appears to vary directly with the amount of polishing present. Some goods may be used for ritually or socially important activities as well as for normal domestic activities. For example, although Rio Grande Glaze ware vessels were used within ordinary household contexts, they were also used in communal feasting. Spielmann (2002) argues that the presence of burnishing, reflective decoration with glazes, and certain slip colors on these vessels is directly related to their use in ceremonial activities.

In a similar vein, Saunders (1999) discusses how the perceived visual attributes of brilliance, translucence, and iridescence were associated with the value and meaning of materials such as pearls, shell, and glass in indigenous societies in the New World, documented at the time of contact with Europeans. As these traits were widely associated
with supernatural beings and “cosmological matter” (1999:247), objects made from these materials had ritual significance and were thought to possess spiritual power. In addition to such visual attributes, tactile qualities may also have been important in the meaning of objects. Macgregor (1999) considers how the “sensory experience” of carved stone balls, deposited in bogs and rivers as offerings or within mortuary and ceremonial contexts in southeast Scotland, may have been an essential element in the creation of meaning involving these objects. He performed a “haptic” analysis, recording attributes such as weight, volume, hardness, texture, perceived temperature, and both visual appearance and feel as objects were moved and rotated in various ways. Although not conclusive, his analysis highlights the potential utility of including traits related the holistic perception and experience of objects in the interpretation of their meaning and value in the past.

In designing the ornament analysis for Pueblo Bonito and Aztec Ruin, it was expected that a small number of attributes would exhibit patterned variation significantly related to social use; however, since it was impossible to identify these specific attributes in advance, numerous potentially meaningful characteristics were recorded during the first phase of research. Although only a portion of the recorded attributes (primarily form and material) were considered in the paper included in this dissertation, others will be considered in future publications. Determining how to measure some of these subjective aesthetic and sensory attributes, particularly perceived color and perceived temperature, in a standardized manner was one of the main methodological challenges of the research.

Rather than using traditional and subjective means to categorize color (i.e., Munsell), I used a technique known as spectral colorimetry—the quantification of human color perception. Most colors that humans perceive are either near-spectral (not
completely saturated) or mixtures of spectral and grayscale colors (such as pink, purple, brown, navy, etc.). Differences between colors in terms of wavelength do not necessarily correspond to perceived differences in color, due to the uneven distribution of cones on the retina of the human eye. In addition, color perception changes with the light source, the angle and distance of viewing, and the reflectivity of the viewed surface. In my study, a ColorLite spectrophotometer 850 was used to measure the color of artifacts. This hand-held instrument—specifically designed for use on solid, curved surfaces—measures the reflected spectrum of light using a standardized LED illumination source contained within the probe head. The spectrophotometer and its associated software (Color DaTra) calculate color using the International Commission on Illumination (CIE) system for color specification, which relies on tristimulus values. Since the human eye contains only three main types of retinal cone cells, colors are sensed as combinations of the wavelengths perceived by these different receptors; the sensory quantities associated with these three color receptors are known as tristimulus values. Traditionally, these values were defined based on human perception of the primary colors of red, green, and blue (RGB). However, because some colors could not be produced using these true colors, three alternate primaries (designated as X, Y, and Z) were defined. The CIE system calculates perceived color using both the spectral power distribution (the proportion of light, measured in nanometers, reflected by a sample at every visible wavelength) and the predefined XYZ tristimulus values for the human eye. For each sample measured with the spectrophotometer in this study, therefore, color is comprised of three values, each located along the X, Y, and Z tristimulus axes. Because many of the artifacts were not produced from homogenous materials, ten different scans were conducted for each
sample; color values were calculated as averages of these measurements. Since the smallest probe aperture available is 3.5 mm in diameter, and the probe head must be securely placed over the sample to avoid the effects of stray light, the spectrophotometer could not be used on very small artifacts, such as tiny discoidal beads. In 2008, I consulted with optical engineers associated with Hewlett-Packard, Inc. to help in designing an accessory that would correct this issue; while this collaboration did not produce a solution in time to directly benefit this research, it is hoped that these technological improvements will benefit future work and the field of archaeometry.

Perceived temperature is another attribute that required a standardized proxy for consistent measurement. Although this attribute was not included in the results reported in Chapter 3, it was recorded along with other aesthetic and haptic qualities and will be incorporated into an expanded synthesis of the Pueblo Bonito and Aztec Ruin ornament assemblages. The perceived temperature of an object is a result of heat conduction between it and the skin; if the object is colder than the temperature of the skin, then heat will transfer out of the skin, and the object will feel cool to the touch. This process is a function of the thermal conductivity (ability to transfer heat efficiently), the initial temperature of the skin and the object, and the resistance to thermal contact resulting from differences in texture and shape. Materials with high thermal conductivity, such as metals and dense solids, transfer heat more readily than those with low conductivity, such as wood and porous materials. In metals, this is a product of the availability of free electrons; in crystalline materials, it is related to phonon coupling (vibration of atoms and molecules along crystal axes). In addition, air-filled pockets, such as those within organic materials, serve as barriers to heat convection and conduction. As a proxy for perceived
temperature, I used specific heat capacity, the amount of heat per unit mass required to raise the temperature of a material by one degree. This measurement is directly related to thermal conductivity \( c = \frac{Q}{m^*\Delta T} \) [where \( c \) is specific heat, \( m \) is mass, \( \Delta T \) is the change in temperature, and \( Q \) is the heat added]. The specific heat capacities for a multitude of substances have been calculated and are available in published format (e.g., Waples and Waples 2004).

Ceramic analyses of assemblages from the Ancestral Pueblo and Mogollon areas typically lump utility wares into broad categories and record relatively few metric attributes, focusing instead on decorated wares and traits such as design layout and line width. Utilitarian ceramics are placed in ware categories primarily by temper composition and in specific type categories based on general characteristics of surface manipulation, particularly traits related to corrugations (e.g., banded, clapboard, and indented). However, there is a significant amount of variation included within each of these categories. For the detailed analysis of the gray ware ceramics from the Pueblo Bonito mounds, I attempted to capture this variation through the recording of attributes such as coil width, indentation distance, indentation direction, and corrugation patterning. These were selected based on the results of previous research on the technological characterization of utility wares, such as the studies of Dobschuetz (1999), Hegmon et al. (2000), King (2003), Neuzil (2001, 2005), Schleher and Ruth (2005), and Peeples (2010, 2011). As discussed above, Cibola Gray Ware contains a significant amount of intraware variation in these attributes. In addition, this variation is not randomly distributed, suggesting that portions of the Cibola Gray Ware assemblage were made by different production units. As demonstrated by Peeples’ (2010, 2011) research on social identity in
the Cibola region during the Pueblo III period, such technological attributes of utilitarian wares likely correlate with compositional groups, and thus may serve as valuable indicators of production location.

**Directions for Future Research**

These three studies highlight several important topics for future research. First, a detailed analysis of ornaments from sites in the Northern San Juan area is the next critical step in examining social identity as expressed in adornment practices at Aztec Ruin. Based on preliminary literature reviews, the styles, materials, and contextual associations of ornaments in the Mesa Verde area are significantly different than those at Chacoan sites. Another valuable addition to the study, though perhaps not likely, would be the inclusion of ornaments from Aztec East Ruin, which appears to have served as the main residential structure during the thirteenth century occupation of the site.

Second, in reviewing previous research on ornamentation across the Southwest, immediately apparent is the paucity of information regarding Pueblo IV period jewelry in the Middle and Northern Rio Grande Valley. In light of the dramatic social transformations occurring in the area during this time, including changes in demography and ritual practice, it would be valuable to compare Classic period adornment practices with those of the Cibola region and the Northern and Middle San Juan Basin areas during the Pueblo III period. In addition, the presence of iconographic representations of humans wearing jewelry items on Classic period kiva murals would serve as an indirect line of evidence regarding how pieces were worn and their possible meanings.
Finally, an expanded study on the Cibola Gray Ware ceramics from Pueblo Bonito could provide new data on social ties and trade networks in the Chacoan system. Particularly valuable would be a comparison of groups of correlated technological attributes in the Pueblo Bonito assemblage with those from other core great houses and contemporaneous sites in the larger Cibola region. This could potentially delineate specific intraregional connections between Chaco Canyon and outlying areas, perhaps even resulting in the identification of links between individual great houses in the canyon and outlying great house communities. Comparing the configuration of these ties in the Cibola region during the Pueblo I and Pueblo II periods to those identified by Peeples (2011) in the post-Chaco period would also be interesting in addressing the larger research issue of continuity and/or transformations in social identity during periods of demographic reorganization.
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